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New Educational Tools and Essential Educational Methods in Learning Process

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Abstract:

New education tools and essential methods have been evolving rapidly, driven by technological advancements and new pedagogical insights.

Keywords: *Education, technology, methods, reality, artificial intelligence, models, systems.*

Platforms like Moodle, Blackboard, and Canvas facilitate course management, assignment submission and communication between students and instructors. Additionally, apps like Kahoot, Duolingo and Quizlet make learning interactive and engaging through gamification and personalized learning experiences. Tools like Google Expeditions and Nearpod bring immersive experiences to the classroom, allowing students to explore virtual field trips and interact with 3D models. However, there are also online collaboration tools like: Google classroom, Microsoft Teams, Zoom enable real-time collaboration, virtual classrooms, and seamless communication among students and teachers. Educational methods are crucial because they directly impact the quality of learning and student outcomes. Different methods cater to diverse learning styles (visual, auditory, kinesthetic) helping students grasp complex concepts better.

1. Competency-Based Education (CBE)

➢ Focuses on students demonstrating mastery of specific skills or competencies at their own pace, rather than progressing through a fixed curriculum.

2. Experiential Learning

➢ Learning through direct experience, such as internships, apprenticeships, and field trips, helps students apply theoretical knowledge to real-world situations.

3. Service Learning

➢ Integrates community service with instruction and reflection, promoting civic responsibility and reinforcing academic concepts through practical application.

4. Peer Teaching and Collaborative Learning

➢ Encourages students to work together and learn from each other, fostering communication, teamwork, and a deeper understanding of the material.

5. Holistic Education

➢ Emphasizes the development of the whole person, including intellectual, emotional, social, physical, and spiritual growth.

6. Design Thinking

➢ A problem-solving approach that encourages creativity, innovation, and iterative testing, often used in project-based learning contexts.

7. Mindfulness and Well-Being Practices

➢ Incorporates mindfulness exercises, stress management techniques, and physical activity to enhance students' mental health and focus.

8. Culturally Responsive Teaching

➢ Recognizes the importance of including students' cultural references in all aspects of learning, making education more relevant and effective for diverse student populations.

9. Universal Design for Learning (UDL)

➢ A framework for designing educational environments that enable all students to gain knowledge, skills, and enthusiasm for learning by providing multiple means of representation, engagement, and expression.

10. STEM and STEAM Education

➢ Focuses on integrating science, technology, engineering, and mathematics (STEM), with the addition of arts (STEAM) to foster creativity and innovation.

11. Blended Learning

➢ Combines traditional face-to-face instruction with online learning, allowing for more flexibility and personalized learning experiences.

12. Flipped Classroom

➢ Students watch lectures and engage with learning materials at home, then use class time for interactive activities, discussions, and hands-on projects.

13. Project-Based Learning (PBL)

➢ Students work on real-world projects that require critical thinking, problem-solving, and collaboration, fostering deeper understanding and practical skills.

14. Inquiry-Based Learning

➢ Encourages students to ask questions, conduct research, and explore topics deeply, promoting curiosity and active engagement in learning.

15. Social-Emotional Learning (SEL)

➢ Focuses on developing students' emotional intelligence, self-awareness, and interpersonal skills, which are essential for personal and academic success.

16. Gamification

➢ Incorporates game elements into learning activities to increase motivation, engagement, and enjoyment, making learning more dynamic and interactive.

17. Differentiated Instruction

➢ Tailors teaching methods and materials to meet the diverse needs of students, recognizing that each student learns differently and may require different approaches to achieve their potential.

These tools and methods, when effectively integrated, can create a more engaging, inclusive, and effective educational environment for students.

These educational tools and methods are essential for several reasons:

Addressing Diverse Learning Styles

1. Personalization: Different students have different learning preferences and needs. Methods like adaptive learning platforms and differentiated instruction tailor educational experiences to individual students, improving engagement and outcomes.

2. Inclusivity: Culturally responsive teaching and Universal Design for Learning ensure that all students, regardless of background or ability, can access and benefit from education.

Enhancing Engagement and Motivation

1. Interactivity: Tools like VR/AR, gamification, and educational apps make learning more engaging and enjoyable, which can increase students' motivation and enthusiasm for learning.

2. Real-World Relevance: Project-based learning, experiential learning, and service learning connect classroom content to real-world applications, making learning more meaningful and relevant to students.

Developing Critical Skills

1. Collaboration: Peer teaching, collaborative learning, and online collaboration tools help students develop teamwork and communication skills, which are crucial for success in both academic and professional settings.

2. Problem-Solving: Design thinking, STEM/STEAM education, and project-based learning encourage critical thinking, creativity, and innovation, preparing students for complex challenges.

Supporting Mental and Emotional Well-Being

1. Mindfulness and Well-Being: Incorporating mindfulness and stress management practices helps students maintain mental health and focus, which is essential for effective learning.

2. Social-Emotional Learning (SEL): SEL fosters emotional intelligence, self-awareness, and interpersonal skills, which are critical for personal and academic success.

Flexibility and Accessibility

1. Blended Learning and Flipped Classrooms: These methods offer flexibility, allowing students to learn at their own pace and time, which can be especially beneficial for those with different learning speeds or external commitments.

2. MOOCs and OER: Online courses and open educational resources make high-quality education accessible to a global audience, breaking down geographical and financial barriers.

Continuous Assessment and Feedback

1. Real-Time Assessment: Tools like Socrative and Poll Everywhere provide immediate feedback, helping teachers adjust instruction and students improve their understanding in real time.

2. Competency-Based Education (CBE): CBE focuses on mastering specific skills, allowing students to progress as they demonstrate understanding, rather than being held back by a fixed curriculum.

Preparing for Future Careers

1. Coding and Robotics Kits: These tools introduce students to essential 21st-century skills, such as programming and engineering, which are increasingly important in the job market.

2. Experiential Learning: Internships, apprenticeships, and field trips provide practical experience, preparing students for future careers and helping them apply theoretical knowledge in real-world contexts.

By incorporating these methods and tools, education systems can better meet the needs of diverse student populations, foster essential skills, and create more engaging and effective learning environments.

Students can significantly enrich their learning outcomes with the help of these tools and methods. Here's how:

Enhanced Understanding and Retention

1. Adaptive Learning Platforms: These platforms personalize the learning experience based on individual performance and learning style, which can lead to better understanding and retention of material.

2. Flipped Classroom: By engaging with lecture material at their own pace outside of class, students can come to class prepared to engage in deeper discussions and hands-on activities, reinforcing their learning.

Improved Engagement and Motivation

1. Gamification: Introducing game elements into learning can make the process more fun and motivating, encouraging students to participate actively and persist through challenges.

2. VR/AR Experiences: Immersive learning experiences make abstract concepts tangible and engaging, which can enhance students' interest and involvement in the subject matter.

Development of Critical Thinking and Problem-Solving Skills

1. Project-Based Learning (PBL): Working on real-world projects helps students develop critical thinking, problem-solving, and collaboration skills, which are crucial for academic and career success.
2. Design Thinking: This method encourages innovative thinking and iterative problem-solving, helping students tackle complex problems creatively and effectively.

Better Preparedness for Exams and Assessments

1. Online Assessment Tools: Platforms like Socrative and Poll Everywhere provide instant feedback, helping students identify areas of weakness and focus their study efforts more effectively.
2. Quizlet and Educational Apps: These tools offer various ways to review and practice material, from flashcards to interactive quizzes, which can improve exam performance.

Personalized Learning Paths

1. Differentiated Instruction: By tailoring learning activities to meet the diverse needs of students, differentiated instruction helps each student reach their full potential.
2. Competency-Based Education: This approach allows students to progress at their own pace, ensuring they master each concept before moving on, which can lead to deeper learning and better academic results.

Enhanced Collaboration and Communication Skills

1. Online Collaboration Tools: Platforms like Google Classroom and Microsoft Teams facilitate teamwork and communication, skills that are essential both in school and the workplace.

2. Peer Teaching and Collaborative Learning: Learning from and with peers can reinforce understanding and build communication and social skills

Development of Technical and Digital Skills

1. Coding and Robotics Kits: These tools introduce students to essential STEM skills, preparing them for future careers in technology and engineering fields.

2. E-books and Digital Textbooks: Using digital resources helps students develop digital literacy, which is increasingly important in the modern world.

Increased Accessibility and Flexibility

1. MOOCs and OER: These resources provide access to a wide range of high-quality educational materials, allowing students to learn from experts around the world.

2. Blended Learning: Combining online and in-person learning offers flexibility, enabling students to manage their time better and access resources anytime, anywhere.

Supporting Social and Emotional Development

1. SEL Programs: Social-emotional learning programs help students develop resilience, empathy, and self-regulation, which contribute to a positive learning environment and better academic performance.
2. Mindfulness Practices: Incorporating mindfulness into the classroom helps students manage stress and stay focused, which can enhance their overall learning experience.

By leveraging these tools and methods, students can not only improve their academic performance but also develop a wide range of skills that will benefit them throughout their education and future careers.

Resources:

1. https://ares.uz

2. https://yomi.uz

3. https://www.ziyouz.com

4. https://esijournal.uz/

Aviation Precision Weapons: Logical-Epistemological Aspect

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Annotation:

The article presents an approach to the concept of «high-precision aviation weapons», the composition of the concepts used by researchers in defining the concept of «high-precision weapons». Technical and tactical features of high accuracy are revealed. Classification features of the method of applying an air strike are proposed. The methods of organizing the use of high-precision aviation weapons are given.

Keywords: high-precision weapons, scope and content of the concept, features of high-precision, methods of organizing the use of aviation high-precision weapons.

Introduction. It is known that the basis of all technology and weapons is science, moreover, technology and weapons are science itself. Thus, the course and outcome of modern armed struggle in war have become increasingly dependent on scientific achievements and the potential capabilities of the state in the field of technology and weapons. Both the creation and modernization of aviation weapons are the result of the process of evolution of types of aviation weapons. Evolutionary transformations of aviation weapons (as a technical system) follow the path of adaptation to the conditions of aviation combat operations (conditions for the functioning of aviation weapons). It should be noted that from a systemic point of view, a technical system, which is an aviation precision weapon, cannot exist in these conditions if it (it is an aviation precision weapon) is not adapted to these conditions. Otherwise, such systems are doomed to disappear. In the creation and modernization of aviation precision weapons, general progress (systemic progress) and private progress are distinguished

Relevance. General or systemic progress is achieved on the basis of a transition to new, more effective principles of the general design of an aircraft weapon system, to optimization of the main parameters of these weapons and aircraft weapons (energy, reliability, weight, accuracy, etc.), to the creation of redundant structures , increasing the efficiency and reliability of aircraft weapons.

General progress is complemented by information and energy progress. Information criteria for progress characterize the progress of aircraft weapons systems in terms of accumulating information about the conditions of aviation combat operations, and energy criteria show the degree of efficiency and economy of the aircraft weapons system. General progress is characterized by the emergence of such structural and functional changes that lead to the improvement of the aircraft weapon system itself. Progress is carried out in this case by improving not only individual elements and parts of the aircraft weapon system, but also the weapon system as a whole. As a rule, the general progress of aviation precision weapons was accompanied by a constant complication of the system of these weapons. In contrast to systemic or general progress, private progress is achieved by improving individual elements or parts of aviation precision weapons. And as experience shows, private progress occurred more often. Particular progress has made it possible to adapt evolutionarily modernized aircraft weapons systems to the new conditions of aviation combat operations.

In contrast to the private progress of aviation weapons, narrow specialization represents the development of individual types of weapons that are highly specialized in nature. Given the narrow specialization of aircraft weapons and means of destruction, the transformation was limited and affected only individual parts of aircraft weapons or means of destruction. At the same time, the modernization of some parts of weapons or weapons was accompanied by changes or even the disappearance of others. An example of narrow specialization is aviation precision weapons, adapted to solve limited functions (special combat missions).

Turning to the issue of the emergence of prerequisites for the creation of aviation precision weapons, one should focus on trends in the modernization of equipment and weapons. The results of the analysis allow us to conclude that two main trends dominate in the modernization of equipment and weapons: the trend of increasing the degree of dynamism and the trend of transition to a supersystem. The tendency to increase the degree of dynamism manifests itself in the evolutionary process. In this sense, the modernization of aviation high-precision weapons is associated with increasing the accuracy of the use of weapons, increasing the effectiveness of the lethal effect of combat units, expanding the capabilities of weapons and the degree of their implementation in the increasingly complex conditions of combat operations of strike aircraft. The trend of transition to a supersystem highlights the main thing in improving aviation high-precision weapons and is manifested not in the creation of individual models of aviation weapons and sighting systems, but in systems of high-precision weapons. At the same time, the degree of implementation of the capabilities of a high-precision weapon system to destroy enemy targets increases significantly, especially if it is synthesized with reconnaissance and information subsystems.

The approach described above in practice is associated with the evolution of views on air destruction of enemy ground and sea targets, which dates back to the First World War. The lack of accuracy in the use of aviation weapons has led to the problem of the effectiveness of destruction of enemy ground and sea targets. In turn, tactics made demands on the improvement of means and systems for solving the aiming problem, as well as ballistic support for aircraft weapons. However, it was impossible to avoid mistakes and mistakes; the best that could be done was to reduce them to a minimum. To ensure high accuracy in the use of aircraft weapons, it is necessary that, firstly, the algorithm for solving the problem of aiming with an aircraft sight is fully and accurately described. Secondly, the initial parameters must be determined and taken into account when solving the aiming problem absolutely accurately. Thirdly, the algorithm for solving the aiming problem in the computer must be implemented without errors. Fourthly, the crew must carry out all operations on the combat route without errors. In fact, when using unguided aircraft weapons at the end of the twentieth century. none of the above conditions could be met. Solving the problem of high

efficiency of fire destruction of enemy ground and sea targets when using unguided weapons through extensification is possible only by increasing the number of aircraft weapons (bombs) in a salvo or series. Intensification of fire destruction of enemy targets is possible through the use of aviation weapons with high accuracy of hitting the target. At the same time, it turned out to be possible to intensify the fire destruction of enemy targets in two ways: by developing controlled aircraft weapons, the flight trajectory of which could be adjusted discretely or continuously (quasi-continuously) after being dropped from a carrier aircraft; improvement of ballistic support for solving the aiming problem during bombing with unguided bombs, i.e. modernization of the targeting and navigation system of the carrier aircraft.

It is known that since 1925, in Germany, the USSR and other economically developed countries, scientific research and development work on the creation of new weapons, including guided aircraft weapons, have been resumed in great secrecy. The successes achieved in radio electronics, communications technology, radio control, and navigation of aircraft in the 30s of the twentieth century made it possible to create unmanned vehicles with a range of impact on the enemy of several hundred kilometers. The creation in 1933, first in the USSR, then in Germany (in 1934), of a pulsating air-breathing engine was a prerequisite for expanding the capabilities of using guided weapons and significantly reducing the cost of their design. In the mid-1930s in Germany, the USA, the USSR and Great Britain, efforts were focused on research and experimental development in the field of radar. The main attention at that time was paid to the creation of air defense radar systems, although at the same time research was carried out on the possibility of using radar on board an aircraft. It should be noted that during these years, research was also carried out and systems and means were developed to determine the location of air targets by their infrared radiation and the sound produced. Thus, by the beginning of World War II, the prerequisites had been created for the development of aviation precision weapons. The main ones of these prerequisites include:

1. Since the birth of aviation, schools of aerodynamics have been formed. The level of research into the aerodynamics of aircraft carried out at research institutes and flight test centers in the leading countries of the world has made it possible to create and develop a methodology for studying and determining the aerodynamic characteristics of unmanned aerial vehicles.

2. The foundations of guidance and control systems for technical objects were laid, engineering methods for their design were developed, which made it possible to create stabilization systems and build autopilots for unmanned aerial vehicles

3. Advances in various fields of radio engineering, communications, and radio electronics have made it possible to design systems for correcting the flight path of unmanned aerial vehicles in acceptable dimensions and weights for placement on board unmanned aerial vehicles.

As noted above, to solve the problem of hitting the target accurately, two trends were observed, which were reflected in the concepts of the concept of "high-precision weapons."

Currently, a number of publications have a sufficient number of definitions of "high-precision weapons". Based on the results of this analysis, six groups of characteristic features are identified (Figure 1), which guided the authors when defining the concept of "high-precision weapons" [1].

It is known that a concept has four sides, which include sign, idea, content and volume. The main aspect of any concept, but not the only one, is a sign that unites an object or a group of similar objects with the thought of this object. The sign structures the thought itself, giving it integrity, a complete appearance and highlighting certain parts in it. The sign includes this thought in the semantic field, a space filled with related signs, which facilitates the comparison of thoughts in the form of judgments and inferences. In any concept there is an integral spiritual element, which has long been designated by the term "idea" (appearance, form, face, appearance).

An idea is a specific difference between an object or a group of objects from others, something that unites them and allows them to be denoted by the same word or sign. The idea, being the second side of the concept, intuitively arises every time we see a familiar object and call it a certain word or group of words. An idea is a visual image in a person's brain that precedes all his actions and is therefore the "beginning".

The content of a concept is a set of essential features of an object, which is conceived in a given concept. The content of a concept is a set of qualities, structural properties and relationships inherent in the object that is denoted by a given word, sign, or concept.

The scope of a concept is the set of objects that is conceived in the concept. Essentially, the scope of a concept covers the number of similar objects that can be designated by a given concept. The concept also has an addition to the volume, i.e. the totality of all objects that do not have a given concept. The connection between a concept and the scope of a concept is illustrated by the famous "Euler circle" [2].

The name of the charasteristics used in the WTO definitions	Share of preference% 10 20 30 40 50 60 70 80 90
By controllability	Only controlled
	Controlled and uncontrolled
By ensuring target destruction	Due to accurate hit
	Due to the power of the warhead and the accuracy of the hit — No Respect
	N P
By intergrating systems and means of reconnaissance	Integrated,
	Non-integrated
By depending on weather conditions	Depend
	N.P
By depending on the accuracy of the hit on the range of use	Independent
	Dependent
By the guaranteed probability of hitting the given damage zone	P 0.5
	0.9
	N P

Figure 1. Composition of ideas used by researchers when defining the concept of "precision weapon"

If a concept is a four-way relation, then its structure is depicted using an iconic sign: a square, shown in Figure 2. Like the sides and corners of a square, the sides of a concept are connected in pairs by relations of identity and opposition. The equality of all sides and angles of the figure indicates the equality and mutual substitutability of sign, idea, content and volume.

The content and scope of a concept are related by relations of inverse proportionality: the richer the content of the concept, the smaller its volume, and the larger the scope of the concept, the poorer its content. For example, the concept of "weapon" has an indefinitely large scope, since such a term can designate any object that represents a means of defeating the enemy in an armed struggle. The entire set includes conventional weapons, weapons of mass destruction, precision weapons, weapons based on new physical principles, etc.
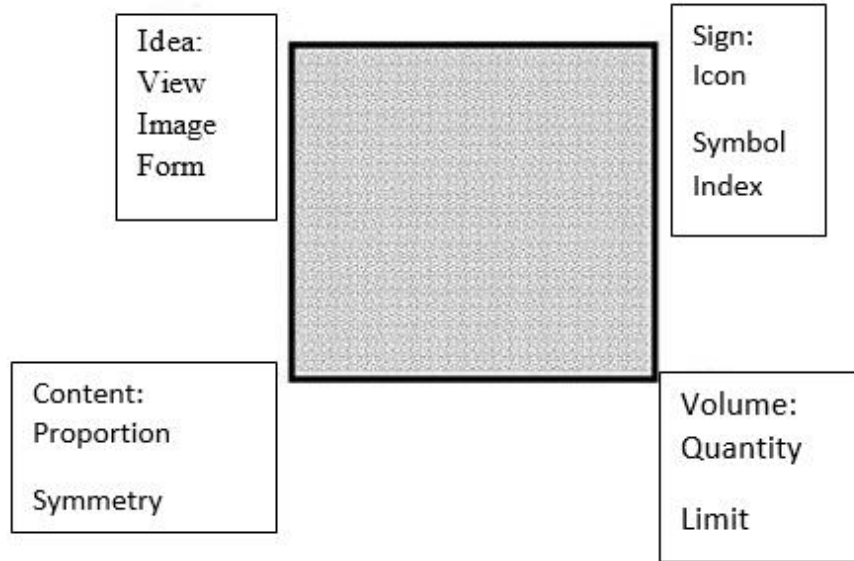
Figure 2. Sides of the concept

In this example, the scope of the concept "weapon" is maximum, and the content of the concept is minimum, since one single property of a weapon is the ability to kill (Figure 3).
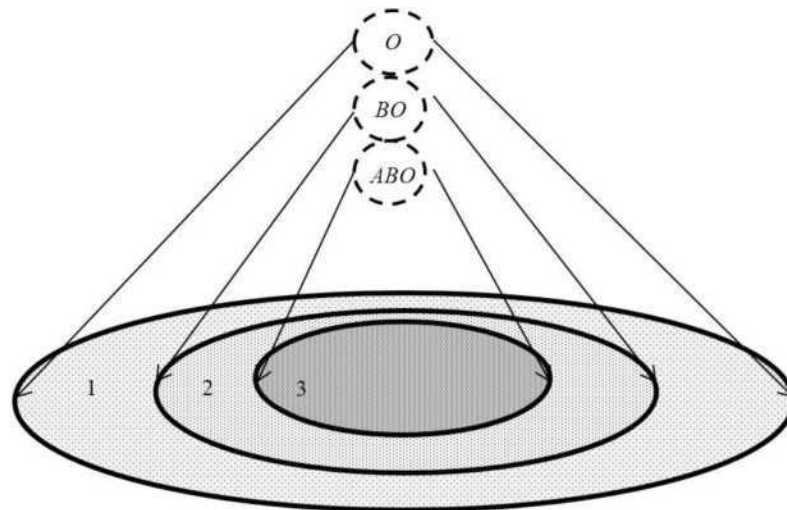
Figure 3. Relationships between the content and scope of a concept

Let's take another, similar concept: "high-precision weapons." It has a smaller scope than the concept of "weapon", since high-precision weapons are not only any object that represents a means of defeating the enemy in an armed struggle, but also an element of the scope of the concept "weapon". This element is similar to the object it represents. Here, an essential quality is added to the ability to hit - "high-precision hitting the enemy." The content has become richer, more extensive, and the volume has become smaller. And one more concept: "aviation precision

weapons." This concept has an even smaller scope and even richer content, since a variety of means of defeating the enemy has been added to the initial possibility of destruction and essential quality.

In Figure 3: 1, 2, 3 - respectively, the volumes of the concepts O (weapons), high-precision weapons (HP) and aviation high-precision weapons (APW); the content of the concept ABO is greater than the content of the concept VO (in the sense that the concept ABO, in addition to the attributes B and O included in the concept VO, contains the attribute A), and the content of the concept VO is greater than the content of the concept O.

The concept of "aviation precision weapons" is relatively complex. An analysis of the definitions of "high-precision weapons" (HPE) used by various authors in educational and scientific publications showed that by this concept some authors mean ammunition, others - guided and unguided weapons, others - strike aircraft or reconnaissance-strike complexes, and etc.

The concept of "aviation weapons" is essentially associated with the aviation complex, and the concept of "aviation precision weapons", for example for strike aircraft, will be expressed as an aviation missile-bomber complex (ARBC) or (in the future) an aviation reconnaissance-strike missile-bomber system . In this case, a specific feature of an aviation high-precision weapon will be associated and coordinated with the tasks of aviation (fire) destruction of the enemy, and the choice of an essential feature will be with the main feature of a high-precision weapon - accuracy as the degree of correspondence of the possible position of the point of impact of the weapon to a given position.

Thus, by high-precision aviation weapons of strike aviation we should understand those weapons that provide a high probability of hitting ground and sea targets not due to the power of the warhead of the aircraft weapons used (or the number of aircraft weapons in a salvo or series), but due to high accuracy their hitting the target (given affected area).

The effectiveness of the use of weapons is assessed using generalized characteristics of the damaging effect: the reduced damage zone (LEZ) - Sn, which has the following properties: when a weapon hits it, the target is hit reliably (probability of hitting the target $W_n = 1$), when using another weapon, it changes and the PPP itself. The magnitude of the PZP is not equal to the target area and depends on the conditions of use of the weapons. Thus, the given affected area is simultaneously a characteristic of the target, the weapon and the conditions of its use, and the probability of hitting the target is equal to the probability of the weapon hitting the PZP.

High-precision weapons (due to high accuracy of hitting the target) are used to hit targets with relatively small sizes. To assess the accuracy of using HTO, the value of the probable radial deviation is used. The law of dispersion of ASP is considered to be normal, since the dispersion of each weapon is determined by the total influence of many factors and at the same time the condition of the central limit theorem is satisfied. If we assume that dispersion occurs on a plane within the reduced dispersion area (SSA), the shape of which is assumed to be a circle with radius R_p and the SSA is covered by the SSA, then the geometric meaning of the probability of hitting a target will be expressed by the ratio of these areas, i.e. $W_n = \min\{1; S_p / S_p\}$, where S_p is the area of the reduced zone (area) of the lesion; S_p is the area of the reduced scattering area.

The numerical value of this probability will be a characteristic of the effectiveness of the combat use of ASP (aircraft weapons). Ensuring high efficiency not by increasing the energy power of the warhead and the number of ASPs used, but by increasing the accuracy of their hitting the target is the essence of the technical feature of aviation high-precision weapons. In the established dependence of the probability of hits of a weapon on the coefficient for the radius of the circle describing the zone of permissible deviations of the hit points (the limits of high hit accuracy), a guarantee probability close to 0.95 was accepted. In this case, the relative radius of the reduced target engagement zone is equal to two (Figure 4).

Therefore, by technical definition, aviation precision weapons of strike aviation mean an aviation missile and bomber complex designed to destroy enemy ground and sea targets with a probability of at least 0.95 in range conditions.

The range of combat use of high-tech weapons is one of the main controllable parameters of an air strike. An increase in the range of application of anti-aircraft guns, as a rule, led to a decrease in the accuracy of hitting the target. However, the tactics quite naturally imposed requirements on the aircraft weapons used: the range of use of the ASP should exclude the entry of an aircraft missile-bomber complex into the zone of destruction of air defense facilities; An increase in the range of application of ASP should not conflict with the accuracy of their hitting the target. In other words, it is necessary to have a so-called tactical sign of high-precision weapons.
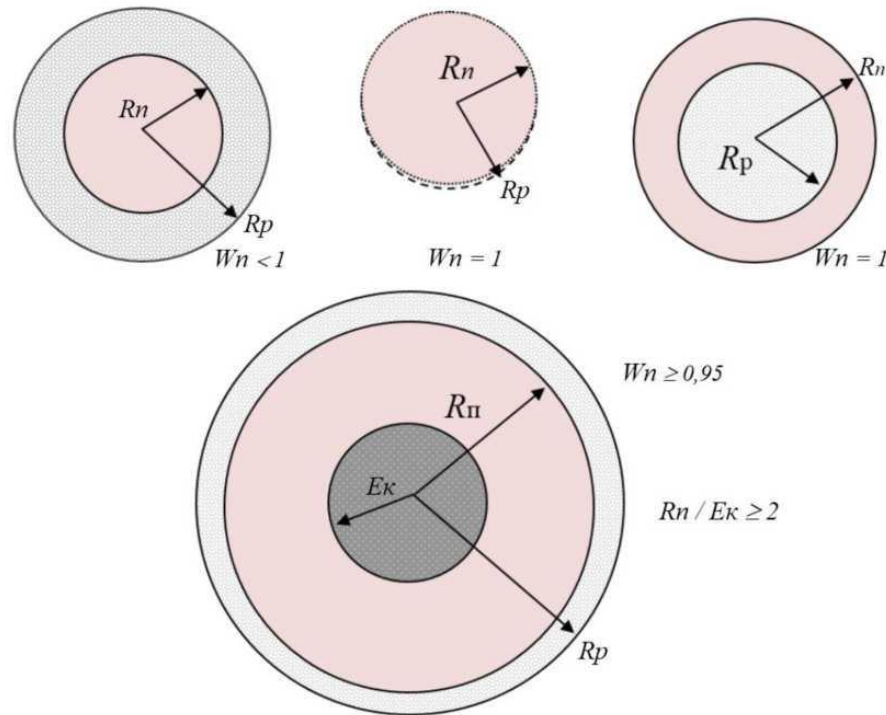
Figure 4. Technical feature of precision weapons

This feature is associated with the range of use of the weapon, which, in turn, affects the accuracy of the weapon's hit. If in the coordinate system "range of use - hit accuracy" we consider the conditional area for the dependence of the range of use of the weapon on the accuracy of the ASP hitting the target, then it is possible to establish a tactical sign of the high-precision weapon. With respect to this attribute, an increase in the range of use of a weapon should not affect the accuracy of hitting the given kill zone or the probability of hitting the target. Thus, on a tactical basis, high-precision strike aviation weapons include aircraft missile and bomber systems capable of using aircraft weapons outside the zone of the target air defense fire system and hitting ground (sea) targets with a probability of at least 0.95.

Summarizing the approach discussed above, it can be noted that such weapons should include ARBCs capable of using guided aircraft missiles and guided aircraft bombs with television-command, correlation-extreme correction systems and homing systems. Modern attack aviation ARBCs are equipped with systems and means to solve the problem of aiming based on target designation data or autonomously when performing complex types of maneuver in the target area. They are capable of hitting ground and sea targets using both guided and unguided aircraft weapons with a probability of at least 0.95. Such high-precision weapons of strike aircraft include, for example, the modernized ARBC Su-24M (SVP-24) and Tu-22M3 (SVP-22), Su-34, Tu-160.

Complex types of ARBC maneuver in the target area have virtually no effect on the accuracy of solving the aiming problem during bombing, and controlled ASPs are used outside the affected areas of air defense systems. These factors have a significant impact on increasing the ability to overcome countermeasures of target air defense systems and make it possible to increase the degree of implementation of capabilities to defeat enemy ground and sea targets.

The results of the analysis of the organization of air strikes using high-precision weapons based on the experience of military conflicts of the second half of the twentieth century. showed that each combat mission must have a corresponding method that resolves contradictions within the tactical situation. A tactical situation is an initially formulated combat mission that involves finding a way to resolve an organizational or tactical contradiction. When using high-precision weapons, the tactical situation determines the methods associated with the intensification of fire destruction of the enemy. Such methods, depending on the classification attribute of the method of delivering an air strike, are shown in table 1.

A selective method of organizing an air strike involves the simultaneous or sequential use of high-precision anti-aircraft missiles from one or several ARBCs against a vulnerable element of the target system.

Table 1

Classification attribute of the method of delivering an air striker	Name of the method of organizing an air strike using high-precision weapons
The nature of the organization of the use of precision weapons	Selective Concentrated Selectively focused
Required number of high-precision anti-aircraft weapons used to destroy an objekt	Single high-precision strike Group high-precision strike Massive air strike
Range of use of high-precision anti-aircraft missiles	Short-range air strike Long-range air strike

The essence of the concentrated method is to organize the simultaneous use of high-precision ASP throughout the strike target system as a whole. With this method of delivering an air strike, a high density of fire destruction of the enemy is achieved. The selectively concentrated method of delivering an air strike involves the simultaneous or sequential use of high-precision anti-aircraft weapons against targets from the system of the strike target. In this case, the aiming task is solved for any target from the strike target system. This method of organizing an air strike can be used against air defense system facilities in the presence of distracting radiation sources. A subsystem of methods for delivering an air strike is a set of methods for using high-precision anti-aircraft weapons on a target.

Conclusions

Thus, the emergence of aviation precision weapons and the experience of their use in wars and armed conflicts of the second half of the twentieth century. and military conflicts of recent decades - a factor that influenced the transition from extensification to intensification of fire destruction of the enemy. The transition to intensifying the fire destruction of the enemy has determined the relevance of the scientific problem, the essence of which is to develop, on a new methodological basis, the theory of organizing the fire destruction of the enemy by strike aircraft using high-precision weapons.

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The Importance of the Application of Artificial Intelligence in the Field of Aviation

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Annotation:

In the article, development and implementation of artificial intelligence technologies in manned and unmanned aerial vehicles, the construction of intelligent aviation systems based on them is one of the most promising areas of combat aviation development, and the introduction of artificial intelligence technologies largely overcomes the above shortcomings and coverage of limitations and working with large volumes of data, high speed of information processing and autonomy of actions are discussed.

Keywords: *artificial intelligence, factors, psychophysiological stress, cognitive ability, aerobatics, intellectual system, thinking, emotion, software technology.*

Currently, the military sector is witnessing an unprecedented rate of technological development. The traditional process of gradual development and modernization of conventional weapons is replaced by the introduction of technologies that provide a sharp increase in tactical-technical characteristics and combat potential, combined with efforts aimed at quality renewal, effective use. operational interaction of these systems. Aviation is no exception.

According to leading local experts, the armed struggle in the 21st century is fundamentally different from the ways and means of conducting wars in the past. The development and implementation of artificial intelligence technologies in manned and unmanned aerial vehicles, building intelligent aviation systems based on them is one of the most promising areas of combat aviation development, which ensures a significant increase in efficiency and effectiveness

With the development of weapons and military equipment, changes in the forms and methods of conducting combat operations, as well as the emergence of wars and armed conflicts, new requirements are imposed when both classical military operations and operations of irregular armed formations are combined.

In order to achieve the goal of military operations, it is necessary not only to quickly and effectively confront the enemy in the execution of a combat mission, but also to carry out multifaceted

planning and forecasting the development of the operational-tactical situation. taking into account and analyzing a large number of factors in a very short time for the rational use of opportunities and resources. All this often happens in the absence of complete, reliable information about the enemy and under the highest psychophysiological stress. [1-2]

75-80% of all incidents in aviation (flight incidents) are related to the psycho-physiological state of a person, and the share of accidents caused by a personal factor can be from 50 to 90% of the total coefficient of accidents. Physiological costs of a pilot in flight are quite high. In fighter jets, the heart rate of many pilots rises to 120 beats per minute or more in normal level flight, and up to 160 beats per minute in supersonic and cloud-bursting. During aerobatics, there may be a short-term increase in blood pressure up to 240/150 mm Hg. In a military pilot, a test pilot, the body is constantly working under stressful conditions.

When limited flight conditions are reached, equipment failure, flight in severe conditions, ejection, changes in the cardiovascular system are accompanied by the release of steroid hormones, adrenaline, glucose, triglycerides 5-7 times higher than the physiological norm. The stress and concentration required for an hour of flight in a fighter jet is equivalent to the eight-hour workload of a ground transport driver. In the short term, man, with his naturally limited ability to process vast amounts of information and make quick decisions as a commander and operator of aviation equipment, becomes a bottleneck as most species grow. is going Complex tasks that must be solved "here and now" reduce to a minimum the psychophysiological and cognitive abilities inherited by man from nature.

At the same time, against the background of improving the technical characteristics of aircraft, the following physical limitations of a person are becoming more and more important. [3-4]

Limits on maximum overload.

A person can withstand overloads of up to 15 g for 3-5 seconds without losing consciousness. Trained pilots in anti-g suits can tolerate g-forces from -3g to +12g. With a positive overload of 7-8 g, the pilot's eyes "go black", vision disappears, and the person gradually loses consciousness. Accordingly, with such overloads, he cannot focus on the complex tasks that arise in a combat situation.

Perceptual blindness (blindness of inattention).

Neglect of any object of a purely psychological nature can also be defined as the pilot's inability to see a stimulus that suddenly appears in his field of vision. According to research, perceptual blindness occurs in any person, regardless of the presence of cognitive impairment. It cannot recognize all the stimuli offered at the same time, and as a result it has a "temporary blindness effect", when it is not possible to distinguish objects or stimuli that appear unexpectedly and are often very noticeable.

Cognitive disorders.

Thinking biases or pattern deviations resulting from dysfunctional beliefs embedded in cognitive schemas. Cognitive distortions are an evolutionarily established pattern of human behavior, whereas a machine is not subject to such distortions of reality (a combat situation).

Limits on the number of regular social contacts (Dunbar's number).

Maintaining such relations involves knowing the specific characteristics of a certain object, with which it is necessary to maintain relations, its nature, as well as its social status, which requires the use of certain mental abilities and considerable intellectual resources. According to various estimates, the number of Dunbar in human communities is in the range from 100 to 230, and is

often conventionally accepted as 150. Accordingly, in large groups, a person cannot physically store more things in memory.

Psychological aspects of the human factor.

The psychological aspect of the human factor of technical activity belongs to its personal and social subsystem, where it represents the anthropological limitations caused by the psychological characteristics of the individual. These include:

➢ decreased ability to predict the development of the situation (decrease in cognitive function);

➢ sufficiently objective self-assessment, which leads to the adoption of decisions, the implementation of which is beyond the power of a particular person;

➢ insufficient professional (technological) discipline;

➢ Tendency to make unreasonable decisions (adventurism, unreasonable "bravery", etc.);

➢ decreased resistance to stress;

➢ Incomplete psychological compatibility in the team.

Naturally, artificial intelligence is free from the above limitations, and it surpasses human capabilities in solving the problems of identifying and recognizing objects.

The implementation of artificial intelligence technologies can largely compensate for the above shortcomings and limitations and bring three main advantages: working with large amounts of data, high speed of information processing and autonomy of actions.
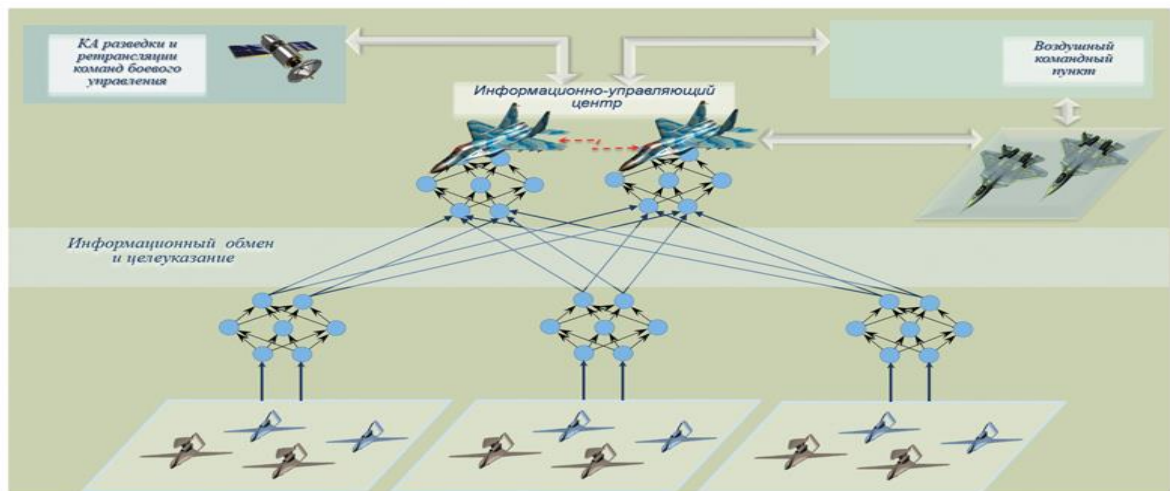
From a practical point of view, the development of artificial intelligence technologies refers to the creation of intelligent machines or computer programs capable of automatically performing functions that were previously only available to humans. The main properties of technical systems belonging to the SI class are appropriate behavior, automatic problem solving, rational thinking, pattern recognition, and the ability to acquire knowledge by itself (learning by examples). Basically, the result of the development and implementation of artificial intelligence is the ability to exclude a person from the process, where a decision must be made in the shortest possible time, and the system does not have seconds to consult with a person.

On the battlefield, whoever makes quick decisions and reacts wins. Cars are unmatched here. Artificial intelligence allows to quickly and accurately identify targets without human intervention,

to issue options and scenarios for further actions, and to respond flexibly to a changing situation in real time.

Conceptually, it is possible to distinguish a number of main directions, the development of which will allow the creation of artificial intelligence systems in relation to military activities.

1. Representation of knowledge - development of methods of systematization, classification and formalization of knowledge from various problem areas (political, military, military-technical, psychological, organizational, etc.) for further development of solutions at all stages of military development.

2. Modeling of reasoning (decision-making processes) - studying and formalizing various schemes of human conclusions based on various information for conducting combat operations, creating effective programs for computer implementation of these schemes.

3. Creation of dialogue procedures for communication in natural language, which provides communication between an intelligent system and a human specialist in the process of solving problems, including in extreme situations involving danger to life, in the transmission and reception of informal orders.

4. Planning of combat operations - the development of control algorithms based on knowledge of the problem area, which are stored in an intellectual system and are constantly obtained from various and diverse data sources: reconnaissance, geodetic, topographic, meteorological, hydrographic, etc.

5. Creation of tools for learning and updating the knowledge base of intellectual systems during their activity, acquiring, collecting and generalizing skills and qualifications. [5-7]

Undoubtedly, the development and introduction of artificial intelligence methods will lead to breakthroughs in the combat potential, in the formation of the appearance of weapons, and even in the philosophy of creating and using weapon systems and military equipment.

According to the opinions of domestic and foreign experts, the further development of combat aviation systems with unmanned aerial vehicles will move from single use to group, collective actions with a high level of information impact, as well as independence, autonomization of behavior. and decision making.

The management system of such groups should have artificial intelligence and sophisticated calculation tools. The group control algorithm should determine the conditions and methods for calculating the reasonable composition of the combat group, solve the problems of situation modeling, target allocation and task effectiveness assessment.

To achieve such a result, it is necessary to create promising intelligent aviation systems and software for them, as well as "teach" them all the necessary things.

Intelligent aviation system (Intelligent Aviation System) built on the basis of unmanned aerial vehicles controlled using "artificial intelligence" technologies allows to conduct combat operations and perform multi-component tasks characterized by a high level of uncertainty. Exactly:

Reconnaissance, surveillance, search for targets;

Fire damage;

Information loss;

Transport tasks;

Organization of information and communication exchange networks, etc.

By analyzing the purpose of advanced intelligent aviation systems and the current level of technological development of artificial intelligence systems based on knowledge and machine learning, a number of key problems and tasks can be formulated and solved. creation of effective combat aviation systems.

According to current forecasts, practical functional artificial intelligence can be created by 2024-2027. It will not be thinking and feeling (so-called "strong" or universal SI), but software and hardware technology that can replace humans in almost any field of activity, special or functional SI). Undoubtedly, in the near future in the field of intellectualization of aviation, there will be a large-scale competition between leading countries and companies for the rapid development and introduction of artificial intelligence technologies. The main directions of artificial intelligence technologies in combat aviation systems, intelligent aviation systems and their application methods can be identified today.

Artificial intelligence has great potential for the development of military aviation. Despite the fact that the implementation of artificial intelligence is only in its early stages, great progress has already been made. Currently, all technological conditions are created for the development of intelligent aviation systems capable of bringing the entire weapon system to a new level of quality.

Thus, advanced intelligent aviation systems are the concept of the future battlefield. Advances in the application of artificial intelligence will undoubtedly provide leadership in the 21st century world in the coming years, just as the leaders of countries that mastered nuclear physics technologies did in the second half of the 20th century.

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Enhancement of Execution Time and Management in a Smart City Environment

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Abstract:

The research focuses on improving task execution and aid management in clever towns, where interconnected gadgets and systems collaborate to improve citizens' excellent of existence. The research proposes an efficient computation offloading mechanism for clever cities, leveraging network facet infrastructure. This mechanism offloads computationally extensive tasks from aid-constrained devices to greater effective aspect servers or cloud assets, lowering the load on local devices. The mechanism makes use of dynamic choice-making algorithms considering factors like tool abilties, network situations, project requirements, and person preferences. The research suggests huge enhancements in execution time, power efficiency, and system performance in smart town contexts, supplying sensible insights for designing and enforcing smart city infrastructures, optimizing resource usage, and improving consumer revel in.

Keywords: Smart city, Execution time, Computing offloading, Edge computing, Cloud computing.

Introduction

1.1. Background

The rapid advancement of technology has paved the manner for the development of smart cities, in which diverse interconnected devices and structures collaborate to enhance the satisfactory of existence for citizens. The Smart City idea has received popularity since the 2010s, with no consensus on its definition. It is broadly commonplace that a clever metropolis need to have offerings that cope with precise issues. The concept is summarized as the 3 Is - Instrumented, Interconnected, and Intelligent - in marketing language. The fundamental intention of a Smart City is to gather statistics thru numerous varieties of sensors and utilize this records to broaden offerings that address precise troubles. Instrumented refers back to the capacity to capture stay information thru numerous types of sensors, Interconnected refers to services communicating and integrating records, and Intelligent refers to the use of analytics, optimization, and visualization to make higher decisions [1]. Despite the great potential of smart towns, numerous demanding situations want to be

addressed to obtain powerful execution time and management. These demanding situations encompass the complexity of integrating numerous systems and technology, privacy and safety worries related to the gathering and analysis of big-scale facts, the need for collaboration and coordination amongst various stakeholders, and the variation of regulatory frameworks to aid the evolving nature of clever town technology.

Smart towns leverage the strength of the Internet of Things (IoT), cloud computing, and area computing to successfully manipulate resources, decorate citizen services, and optimize urban operations. However, the big amount of facts generated through those clever metropolis programs poses widespread challenges in terms of execution time and management. The Internet of Things (IoT) connects physical objects to the internet, allowing environmental facts series and application improvement. However, excessive information era makes it difficult for IoT devices to handle processing needs. Cloud computing gives on-demand access to computing, garage, and verbal exchange sources over the Internet, but incurs high verbal exchange delays and place independence. Cloud computing provider fashions encompass software as a provider (SaaS), platform as a provider (PaaS), and infrastructure as a service (IaaS). Virtualization simulates hardware functionality, growing flexibility and scalability.[2]

The community side performs a essential role in assisting computation offloading in smart city environments. Edge computing infrastructure, deployed towards the give up-consumer gadgets, allows faster records processing and occasional-latency communique. Leveraging the abilities of edge servers, computation offloading can be carried out in a decentralized and disbursed manner, enhancing usual device efficiency and responsiveness [3]. This technique reduces latency, improves electricity performance, and gives bendy computing options for computation-extensive duties. Edge computing minimizes latency, particularly for time-crucial programs like IoT applications, video streaming, self reliant vehicles, and augmented truth. It additionally reduces the need for great nearby processing, that could devour widespread amounts of strength.

Execution time refers back to the period required to complete a selected task or system inside a clever metropolis. It includes a extensive variety of sports, inclusive of transportation, electricity distribution, and waste control, public offerings, and infrastructure protection. Efficient execution time guarantees timely shipping of services, minimizes delays, and maximizes productiveness. On the alternative hand, powerful control entails the allocation and utilization of resources in a manner that optimizes their performance and minimizes waste. It encompasses strategic making plans, choice-making, coordination, and monitoring of diverse elements inside a smart town surroundings. Enhancement of execution time and management in a clever town environment is vital for numerous motives [4]. Firstly, it enables the seamless operation of critical offerings and infrastructure, making sure that residents have get admission to to important amenities and offerings after they want them. Secondly, it promotes monetary boom and attracts agencies by way of presenting a conducive environment for innovation and productiveness. Thirdly, it contributes to sustainability and environmental renovation by means of optimizing aid utilization, decreasing strength intake, and minimizing carbon emissions. Lastly, it complements the overall first-class of life for residents by way of growing a more green, handy, and interconnected urban surroundings.

This studies focuses on addressing the challenges related to execution time and management in a smart city environment thru the implementation of efficient and dynamic computation offloading at the community part. Computation offloading refers back to the process of shifting computational obligations from resource-constrained devices to greater effective computing resources, including edge servers or cloud infrastructure. By offloading computation, clever town programs can gain from enhanced overall performance, reduced latency, and advanced useful resource usage.

The key targets of this research are to layout and enforce an efficient and dynamic computation offloading framework especially tailor-made for smart metropolis environments. The framework

will keep in mind elements along with tool talents, community conditions, application necessities, and energy constraints to intelligently determine which obligations have to be offloaded and in which they should be accomplished. By dynamically adapting to converting situations, the framework can optimize useful resource allocation, lessen execution time, and enhance basic gadget performance. Furthermore, this research targets to assess the proposed framework via massive simulations and actual-global experiments. Performance metrics along with execution time, power consumption, and device scalability could be analyzed to evaluate the effectiveness of the offloading strategies in distinctive smart metropolis eventualities. The studies outcomes will offer treasured insights into the layout and optimization of computation offloading strategies for smart metropolis environments, contributing to the advancement of green and sustainable urban infrastructure.

1.2. Research Objectives

➢ To identify the key factors influencing execution time in a smart city.

➢ To identify the management challenges faced in smart city environments as resource allocation, task scheduling, load balancing, and overall system management.

➢ To explore management strategies for optimizing resource allocation and utilization in a smart city.

➢ To assess the potential of computation offloading in addressing execution time and management challenges in smart city environments.

Literature review

2.1. Smart City Challenges

Numerous research research had been conducted to address the anticipated demanding situations inside the discipline of IoT, inclusive of optimizing resource allocation, coping with service best, and acting computation offloading. In mobile area computing and wireless sensor networks, gadgets that own multiple operation modes were represented within the form of computation offloading schemes or adaptive records input prices [5]. The following key findings emerge from the literature evaluation:

Increasing Data Volume: Smart cities generate a big quantity of records from diverse assets, including sensors, IoT gadgets, social media structures, and public services. This facts encompasses diverse sorts which includes environmental records, traffic statistics, and citizen-generated facts. Managing and processing this big volume of data in real-time or close to-actual-time can strain the computational assets and effect the execution time of clever town applications.

Resource Limitations: Edge devices deployed in smart town environments frequently have constrained computational competencies, memory, and electricity supply. These devices may also include sensors, actuators, wearables, and embedded systems. The limited resources of these gadgets can prevent their capability to carry out complicated computations regionally, main to longer execution times and decreased typical device performance.

Real-Time and Near-Real-Time Response: Many smart metropolis packages require real-time or near-actual-time reaction to make sure effective choice-making and well timed moves. For example, traffic control systems need to process records speedy to offer real-time visitors updates and optimize visitors go with the flow. Emergency response structures rely upon speedy facts processing to stumble on and respond to incidents directly. Achieving low-latency execution turns into vital to satisfy the reaction time necessities of such packages [6].

Scalability: Smart city infrastructures need to handle the increasing quantity of gadgets, users, and records sources. As the infrastructure scales up, making sure that the execution time remains within

proper limits will become hard. Scalability troubles can stand up in terms of information garage, processing capacity, community bandwidth, and infrastructure management. Efficient execution time management techniques are required to hold system overall performance because the clever metropolis surroundings expands.

Heterogeneity of Devices and Networks: Smart metropolis environments incorporate a wide range of gadgets, every with extraordinary computational competencies and network connectivity. These devices can consist of low-energy sensors, smartphones, vehicles, and infrastructure additives. Coordinating and handling the heterogeneous resources to optimize execution time will become complex. Additionally, the variety of communication networks, inclusive of mobile networks, Wi-Fi, and LPWAN, similarly provides to the mission of ensuring green and well timed facts processing.[7]

Energy Efficiency: Energy consumption is a important component of smart town environments, especially for aid-confined devices running on constrained battery energy. Optimizing the strength usage of gadgets is important to increase battery life, lessen upkeep costs, and decrease environmental impact. Execution time control strategies that do not forget strength performance can assist prolong the lifespan of devices and permit sustainable operation in clever town deployments.

The Internet of Things (IoT) has become a ubiquitous technology, connecting diverse physical objects to the Internet, enabling the collection of environmental statistics and the development of new programs and services. The IoT performs a essential role in clever towns through connecting numerous bodily gadgets and allowing information series, communique, and interaction among them. In the context of execution time and control enhancement, the IoT serves as the underlying network of interconnected gadgets that generate real-time statistics. These gadgets can encompass sensors, actuators, wearables, and other smart devices deployed throughout the smart metropolis infrastructure. The records generated with the aid of IoT gadgets gives treasured insights for choice-making, optimization, and improving the overall performance of clever metropolis operations [8].

However, the increasing amount of records generated makes it difficult for IoT devices to deal with the excessive processing needs of those programs. The IoT includes diverse items with one-of-a-kind functions and necessities, making it greater difficult to meet the Quality of Service (QoS) necessities. Cloud computing enables on-demand community get admission to to shared assets, no matter a person's area, and has revolutionized the way scientists handle big amounts of statistics in numerous fields [9]. Additionally, it has obstacles, including its region independence of processing, that's specifically difficult for precise types of networks that require actual-time processing.

Cloud computing enhances the IoT in smart towns via offering the important computational resources, storage skills, and information processing competencies. Cloud computing is a generation that offers on-demand get entry to to computing, storage, and conversation resources over the Internet. Cloud platforms enable the storage and evaluation of the full-size quantities of data generated by IoT devices in a scalable and flexible way. Cloud computing empowers clever metropolis programs and services with the capability to efficaciously process and manage statistics, host programs, and offer real-time get right of entry to to records. The cloud additionally facilitates collaboration and records sharing among unique stakeholders involved inside the clever town surroundings.[10]

Several studies have employed cloud computing to solve large-scale computational problems. For example, Sun et al. [11] developed a learning-based system to deal with the challenging offloading task in vehicle cloud computing and reduce offloading latency based on prior latency measurements. Chen and Hao [12] employed the idea of software-defined networking (SDN) to study the issue of task offloading in ultra-dense networks, with the purpose of not only lowering challenge execution time but also saving tool battery potential. Hasan, Hossain, and Khan [13] proposed a localized cloud computing version in an IoT context that allows users to construct ad

hoc clouds through computing equipment in their nearby settings for problem offloading techniques. Cloud computing has transformed the way scientists handle vast amounts of data across multiple professions. For example, Langmead & Nellore [14] used cloud computing in genomics facts analysis, with large, archival sequencing records requiring huge computational power to perform.

Cloud computing provides numerous benefits, but because to its centralized and remote architecture, it causes significant verbal communication delays in meeting the demanding criteria of future time-critical applications [15]. Furthermore, Firdhous, Ghazali, and Hassan [16] identified various barriers to cloud computing, including its geographical independence of processing, which is primarily challenging for precise kinds of networks (e.g., IoT and sensor networks) that demand real-time processing.

2.2. Execution Time Optimization

Execution time is a key metric that measures how long it takes for a selected undertaking to be completed on a device inside the context of venture of entirety. It acts as a crucial gauge of the tool's effectiveness in finishing obligations fast and producing responsive outcomes. We accumulate valuable insights into the tool's overall performance ability through cautiously analyzing the execution time. A faster execution time shows that the device can method and whole sports quick, enhancing user revel in and growing productivity. A longer execution time, on the other hand, could imply potential bottlenecks or inefficiencies in activity execution, that may have a negative impact on person pleasure and system overall performance as a whole.[17]

Real-time structures, as an example, where time-sensitive operations must be completed with the aid of set closing dates, region a top rate on execution time performance. For instance, the potential to reap low execution instances is critical for preserving device responsiveness and ensuring short choice-making in crucial packages like independent vehicles or clinical tracking device [18]. Furthermore, for clean user experiences in interactive packages or user interfaces, a short execution time is important. Users expect instantaneous responses to their instructions, and any observable postpone may reason annoyance and discontent. Thus, decreasing execution time will become important for developing effective and person-friendly apps.

Execution time is a critical parameter that enables us to evaluate how successfully a tool completes sports on time. In loads of programs and areas, we are able to enhance person studies, growth device responsiveness, and growth average productiveness by means of cutting down on execution time. Several studies have investigated diverse approaches to optimize execution time in clever town environments. One commonplace approach is mission scheduling and allocation, which involves assigning computational obligations to suitable sources for you to minimize execution time. For instance, [19] proposed a mission scheduling set of rules based totally at the genetic set of rules to optimize the execution time of obligations in a smart town. The algorithm considers various factors along with task traits, aid availability, and communique delays to allocate duties successfully.

Another place of studies is parallel processing and allotted computing. By dividing a complex mission into smaller sub-tasks and processing them concurrently, execution time can be significantly reduced. [20] provided a parallel computing framework for smart metropolis programs, where duties are divided into parallel gadgets and finished concurrently on a couple of processing nodes. The observe validated that parallel processing can correctly enhance the execution time of useful resource-intensive tasks in a smart town surroundings.

In addition to task scheduling and parallel processing, different strategies have been explored to optimize execution time. For example, caching and information replication techniques were investigated to reduce the latency of records get entry to and improve universal machine performance. [21] proposed a caching mechanism for smart metropolis packages, where regularly

accessed facts is stored towards the threshold of the network, reducing the retrieval time and enhancing execution time.

The research on efficient and dynamic computation offloading at the network facet for clever town environments is carefully related to the execution time optimization literature. Computation offloading involves shifting computational responsibilities from resource-restrained devices to extra effective facet servers or cloud resources, thereby decreasing the execution time and improving the performance of clever town applications. Efficient and dynamic computation offloading techniques purpose to determine the highest quality offloading choices based on elements consisting of mission traits, network situations, and useful resource availability. For instance, [22] proposed a dynamic computation offloading scheme for clever town environments that considers the real-time challenge necessities, network congestion, and energy intake of facet devices. The examine demonstrated that dynamic offloading decisions can effectively lessen execution time and improve the general device performance.

2.3. Computation Offloading

Computation offloading involves the delegation of computational tasks from a useful resource-confined device (e.G., IoT device, part device) to greater capable sources, together with cloud servers or part servers. The aim of computation offloading is to improve execution time, beautify resource usage, and optimize the overall overall performance of smart town packages. Various offloading techniques have been proposed within the literature to decide whilst and in which to dump computation in clever metropolis environments. These techniques don't forget factors including tool capabilities, community conditions, application necessities, and strength constraints. Dynamic offloading approaches, which include decision-making algorithms and system learning strategies, were explored to adaptively determine the most desirable offloading selections primarily based on actual-time context and gadget conditions.[23]

Offloading techniques like paintings department and partitioning are often hired and are vital for reinforcing the effectiveness and performance of mobile and distributed structures. In order to distribute and perform a complex venture or workload among many computing assets, these strategies require breaking it down into smaller, more viable subtasks. Task partitioning is the manner of breaking a mission down into smaller subtasks relying on predetermined criteria such useful resource availability, computational wishes, and information dependencies. Due to this separation, the undertaking can be done in parallel or in a distributed fashion the use of many pc resources. Task partitioning seeks to lower overall execution time and decorate system performance through effectively partitioning a task.[21]

On the opposite hand, venture division concentrates on allocating the subtasks to suitable laptop sources within the machine. This allocation might also keep in mind things like load balancing, strength performance, network situations, and processor power. Task division aims to match every subtask with the most appropriate computing resource, taking into account both that useful resource's skills and the device's overall goals. For powerful offloading in various settings, work division and partitioning are each essential. Task partitioning, for instance, aids in breaking down the workload into smaller chunks that may be executed regionally or offloaded to the correct aid in mobile edge computing, wherein computational activities are offloaded from cellular gadgets to close by part servers or cloud sources [25]. The high-quality way to distribute those subtasks among the available sources is then decided by using mission department, which takes into consideration such things as community latency, power use, and useful resource usage.

Taking under consideration various cost models in mobile contexts, Wu et al. Delivered a direction-based totally offloading partitioning set of rules [26] that identifies which quantities of an application process ought to execute on mobile devices and which quantities must run on cloud servers. In [27], Kiani and Ansari added a challenge scheduling approach made in particular for

hierarchical cloudlets and code partitioning through the years in cellular aspect networks. [28], which offered a partial offloading method for wi-fi mobile cloud computing, is some other piece of labor this is comparable. Given that the workload may be broken down into smaller components, Wang et al. [29] did the identical and evolved a dynamic offloading strategy for MEC-enabled automobile networks, which is similar to our work. Our work varies from [29] in that [29] did now not speak thinking of numerous servers and get admission to points when making selections. However, the majority of the modern-day research ignores the actual constraints given with the aid of the varying motion speeds of automobiles.

Current research is addressing the considerable issue of designing powerful work offloading mechanisms in an side environment with useful resource-intensive devices [30]. Many studies have seemed into aspect offloading for delay-sensitive applications all through the beyond few years. For example, to lessen processing delays, Naouri et al. [31] created a three-layer offloading architecture where every project is offloaded to a separate tier depending on the necessary compute and communique fees. To decrease network latency and energy utilization, He et al. [32] investigated the Edge User Allocation (EUA) issue in an edge computing scenario.

Cloud offloading includes moving computation tasks from resource-constrained gadgets to cloud servers. Cloud computing presents scalable computing assets, storage, and information processing capabilities, making it appropriate for coping with huge-scale statistics generated in clever metropolis environments. Researchers have investigated cloud-based offloading processes, including challenge allocation algorithms, load balancing strategies, and optimization frameworks, to enhance execution time and resource utilization in clever city packages.

Computation offloading in smart town environments involves exchange-offs among factors consisting of latency, energy intake, network bandwidth, and statistics privateness. The decision to offload computation have to consider these trades-offs and strike a balance based at the specific requirements of the utility and the to be had sources. Challenges associated with network reliability, protection, privateness, and the dynamic nature of clever city environments have also been recognized, necessitating the development of strong offloading mechanisms [33].

Computation offloading has been studied in various utility domains within clever cities. These consist of site visitors control, environmental monitoring, healthcare systems, surveillance, strength management, and emergency response structures. Each utility domain has specific necessities and constraints, influencing the layout and implementation of computation offloading techniques.

2.4. Edge Computing in Smart Cities

Computation offloading to the network edge has received giant interest inside the context of smart cities. Edge computing leverages the computational assets available at the edge of the network, in the direction of the data supply, to carry out computation-in depth duties. Offloading computation to aspect servers reduces latency, complements actual-time response, and alleviates the burden at the cloud infrastructure. Researchers have proposed facet-based offloading schemes, together with workload partitioning, assignment scheduling algorithms, and useful resource management strategies, to successfully make use of facet sources in clever city environments.[34]

Edge computing refers back to the paradigm of processing records and appearing computation at or near the community side, towards the records source or give up-person gadgets, in place of depending solely on centralized cloud servers. It pursuits to reduce latency, beautify real-time response, improve scalability, and alleviate community congestion by way of bringing computation closer to wherein it's miles wanted. In the context of smart towns, side computing may be implemented to numerous domains, such as transportation, energy control, healthcare, public safety, and environmental tracking [35]. The deployment of part computing in smart cities calls for the status quo of a disbursed infrastructure on the community part. This infrastructure accommodates side servers, gateways, routers, and different gadgets able to processing and storing statistics.

Researchers have explored the design and implementation of aspect infrastructure which could aid the computational needs of clever city packages. This includes issues which includes useful resource provisioning, scalability, reliability, and energy efficiency.

Edge computing allows the mixing of intelligence and selection-making skills at the threshold of the network. By processing information locally, facet gadgets can examine and extract treasured insights in actual-time, lowering the need for facts transmission to centralized cloud servers. Edge intelligence strategies, inclusive of machine mastering algorithms and statistics analytics, have been investigated for diverse clever metropolis packages. These techniques enable neighborhood data processing, predictive analytics, anomaly detection, and personalized offerings, enhancing the efficiency and effectiveness of clever city structures.

Applying facet computing to the Internet of Things (IoT) can maximize its benefits. IoT gadgets aren't constantly able to in shape the criteria of these applications, regardless of the reality that new time-sensitive applications are speedy rising. Many earlier efforts have used aspect computing to cope with this trouble. For example, Long, Cao, Jiang, and Zhang [36] devised an edge-computing architecture to overcome the issue with typical multimedia IoT systems that experience delays and congestion in constrained bandwidth. The device that has been added permits organization creation and video institution matching to enhance human detection accuracy in a restrained quantity of time. A Mobile Edge Computing (MEC) framework for unmanned aerial motors (UAV) became tested inside the observe by way of Zhang, Xu, Loo, Yang & Xiao [36]. A UAV with MEC abilities can help the system compute time-touchy tasks for IoT terminal devices within a fixed amount of time. A UAV-assisted MEC device turned into also proposed with the aid of Yang, Yao, Wang, Jiang, Benslimane, and Liu [64], wherein UAVs permit project offloading for IoT gadgets. To discover UAVs near ideal places, they created the differential evolution (DE) mechanism. Part computing in the Industrial IoT (IIoT) can provide the benefits of fast processing, autonomy, and network adaptability, allowing for intelligent manufacturing. Chen et al. [37] investigated and implemented an aspect computing framework for a smart manufacturing facility.

Edge computing in smart cities regularly works together with cloud computing to strike a stability among neighborhood processing and centralized assets. Researchers have explored mechanisms for green collaboration between edge devices and cloud servers. This collaboration entails task offloading, workload partitioning, and resource control strategies to optimize the distribution of computation among the edge and the cloud. By leveraging cloud assets whilst needed and offloading precise duties to the edge, smart town packages can achieve higher performance, scalability, and responsiveness.

Although side computing gets round a number of the acknowledged drawbacks of cloud computing, like high latency and community congestion, there are nevertheless a number of issues with the nevertheless-evolving IoT [38]. Area computing, like cloud computing, has a centralized design in which all requests from surrounding IoT devices are sent to a single component server. Furthermore, in comparison to cloud servers, the threshold server contains fewer sources. As a result, an activity from an IoT tool may take longer to conclude universally if too many requests are offloaded to the threshold server. It can be nice to use each cloud and edge sources for processing in edge computing as the need to offload requests from give up devices grows. Let's take the case where the brink server is the handiest location where IoT device-generated tasks are processed. When there are too many jobs inside the side's processing queue, the threshold won't have the ability to finish all of them in a well timed way, which might cross beyond what the IoT devices are able to. Even with minor delays in transit between the threshold and the cloud, some of the requested activities may take longer to perform at the brink than on a cloud server. Thus, in extremely congested aspect settings, combining facet and cloud resources should speed up the overall crowning glory time of obligations from IoT devices.

In order to lower challenge put off and electricity consumption, the have a look at discussed in reference [39] suggests the idea of collaborative Mobile Edge Computing (MEC). This approach became created by and large for unmanned aerial vehicle (UAV) applications that require using images and movies to carry out operations like object detection or site visitors monitoring. An Edge server gets the pics and films for processing. In the original examine, a gadget orchestrator selects the server to use, the information charge at which statistics may be transmitted to the server, and the workload distribution some of the servers. As there might be several operators for the MEC servers, it's far vital to have a more bendy choice-making procedure in our have a look at, in which the mobile node itself makes these choices independently.

In their article [40], Ouyang and associates speak the way to optimize service performance on the cellular edge at the same time as taking an extended-time period price obstacle under consideration. The authors use Lyapunov optimization to divide the optimization problem into many real-time sub-issues that do not require earlier understanding of user mobility with a purpose to address the surprising person mobility. Based on Markov approximation, the authors create an approximation technique that yields a solution this is near ideal. A context-sensitive offloading machine that uses machine gaining knowledge of category techniques is brought in Reference [41]. A profiling system, system getting to know type algorithms, and middleware make up the system. The look at's authors check out whether a project have to be executed locally or on the Edge node. Once the algorithms have made a choice, our advised paintings can assist with the choice-making manner of selecting which server to apply and while to begin offloading.

Methodology

3.1. The proposed method

This chapter describes our endeavors to create a honest online device for offloading computations in part computing. Our objective is to deal with the problems discussed in advance in this thesis. We commence by imparting the system model for our offloading predicament. Subsequently, we introduce a category of straightforward offloading mechanisms, which encompasses our suggested mechanism. We then delve into our precise trouble and have a look at how the general techniques of convex optimization may be utilized to address its extraordinary traits. Lastly, we unveil the set of rules that we have devised as our proposed answer.

Efficient and dynamic computation offloading at the community facet, as proposed in the studies, leverages the IoT and cloud computing to deal with smart metropolis challenges associated with execution time and control. By offloading computational tasks from resource-restricted IoT devices to the network side and using cloud resources, the research aims to optimize execution time, enhance resource usage, and enhance the general performance of smart city operations. This technique takes advantage of the competencies of both the IoT and cloud computing to triumph over the challenges and release the full potential of smart town environments.

3.2. Task Model

In this studies, we explore the idea of an independent mission, denoted as $T=t\_1,t\_2,t\_3,\ldots,t\_j$, for man or woman cellular customers. Each assignment, represented by using t, is submitted by a cell consumer, denoted as n, and may be characterized by using a hard and fast of parameters: c_n, d_n, T_n, and P_n. These parameters correspond to the desired CPU cycle in line with bit of obligations, the size of the mission data, the cut-off date for completing the task, and the concern value assigned to task t_n, respectively. Additionally, we outline l_n as the offloading information size for mobile consumer n, and α_n as the fraction of mission offloading for that person, wherein l_n is calculated because the manufactured from d_n and α_n, i.E l_n=d_n.α_n. Moreover, we introduce the concept of favored strength intake, denoted as E_(b,n), for each mobile device. This fee serves as a baseline for determining the electricity requirement of every cellular device.

3.3. Offloading Decision Model

The Edge computing version employs Edge nodes to carry out workloads in the offloading version, wherein workloads are transferred from a consumer device to an Edge node. This technique has been proven to be useful for workloads that require numerical operations, face popularity programs, and online games. Mobile side clouds or cloudlets are often used to facilitate this model .

The cellular-edge computing system (MEC) structure is a complex structure that mixes a couple of mobile devices and operates as a compact facts middle. It contains two layers: the mobile client layer and the brink server layer. Task allocation models play a essential position in figuring out how duties are dispensed and processed inside the system. Three fashions are designed: all neighborhood techniques all offload techniques, and partial offload techniques.
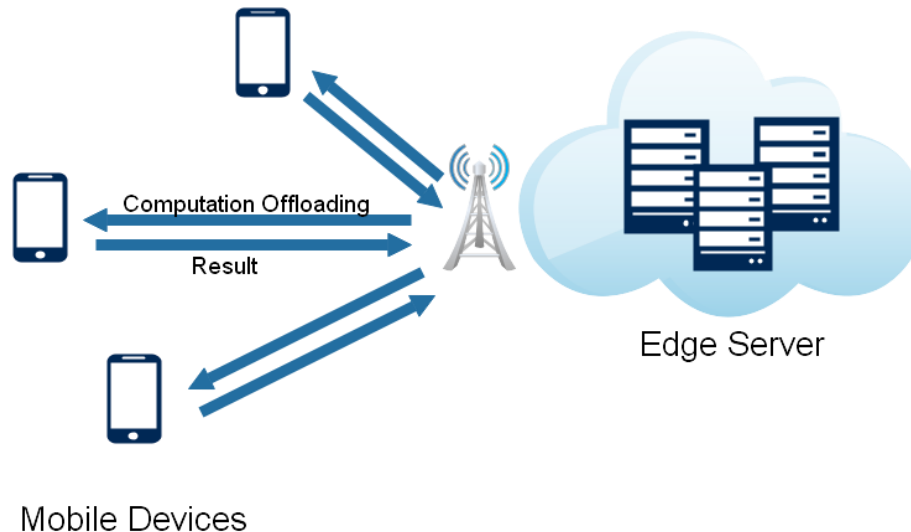
3.3.1. Optimization Offloading Model

The "all nearby manner" model specializes in executing tasks completely on the cellular patron, permitting short challenge execution without depending closely on the edge server layer. The "all offload technique" model offloads all obligations to the threshold server layer for processing, reaping rewards cellular customers with confined computational capabilities or obligations that demand massive computational sources. The "partial offload manner" version strikes a stability among the 2 fashions, allowing the mobile patron to deal with tasks successfully while offloading more complicated or useful resource-in depth responsibilities to the threshold servers.

The choice of the perfect allocation version relies upon on factors which include undertaking complexity, aid availability, latency constraints, and strength performance concerns. The "partial offload process" model allows for a mixture of local processing at the cell consumer and offloading certain quantities of the responsibilities to the threshold server layer. This model calls for effective conversation and coordination between the cell customer and the brink server layer, which includes project partitioning, information transfer protocols, and synchronization mechanisms.

By leveraging the blessings of both local processing and offloading, the "partial offload method" version optimizes aid usage and enhances the general performance of the MEC machine. It moves a stability between leveraging the computational capabilities of the mobile client and utilising the infrastructure of the threshold server layer, ensuing in progressed task execution, reduced latency, and enhanced consumer revel in.

The proposed technique for reading cellular tool overall performance turned into developed the usage of MatLab software program in 2019. The simulator gives a flexible platform for evaluating the approach throughout various eventualities and conditions, incorporating state-of-the-art algorithms and mathematical fashions to correctly mirror actual-global conditions. Its intuitive interface allows users to personalize simulation parameters, satisfactory-tune algorithmic settings, and visualize effects.

The proposed approach become evaluated towards four alternative procedures: "All- Local," "All-Offload," "All Offload+Priority," and "Random." The "All Local" approach focuses on nearby challenge execution without offloading them to outside servers, leveraging the computing abilities of mobile devices. This approach reduces reliance on outside servers, minimizes network latency, enhances records privacy and protection, and distributes computational workload more frivolously across the network. However, the effectiveness of this strategy depends on man or woman cell device computational abilties.

In our performance assessment, we have selected key metrics: execution time. These metrics offer precious insights into the performance and effectiveness of project of completion on cellular gadgets.

Execution time refers to the length required to complete a selected mission. It measures the efficiency of the device in executing the given undertaking right away. By analyzing the execution time, we are able to determine the device's ability to supply brief and responsive outcomes, which is vital for accomplishing best consumer revel in and productiveness.

Completion Time:

Completion time, denoted as t_n, is a crucial overall performance metric for cellular gadgets, encompassing each nearby execution time and partial offloading transmission time. Equation (4 7) estimates the overall time required for a tool to execute responsibilities, considering project allocation strategy and wireless verbal exchange channel trends.

$$t_n = t_{n,l}(1 - \alpha_n) + t_{n,o} \cdot \alpha_n \qquad (4\text{-}7)$$

We may also moreover research extra approximately the exchange-offs amongst nearby execution and partial offloading as well as the consequences of transmission delays on challenge of entirety by means of the use of studying the crowning glory time model. This know-how may be used to beautify load-balancing strategies, venture allocation selections, and useful resource scheduling in cell computing structures.

Each mobile tool takes into consideration both the neighborhood execution time and the partial offloading transmission time at the same time as calculating the final touch time. Equation (four-6) offers a mathematical description of the crowning glory time, allowing us to assess and improve task allocation guidelines and useful resource management tactics to make sure effective and timely pastime execution in cellular computing settings.

Results and discussion

Within this phase, we will present the simulation results obtained from the simulations performed using the aforementioned settings. These simulations were carefully designed to evaluate the overall performance and effectiveness of the tool underneath investigation. By carrying out these simulations, we aimed to gather valuable data and insights into the device's behavior, capabilities, and obstacles. The consequences received from these simulations offer a comprehensive knowledge of ways the machine performs and behaves in numerous eventualities and conditions.

4.1. Evaluation based on the number of tasks

An early experiment turned into done to assess the efficacy of the counseled strategy, with an emphasis on the amount of obligations generated and completed on mobile devices. Figure 5 1 offers the facts from this test, that are associated with execution time and energy use, respectively.

Execution time

Figure five-1 provides insights into the execution time of the duties. It showcases the period required for the proposed approach to finish each venture at the cellular devices. We can compare the effectiveness and responsiveness of the approach in providing quick effects via analyzing this records. A shorter execution time might suggest that the advised solution performs well in phrases of mission final touch speed, improving user experience and boosting productivity.
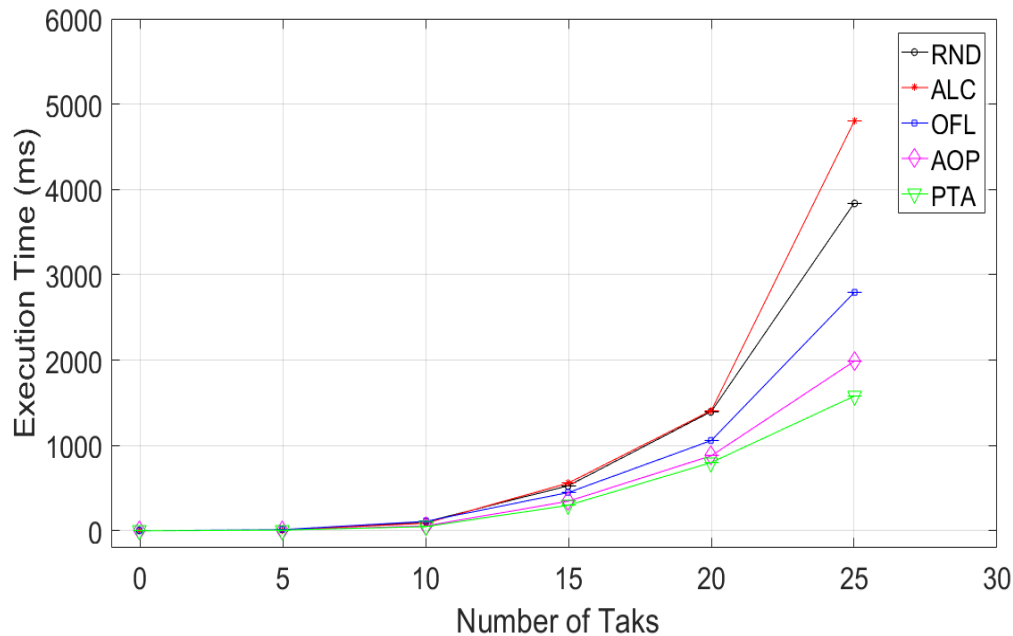
Figure 5-1 Comparison of Execution Time based on the Number of Tasks for the proposed method and the benchmarks.

Discussion

We are able to have a entire hold close of the performance of the cautioned approach while used with mobile devices way to the thorough examination of Figure 5 1. The approach's performance, efficacy, and sustainability are all useful facts that can be received from the evaluation based on execution time.

We can evaluate how nicely the suggested strategy works on mobile gadgets by means of searching at the execution time information shown in Figure five 1. In order to provide the satisfactory consumer enjoy and productiveness, a way have to carry out nicely in terms of activity crowning glory velocity, which is proven through a reduced execution time. These insights permit us to assess the approach's effectiveness and pinpoint regions that would use development.

4.2. Evaluation based on task data size

The size of tasks generated and finished on cellular gadgets changed into the focal point of a 2d test, which turned into achieved to further investigate the efficacy of the counseled strategy. The cause of this experiment turned into to find out how the overall performance of the technique is impacted through the job size. Figure five- three shows the test's results, which include the conclusions about execution time and energy intake, respectively.

Execution time

Figure five- three sheds light on how long various-sized jobs take to finish. We may also evaluate how the counseled approach performs even as coping with duties of diverse sizes or complexity with the aid of reading this data. It allows us to recognize the technique's scalability and spot any potential performance variances connected to various work sizes. In order to make sure powerful challenge execution over a range of paintings sizes, we are able to use the consequences in Figure five- 3 to manual our decision-making on mission allocation, useful resource control, and machine optimization.
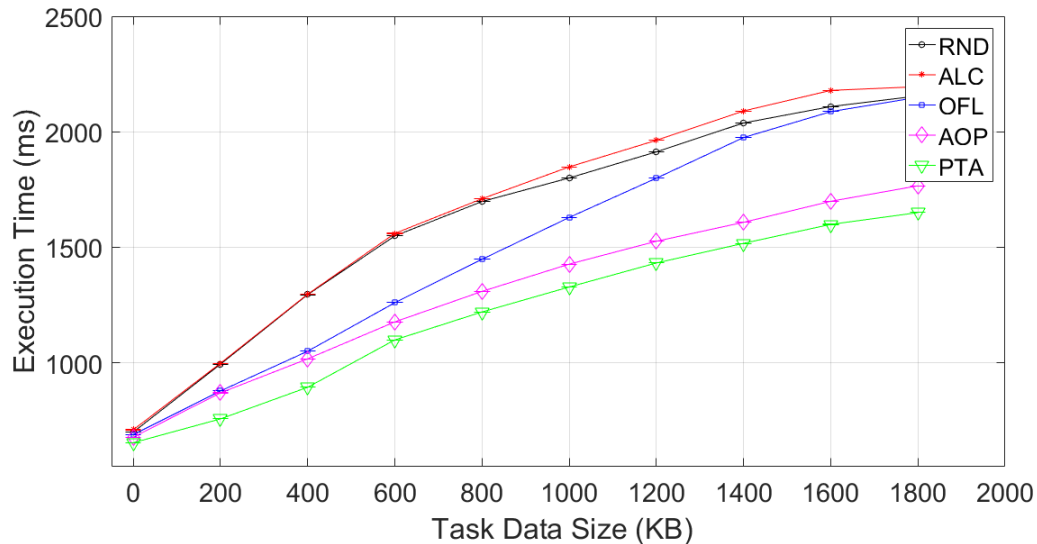

Figure 5-3. Comparison of Execution Time based on the Task Data Size for the proposed method and the benchmarks.

Discussion

In fact, looking at Figure five- 3 in conjunctions enables us to advantage insightful understanding into the performance developments of the recommended method with reference to mission size. A thorough image of how the method operates whilst coping with jobs of numerous complexities or sizes can be gained from the assessment based on execution time and power utilization.

We can compare how the overall performance of the approach is impacted by using various mission sizes by looking at Figure 5 3, which shows the execution time consequences. We can evaluate the method's performance and scalability in dealing with duties of different complexity ranges way to this examination. We can become aware of viable bottlenecks or places for improvement with the aid of comprehending the variances in execution times across various task sizes, which leads to strategic gadget optimization.

4.3. Evaluation based on exponential distributions

A third test, which targeting the exponential distribution of mission size, became performed to similarly evaluate the efficacy of the counseled method. The purpose of this experiment became to study how well the technique performs while the dimensions of the tasks is sent exponentially. The results of this experiment are supplied in Figure 5-5, depicting the findings related to execution time and strength intake, respectively.

Execution time

Figure five-five presents insights into the execution time of tasks following an exponential distribution of size. We may additionally learn the way well the cautioned strategy works while coping with tasks of various sizes that observe an exponential distribution sample via inspecting this

information. We can check the method's effectiveness and scalability in dealing with such task distributions thanks to this evaluation. The results in Figure five-five help decision-makers make properly-informed alternatives about aid allocation, scheduling tactics, and ability upgrades to make sure powerful project execution in instances in which duties have an exponential distribution pattern.
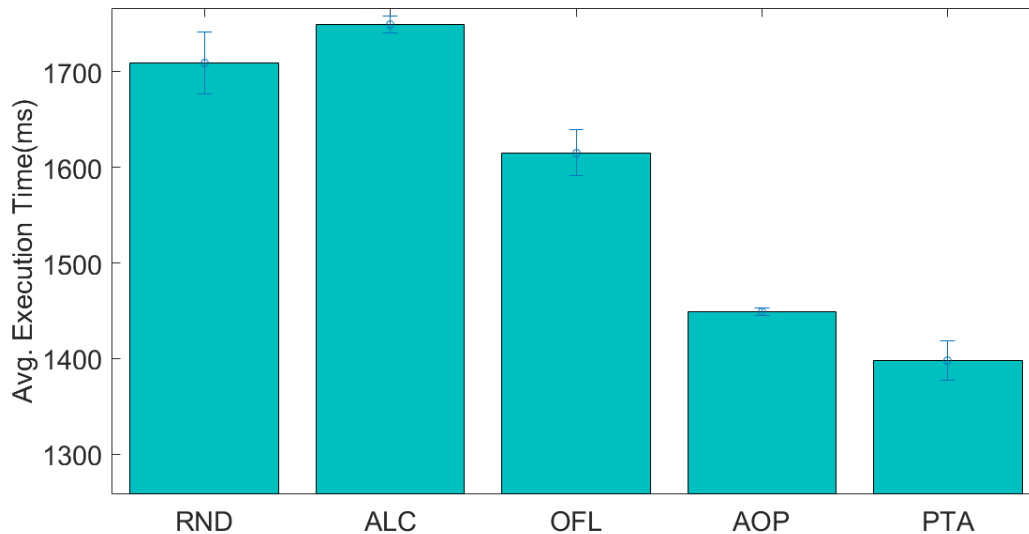

Figure 5-5 Comparison of the proposed method and the benchmarks in terms of Execution Time.

Discussion

Absolutely, inspecting Figure five- five permits us to advantage treasured insights into the overall performance traits of the proposed technique whilst tasks follow an exponential distribution of size. An in-depth insight of the way the approach operates in those occasions can be received from the evaluation based on execution time and electricity consumption.

We may additionally evaluate how an exponential distribution of challenge sizes affects the approach's performance by means of looking at Figure five-5, which indicates the execution time results. Through this research, we're capable of comprehend how the approach manages tasks of various sizes that observe this positive distribution sample. It aids in the detection of any ability overall performance variances or troubles that the exponential distribution may also result in. In situations where sports comply with an exponential distribution of size, these insights resource in strategic gadget optimization and informed choice-making.

Conclusion and future works

This paper provides a mechanism for at the same time offloading computation and prioritizing project scheduling to maximise the effectiveness of multi-person mobile-edge computing structures. In order to improve system overall performance, which includes challenge finishing touch time, and first-rate of provider measures like throughput, the research intends to deal with troubles in undertaking allocation and useful resource management in cellular-facet computing structures. The proposed plan is placed up against present day methods in a radical performance evaluation.

Our findings display that exceptional venture offloading strategies show similar completion speeds for modest process sizes. This consistency in of entirety times can be because of the truth that project sizes, irrespective of the offloading technique used, aren't terrific sufficient to have a substantial effect on execution time. However, when job sizes growth, a great difference in completion times across the numerous work offloading strategies appears. Depending on the

offloading mechanism used, the bigger task sizes bring about varied of completion instances due to the fact they call for greater computational assets and time to manner.

The facet server's computational electricity, the effectiveness of records switch, and the distribution of responsibilities between the cell tool and the brink server are some of the reasons of this discrepancy in final touch times. As undertaking sizes increase, exclusive offloading strategies may additionally have differing ranges of achievement in using these variables, which in the end has an effect on the overall final touch time. Therefore, when choosing a suitable offloading technique, it's far vital to take assignment sizes into consideration. The consequences emphasize the importance of optimizing venture offloading strategies, specifically for larger duties, to gain well timed and powerful execution, lessen of completion times, and enhance machine overall performance.

Task offloading between mobile gadgets and aspect servers is immediately impacted by using latency constraints. Low latency requirements make it possible to offload more jobs to the threshold server, which accelerates project execution and shortens completion instances. Due to effective process execution order scheduling, the advised offloading technique excels in phrases of entirety time. This technique is reliable for enhancing assignment execution in mobile systems because it maximizes resource utilization and minimizes delays, which improves user revel in, reduces queuing waits, and will increase gadget performance.

The studies contributes to the prevailing body of knowledge within the discipline and might manual practitioners in implementing powerful strategies for actual-international deployment. The potential utility of joint computation offloading and precedence-primarily based assignment scheduling extends past the specific context of this have a look at, providing a promising pathway for enhancing the overall performance and efficiency of IoT-Edge structures in various domains and packages.

Recommendations:

Integration of Heterogeneous Networks: To enhance the robustness and flexibility of the computation offloading mechanism, the study recommends the integration of heterogeneous networks, including 5G and beyond, to ensure seamless connectivity and support for a diverse range of smart city applications.

Real-time Monitoring and Adaptation: Implementing real-time monitoring systems that can track network conditions and device capabilities in real-time would allow for more dynamic and responsive offloading decisions, further reducing execution times and improving service quality.

Energy-aware Offloading Strategies: The study suggests the development of energy-aware algorithms that consider the energy consumption of both local devices and edge servers when making offloading decisions, aiming to minimize the overall energy footprint of smart city operations.

Security and Privacy Enhancements: As smart cities become more reliant on data, ensuring the security and privacy of offloaded tasks is paramount. The study recommends the incorporation of advanced encryption and authentication mechanisms to protect sensitive information during offloading processes.

Scalability and Future-proofing: To accommodate the growing number of devices and data volumes in smart cities, the study recommends designing the computation offloading framework with scalability in mind, using modular and extensible architectures that can easily adapt to future technological advancements and increased demands.

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An Optimization Method for Resource Allocation in Industrial Internet of Things

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Abstract:

An approach to improving the overall performance of edge-integrated edge IoT networks is presented in this paper: linked deep learning-based resource scheduling. An IoT network needs to use the greatest resources available from the edge layer in order to do a task efficiently and within the allotted time. Careful resource scheduling is necessary for the selection and distribution of the best resources. Deep learning algorithms were previously developed to reduce information transmission idleness and integrate edge networks with Internet of Things applications. To enhance the overall effectiveness and caliber of management of an IoT application, it is important to examine a few distinct metrics, such as reaction time, hold up time, and data transmission requirements. To achieve this higher performance, a convolutional brain network and gated recurrent unit are used in a connected system. The suggested resource scheduling model takes into account the characteristics and needs of the resources in order to select the best resources from the resource pool and distribute them to the IoT networks. An extensive analysis of the related approach and trial perceptions is included in this paper.

Keywords: *Resource Allocation, Industrial Internet of Things (IIoT), Optimization Method, IoT Resource Management, Industrial Automation.*

1. INTRODUCTION

The creative ways that digitization has changed the way we engage with data and technology have a significant effect on how resources are allocated. On account of digitization, organizations can now accumulate gigantic measures of information from different sources, including machines, sensors, and gadgets. By dissecting this information, one might better oversee resources by acquiring understanding into how well frameworks and processes are doing. as The Internet of Things was conceived out of Industry 1.0. (IoT). In the eighteenth hundred years, the original (1.0) of ventures utilized steam ability to deliver the materials required for their tasks (Karmakar, 2019). Industry 4.0 is a generally new idea. Industry 4.0 purposes new framework to associate industrial processes to the internet, giving specialists remote machine control and quick access to information saved in the

cloud. The transition from Industry 1.0 to Industry 4.0 has led to a significant increase in the amount of information generated. Limiting power misfortune and increasing energy productivity are fundamental to the Industrial Internet of Things (IIoT) (Lai, 2019).

Allocating resources properly entails figuring out how to use them as effectively and efficiently as is practical in order to accomplish this. AI, cloud computing, and edge computing are instances of the state of the art innovations that have arisen because of digitalization and can be utilized for dynamic resource assignment. With regards to the (IIoT), dynamic resource portion alludes to the continuous dispersion of PC resources — like memory, computer processor, stockpiling, and network bandwidth — across different administrations, applications, and processes as per demand and need. These gadgets create a lot of information, which should be instantly broke down, evaluated, and utilized (Fernandez-Carames, 2019). Dynamic resource portion can ensure this information's versatile, reliable, and productive processing. By empowering information processing to occur nearer to the information source, edge computing diminishes latency and upgrades information security. This strategy limits the use of computational resources by keeping away from the requirement for extra information stockpiling and move since it just processes the information that is required. Since cloud computing gives clients internet access to a pool of computing resources, it empowers organizations to develop their PC capacities because of demand (Mariani, 2019). By quickly provisioning and deprovisioning computing resources on a case-by-case basis, it empowers proficient sending of computing resources without the requirement for actual equipment. Contingent upon the particular requirements of the industrial climate, resource distribution in the IIoT can be changed utilizing various methodologies, for example, AI based, reinforcement learning, and optimization systems. With regards to the Industrial Internet of Things (IIoT), "resource allotment" alludes to the productive and effective dissemination of resources, including bandwidth, stockpiling, energy, and processing power, across various gadgets and frameworks (Khan, 2019).

Whenever that the (IoT) is widely used for applications with both vast and narrow scopes. Every sector makes use of the IoT's component benefits, which advance performance scenarios. Massive amounts of information were generated by the proliferation of IoT devices, ranging from intelligent urban communities to astute farming, and these should be used effectively. Distributed computing can effectively address the register and capacity limitations of the Internet of Things (Lynch, 2019). IoT devices with limited resources gather data and forward it to the cloud for further analysis. In any case, information transmission from IoT devices to the cloud and vice versa increases significantly and necessitates important data transfer capacity due to the heterogeneity of IoT devices in the network. One recommended way to reduce idleness is through edge computing, which uses IoT networks to transport computing resources from the cloud to the end user. Edge computing serves as a scaffolding element in cloud and IoT networks. Edge computing applications gradually reduce the overall figure load associated with distributed computing (Wu, 2022).

The processing requirements for each type of information are diverse, reflecting the variety of information that has amassed within the Internet of Things network. All information should be processed, whether on the cloud or at the edge, by scheduling resource requests. Resource requirements are represented by assignments, and the errands are how the edge network receives resource requests. At that point, it selects the best cloud resources and schedules their use for additional computation by IoT networks. Even though the cloud offers a multitude of resources, it must consider some important factors, like energy consumption, bandwidth congestion, and load balancing, to avoid violating service level agreements (Farhad, 2022).

Edge computing is used in IoT networks to reduce real-time actual data processing latency in cloud computing environments. Edge improves network efficiency and reduces computation, blockage, and idle information transmission by giving IoT networks the appropriate cloud resources. The majority of cloud resources are shared virtual or real resources, therefore sharing them over edge

networks will alter their adaptability and flexibility. Because different applications have varying resource requirements, which means that different computing resources are needed, the edge of an IoT network scheduling system needs to be aware of these requirements (Debbabi, 2022).

The most current approaches to resource scheduling are either statistically or machine learning based scheduling strategies. The best resources are selected from the resource pool in accordance with the resource requirements. In an effort to increase scheduling performance, deep learning approaches have lately replaced statistical and machine learning-based scheduling models. Deep learning computations, such as reinforcement learning (RL) calculations, deep neural networks, deep reinforcement learning, or Q-learning, are used in resource scheduling in edge computing. Either way, even if deep learning methods work rather well, it is critical to increase productivity by reducing wait times and scheduling conflicts. Hence, an associated deep learning arrangement is accommodated resource scheduling in edge facilitated Internet of Things networks.

Cloud IoT Coordination Numerous Internet of Things applications have embraced the vast information processing, investigation, and capacity capabilities of cloud computing. In an Internet of Things environment, IoT devices communicate with items via the cloud, and occasionally, linked objects use the cloud computing environment for communication. Clients can use cloud administrations from anywhere at any time, depending on their needs. Smart transportation, smart agricultural, smart urban communities, and smart healthcare applications all made extensive use of this cloud-coordinated IoT strategy. However, due to the large distance information transfer from IoT devices to the cloud, there is a delay in information processing. The level of management provided by IoT apps will depend on reaction times. While coordinating the cloud with IoT, it is necessary to maintain devices and the cloud connected consistently, which poses a challenge. Therefore, it is essential to consider the following few points when developing cloud-cloud integrated Internet of Things applications (Han, 2022).

➢ As little postponement as conceivable from start to finish and a brief reaction are important to work on the quality of administrations.

➢ Reliable and consistent connectivity between nodes and the cloud is essential for Internet of Things applications.

➢ The computational complexity increases with the addition of many networking protocols. Therefore, choosing the appropriate conventions is crucial to limiting computational problems.
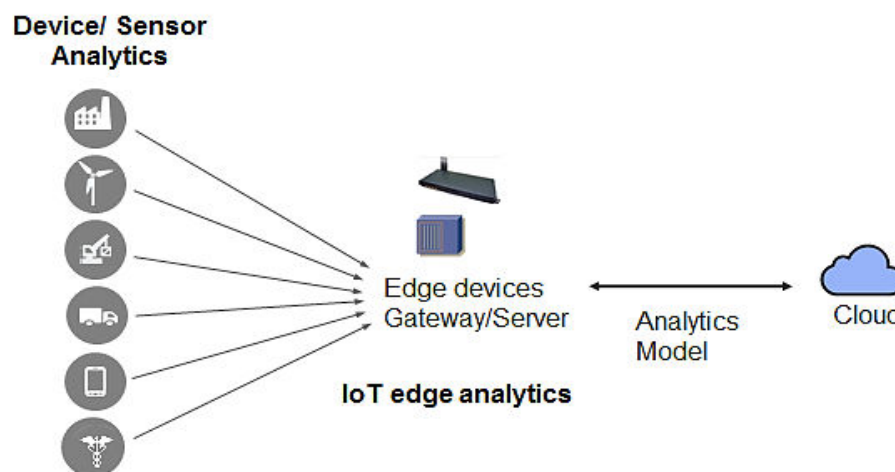

Figure 1: IoT edge networks

1.1. Edge IoT Integration

In a cloud integrated IoT environment, the requirements are limited by an edge integrated IoT module. One of the noteworthy computing situations is edge computing, which transfers cloud resources directly to the device of the end-user, reducing processing complexity and latency. Some of the applications of edge computing include cloudlets, mobile edge computing, and haze computing. Every one of these strategies diminishes how much time expected to process information and gives brief reactions to Internet of Things applications. The Internet of Things application can profit from help with conveyed and limited data handling by utilizing edge computing. Edge moreover upgrades structure strength to non-basic disappointment and enduring quality by bringing down information transmission requirements and furnishing Internet of Things clients with incredible flexibility. Figure 1 gives a fundamental representation of the association between edge cloud and IoT gadgets (Chu, 2022).
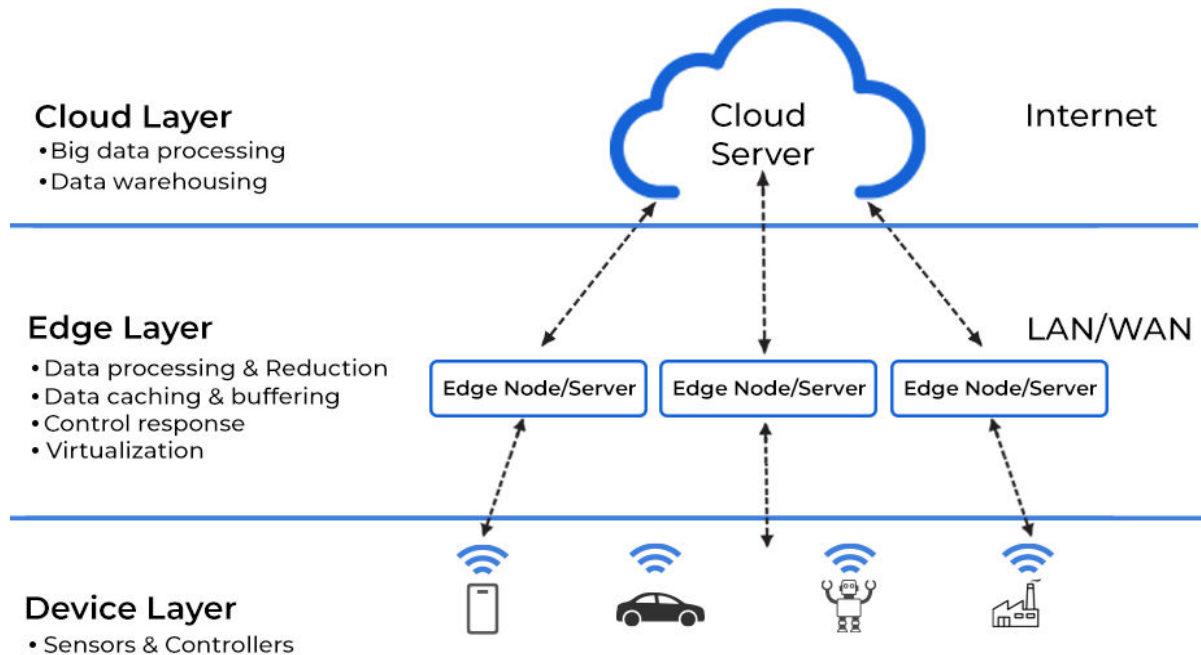
Figure 2: Cloud-edge-IoT device relationship

2. LITERATURE REVIEW

Liu, X., & Zhang, X. (2019): The cognitive IIoT (CIIoT) has been proposed to improve range use by distinguishing and accessing inactive range, in light of cognitive radio (Liu, 2019). This paper proposes a bunch based CIIoT, by which the group heads utilize helpful range detecting to get accessible range and the hubs use nonorthogonal multiple access (NOMA) for transmission. This would work on the CIIoT's detecting and transmission performance. The typical complete throughput and range access likelihood of the CIIoT are determined, and the casing construction of the organization is planned. To boost the typical all-out throughput, a joint asset streamlining for detecting time, hub powers, and group count is created. Through power enhancement and detecting, the ideal arrangement is accomplished. To ensure energy equilibrium and upgrade transmission performance, individually, the bunching calculation and group head rotation are recommended. Reproductions have shown that contrasted with standard NOMA and symmetrical multiple access, the NOMA for the bunch based CIIoT can all the more likely guarantee the transmission performance of every hub.

Yang, L., Li, M., Si, P., Yang, R., Sun, E., & Zhang, Y. (2020): In this paper, we solidify (MEC) into IIoT systems empowered by blockchain development to overhaul the computational constrain of IIoT contraptions and streamline the understanding framework (Yang, 2020). Meanwhile, the

calculation above and energy use are mutually considered while working out the weighted framework cost. To decrease utilization, we likewise propose an improvement system for blockchain-enabled IIoT frameworks and design the recommended issue as a Markov decision process (MDP). To boost gadget energy portion and limit weighted framework cost, dynamic choice and change can be made to the expert regulator, offloading decision, block size, and process server. Considering the exceptionally powerful and huge layered nature of the issue, deep reinforcement learning (DRL) is in this way presented as an answer. Contrasting our proposed plot with other existing plans, recreation discoveries demonstrate the way that it can significantly increment framework performance.

Wang, K., Zhou, Y., Liu, Z., Shao, Z., Luo, X., and Yang, Y. (2020): This examination considers a NOMA-based FC structure for IIoT frameworks, in which a few errand hubs use NOMA to offload their obligations to a few adjoining partner hubs for execution (Wang, 2020). We propose a half and half errand planning and subcarrier distribution issue, taking into account this present reality correspondence and computing limitations, and meaning to limit the complete expense concerning postponement and energy utilization. Remember that power, calculation asset, and assignment distributions are completely remembered for the undertaking booking. Finding the most fitting response to a combinatorial issue like this is troublesome in light of the fact that the work and subcarrier designations contain twofold factors. To accomplish this, we utilize web based learning to deal with the undertaking booking and subcarrier portion issues. We recommend an iterative way to deal with mutually improve the undertaking booking and subcarrier portion in each time episode all through the web based learning process. As per the aftereffects of the reproduction, the proposed plan can significantly bring down the aggregate expense when contrasted with the benchmark plans.

Lai, X., Hu, Q., Wang, W., Fei, L., and Huang, Y. (2020): The self-comparability of the IIoT hubs' perception information is surveyed in this concentrate to focus on the hubs powerfully (Lai X. H., 2020). The (DQN) calculation is then used to make a versatile asset distribution system that thinks about the elements of different hub needs. Contrasting the proposed system with current methodologies, reenactment results demonstrate the way that it can effectively increment network throughput and lessening information transmission dormancy. Critical improvement potential for the headway and execution of the (IIoT) are achieved by the modernization and change of the industrial assembling area. One of the primary difficulties confronting IIoT is the manner by which to connect countless IIoT hubs to the current IP-based Internet to advance the combination of industrialization and informationization. focused on the lack that ongoing strategies just permit one channel and utilize a specific number of time allotments, prompting a decrease in performance while endeavoring to tackle the asset portion issue for hubs with differing needs.

Gao, W., Zhao, Z., Min, G., Ni, Q., & Jiang, Y. (2021): Planning inactivity is the basic execution marker in mechanical Web of things (IIoT) systems since mechanized collecting commonly needs fast handling (Gao, 2021). The continuous endeavors extend the amount of successful devices to enliven the planning handle. By the by, since IIoT system contraptions are routinely appropriated thickly, including more clients might bring approximately basic impedance and extended planning idleness. In this paper, we propose RaFed, a asset dispersion framework for FL. We frame and appear that the optimization issue of restricting arrangement idleness is NP-hard. To choose contraptions that fulfill a sensible part the distinction between mixing time and impedance, we offer a heuristic method. We perform tests on an IIoT system with a RGB-D dataset.

Huang, X. (2020): The advantages of lattice and star networks are consolidated in an original two-layer dispersed mixture industrial Internet of things engineering (Huang, 2020). Its will likely guarantee maximum framework throughput while keeping up with client reasonableness and to meet the quality of service (QoS) requirement. To begin with, to determine the client's need, the postpone need factor and the rate need factor are presented in view of the client's holding up defer in the queue and their rate requirement. A short time later, unique resource scheduling and

designation are executed on the access connect and the backhaul interface, separately. The original calculation can accomplish high framework throughput and decency, better meet GBR requirements, and have a low bundle misfortune rate, as per the recreation discoveries.

Sun, W., Liu, J., Yue, Y., & Zhang, H. (2018): In this work, we concentrate on the joint organize money related angles and asset assignment issue in MEC, where edge servers offer their limited computing benefit at inquire costs and IIoT MDs ask offloading with ensured offers (Sun, 2018). To discover coordinated matches between IIoT MDs and edge servers as well as the assessing components for tall system efficiency beneath region necessities, we unequivocally propose two twofold sell off plans with energetic assessing in MEC:a breakeven-based twofold sell off (BDA) and a more capable special esteeming based twofold sell off. The two calculations are demonstrated to be honest, individual profit producing, framework proficient, and financial plan adjusted by hypothetical review. The recommended DPDA and BDA can enormously expand the framework proficiency of MEC in IIoT, as per the discoveries of broad reenactments used to evaluate the performance of the proposed calculations.

Yang, O., & Wang, Y. (2020): A unique designation model for time and power resources is proposed in this examination (Yang O. &., 2020). A calculation for dynamic resource assignment was made based on the proposed model to bring down energy use. Besides, a calculation for allotting power and time was made to upgrade the framework's energy proficiency. A definite prologue to the two calculations' strategies was given. The results of the reenactment show that both powerful resource distribution calculations could bring down the correspondence framework's energy misfortune while keeping up with the information queue's strength. The review's decisions support improved correspondence framework performance in numerous IIoT situations.

Yu, P., Yang, M., Xiong, A., Ding, Y., Li, W., Qiu, X., ... and Cheriet, M. (2020): This article recommends a wisely determined green resource designation system for the IIoT under 5G heterogeneous networks, given the absence of an energy-effective resource the board engineering for the whole network (Yu, 2020). Initial, a system for insightful, self-sorting out, start to finish resource portion for IIoT services is introduced. The system's energy-proficient resource designation strategy is then recommended. Then, utilizing an offbeat benefit entertainer pundit driven deep reinforcement learning calculation, a keen framework takes care of the issue. The proposed strategy can beat other traditional deep learning (DL) strategies and keep up with service quality above satisfactory levels by looking at different techniques and impetuses under IIoT situations with fitting boundary arrangement.

3. CONCENTRATED DEEP LEARNING ALGORITHM

A meticulous mathematical model for the suggested linked deep learning approach is presented in this section. Figure 1 provides a crucial representation of the suggested model, emphasizing a convolutional neural network and gated recurrent unit for first element extraction. When analyzing the resource request, consideration is given to the necessary resource class, sub-class, class, length, and other factors.

The resource requests are isolated from the encompassing and land information utilizing a solitary layered convolutional neural network. The gated recurrent unit (GRU) has been chosen for the proposed work due to its predominant performance and least measure of processing intricacy. In contrast with ordinary long short-term memory (LSTM), GRU breaks down input features quicker and requires less imperatives. GRU can possibly actually address the vanishing point issue in RNN and bypass existing scheduling techniques. At last, the linked highlights are gathered to orchestrate the ideal resources for the positions.
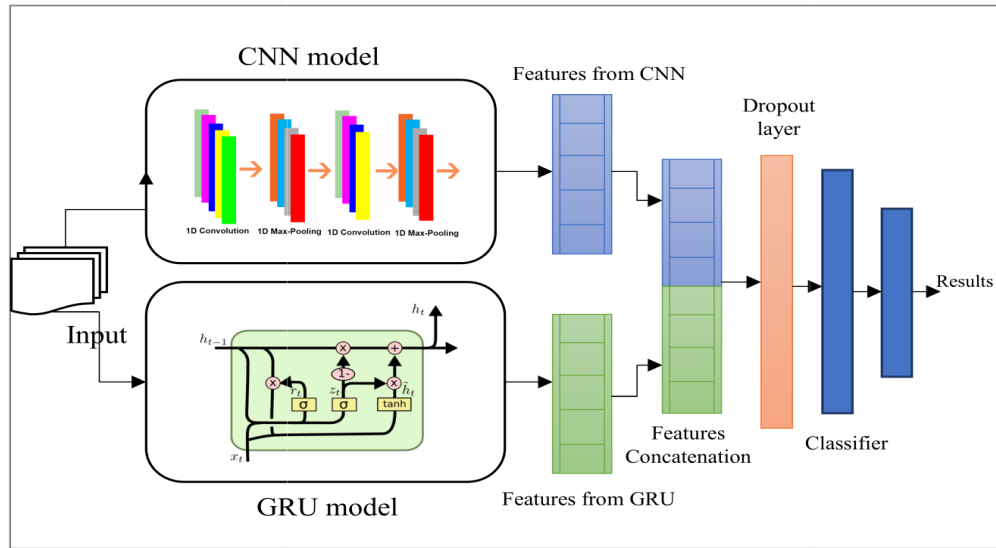
Figure 3: Model for Concatenated deep learning

3.1. Gated Recurrent Unit

The GRU show utilized within the recommended demonstrate could be a gated repetitive neural organize. Differentiated with LSTM's three entries, GRU has as it were two entryways. On account of its upgrade and reset entryways, which also offer assistance to increase affiliation rates, the GRU requires less limits than a LSTM. The memory cell of the GRU show is utilized to urge basic information and is fit for recognizing conditions within the demands for information assets. The futile data is either deleted or fizzled to keep in mind by the GRU's reset entryway. The commitment to the GRU show is customarily period arrangement information, and the asset ask input is seen as a period arrangement information with a singular s time step. For illustration, through graduation works, the GRU model's comes about are obtained. The result of the noteworthy layer is managed with into the ensuing layer, and this strategy is reiterated to confine the critical highlights from the commitment for the succeeding layer (Kai Jiaet al., 2023). Numerically, the GRU demonstrate is delineated as

$$G_u = \sigma\big(w_u(\widetilde{v}^{(t-1)}, \mathbf{x}^{(t)}) + \boldsymbol{b}_u\big)$$

$$G_r = \sigma\big(w_r(\widetilde{v}^{(t-1)}, \mathbf{x}^{(t)}) + \boldsymbol{b}_r\big)$$

where Gr addresses the reset entryway and Gu addresses the update door. The reach of the reset entrance is [-1,1], and the reach of the update door is [0,1]. Wu stands for the update door weight capability, and Wr for the reset entrance weight capability. Similarly, Br handles the predisposition vector for the reset entryway and the inclination vector for the update door. Next is the specification of the probable actuation capacity for the recurrent unit, taking into account the entryway works.

$$\widetilde{v}^{(t)} = \tanh\big[w_u\big(G_r \times \widetilde{v}^{(t-1)}, x^{(t)}\big) + \boldsymbol{b}_u\big]$$

The inclination vector is tended to by the activation capacity weight factors, which are tended to as Wu for the update entrance, for the situation that the data getting ready data is tended to as X(t). At long last, the result of the GRU model is introduced as

$$v^{(t)} = \big((1 - G_u) \times \widetilde{v}^{(t-1)}\big) + \big(G_u \times \widetilde{v}^{(t)}\big)$$

where v(t-1) represents the current unit input and d is obtained from the previous unit yield. The information from the CNN model is combined with the result highlights from the GRU model, and further processing is done to determine the optimal resources for scheduling.

3.2. Convolutional Neural Network

The Convolutional Neural Organize Show utilized within the suggested work at to begin with segments the commitment to subclasses in see of the particulars, which is at that point dealt with into the Convolution layer. Two max-pooling layers and two convolution layers are utilized within the suggested planning to remove noteworthy information from the asset demands. Differentiated with standard neural organize models, CNN offers completely unparalleled information preparing capacities and the capacity to keep up with adjacent affiliations. In relationship with past neural arrange models, this one all the more really gives the components whereas staying the spatial zone of the related information. The free preparation strategy grants the organize to recognize diverse information attributions. The basic thought behind the CNN module is the convolution handle, which is considered as a comparing prepare. The loads of the single one-layered perspectives parcel, which are tended to by the terms {W1,W2,...,Wn}, where n is the part's length, can be thought of to numerically create the convolution prepare.

$$y_t = f\left(\sum_{i=1}^{n} W_i * x_{t-i+1}\right)$$

where the input test is tended to as Xt and the information made at time t is tended to as Yt. The incitation capability within the proposed show is the Rectified Linear Unit (ReLU). The symbol for the activation function is (). Mathematically, the activation function can be expressed as

$$\mathbf{ReLU(x)} = \begin{cases} \mathbf{x, x > 0} \\ \mathbf{0, x \leq 0} \end{cases}$$

The proposed technique utilizes maximum pooling to put down a boundary on the part size following the convolution layer. Alterability is decreased by down analyzing the convolution layer yields. The max pooling administrator sends the maximum worth, which can be mathematically stated as

$$\mathcal{P}_{j,m} = \max\left(\hbar_{j,(m-1)n+r}\right)$$

Where m denotes the maximum pooled band, j displays the channels, and n is the permitted pooling shift between the sections. Generally speaking, the pooling layer reduces the dimensionality of the convolution groups. Cluster standardization, which standardizes the parts to optimize preparation results, occurs after the pooling capability. The mathematical expression for batch normalization features is as follows.

$$\mu = \frac{1}{n_{bat}} \sum_{n=1}^{n_{bat}} x_n$$

$$\sigma^2 = \frac{1}{n_{bat}} \sum_{n=1}^{n_{bat}} (x_n - \mu)^2$$

$$\hat{x} = \frac{x_n - \mu}{\sqrt{\sigma^2 + \varepsilon}}$$

$$y_n = \gamma \hat{x}_n + \beta$$

Where the bunch size is addressed by Nbat and the information by Xn. σ2 addresses the group difference, though μ addresses the mean. A consistent ε, communicated as $\hat{X}$, is added to the standardized information to forestall zero slopes. The vector learning boundaries are addressed by the image Dand K. The result include portrayals are Y and β . The result component's portrayal is signified by Yn.

The parts got from the CNN and GRU models are related within the taking after organize. After concatenation, a dropout layer is utilized to hinder information overfitting. Inevitably, the related parts are portrayed through the totally related arrange layer and SoftMax calculations to create the

fitting assets for the assignment necessities. Scientifically, the SoftMax constrain is communicated as

$$\hat{y} = softmax(2)$$

Where Q is the output of the dropout layer. Finally, the loss function of the proposed model is validated using a cross-entropy entropy function. It has the following mathematical expression:

$$\ell = -\frac{1}{b}\sum_{i=1}^{n} y_i \, log \, y_i'$$

Where b and n denote the batch and training sample sizes, respectively, and yi', the projected factor, and yi, the actual factor.

4. PERFORMANCE EVALUATION

Using the Opuna group and Opkeras abilities in Python for replication examination, the viability of the proposed deep learning model is affirmed through perception. Subsequently, hyperparameters are made and altered to additionally further develop performance with the utilization of these ventures. The assessment was led utilizing benchmark information got from Intel's Berkeley research offices. Subtleties of the hyperparameters utilized in the multiplication test are shown in Table 1. A relative examination is led between current methodologies, for example, the genetic estimation, the (IPSO) computation, the (LSTM), and the (BRNN), to give a better recommendation. These techniques are assessed in view of how productively they use resources and how quick they answer, complete, delay undertakings ordinarily, and work.

Figure 4 shows the accuracy and loss curves for the suggested model. The testing and preparation procedure informs how the performance measures are perceived. The complete dataset has been divided into 70:20:10 for approval, testing, and preparation. Once the perceptions are estimated for ages more than 25, the performances remain unchanged. The results demonstrate that the suggested model has been verified and achieves the highest level of precision.
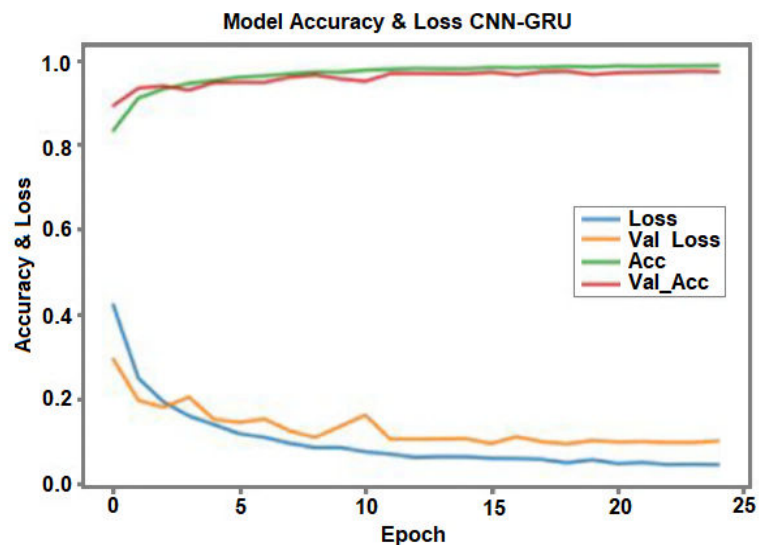
Figure 4:

The resource usage of the suggested model in comparison to the active models is examined in Figure 4. The best possible resource selection enables the suggested model to optimize resource utilization, as ought to be evident from the results. Since the roles have the best resources available, the information estimations will be completed quickly, allowing other activities to use these resources. As a result, the suggested model uses more general resources than the methods used now.

The performance of the suggested model and the current BRNN models performs similarly, although there are significant differences in the resource consumption values between the models.
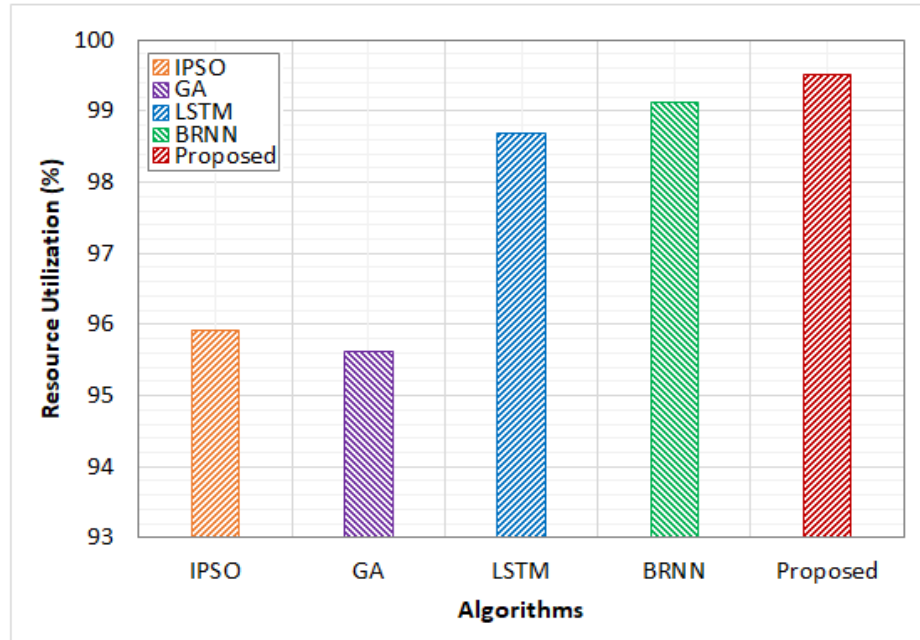
Figure 5:

Figure 5 displays a response time comparison of the existing resource scheduling techniques with the proposed concatenated deep learning methods. The amount of time used by the scheduling computation to evaluate and schedule resource requests is known as the reaction time. The usual time is determined for each approach that requests an alternative resource from edge computing. The suggested model displays a basic reaction season of 1.25 s for resource queries. Fascinatingly, the standard climbs via optional methods. In comparison to the suggested model reaction time, the BRNN, LSTM, GA, and IPSO models have longer reaction seasons. Processing a resource request takes 1.54 seconds for the BRNN model and 1.66 seconds for the LSTM model.
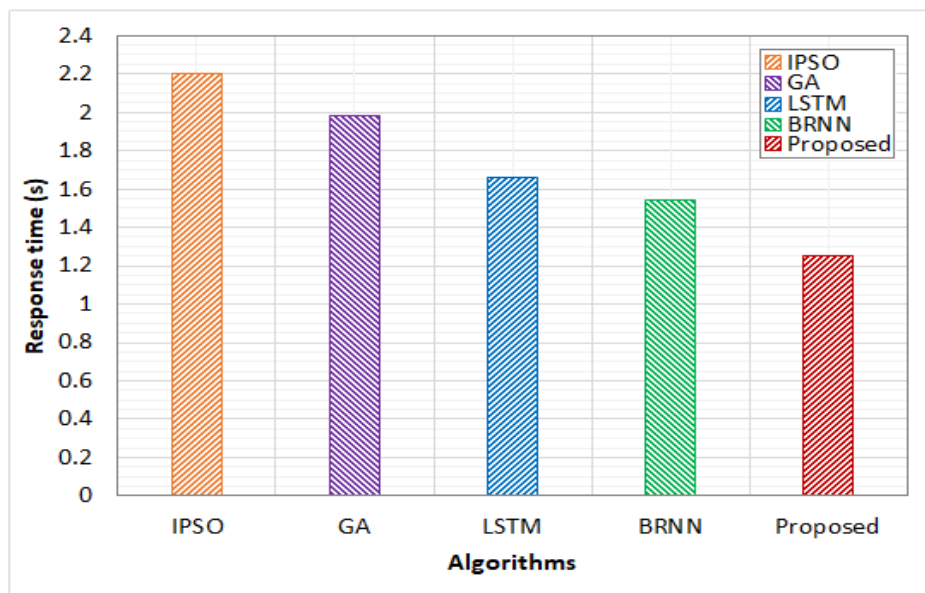
Figure 6:

The general execution seasons of the suggested model are compared to the best-in-class models in Figure 6. The total amount of time anticipated to evaluate a resource request, select the optimal resource from the pool, and schedule the requested resource is known as the execution time. The results demonstrate that, when compared to alternative scheduling strategies, the suggested model has the quickest execution time. It takes 10.25 seconds to run the suggested model, which is 5 seconds longer than the BRNN model, 8 seconds longer than the LSTM-based scheduling model, 11 seconds longer than the GA model, and 16 seconds longer than the IPSO model.
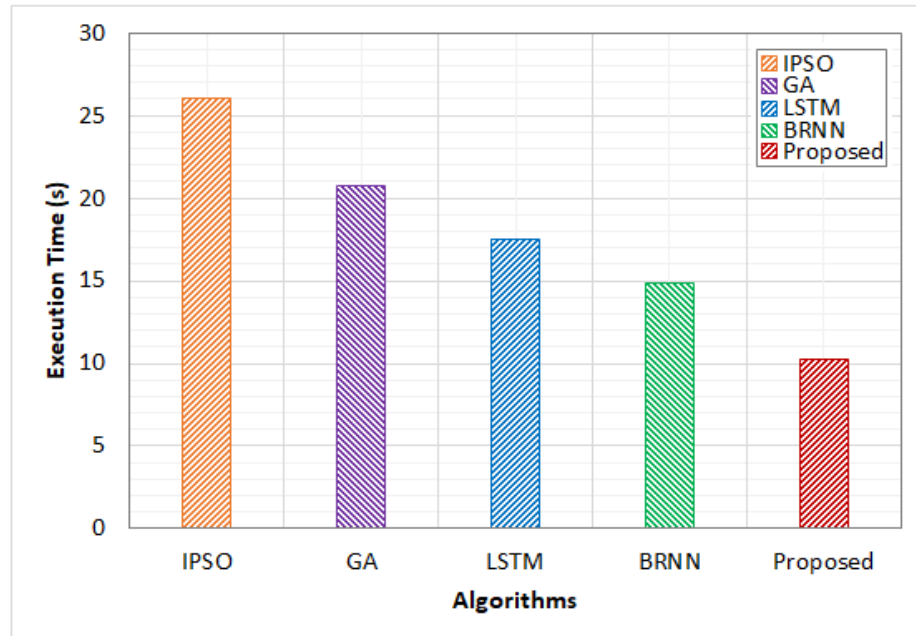
Figure 7: Execution Time Analysis
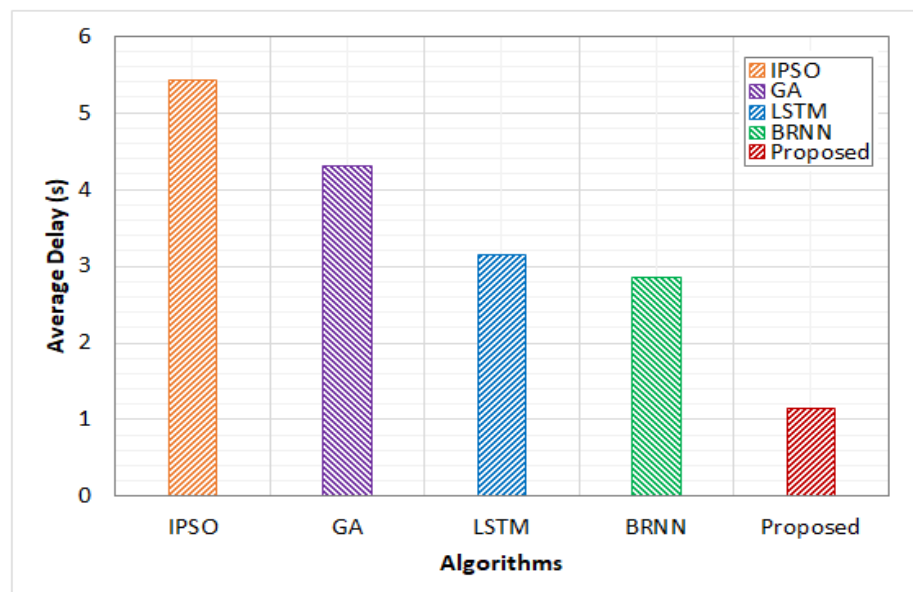
Figure 8: Analysis of Average Delays

It is essential to decrease the span of the asset planning methodology for edge computing. To recognize the proposed model's execution in terms of delay, the standard acquiesce appeared by the modern show and existing models are considered for the examination of distinctive asset requests. When differentiated with existing methodologies, it is clear that the prescribed show has the

slightest normal delay, as appeared by the data presented in Figure 8. The demonstrate with the foremost raised delay is the IPSO show, which is 5 seconds longer than the proposed demonstrate. The suggested show performs 4 seconds more moderate than GA-based planning, a refinement of 4.3 seconds. LSTM and BRNN models perform to a few degrees way better than GA and IPSO models. Coincidentally, it's not precisely the proposed demonstrate. The unessential delay of the proposed demonstrate is 1.15 seconds, which is 2. seconds not precisely the planning demonstrate and 1.5 seconds not precisely the BRNN.
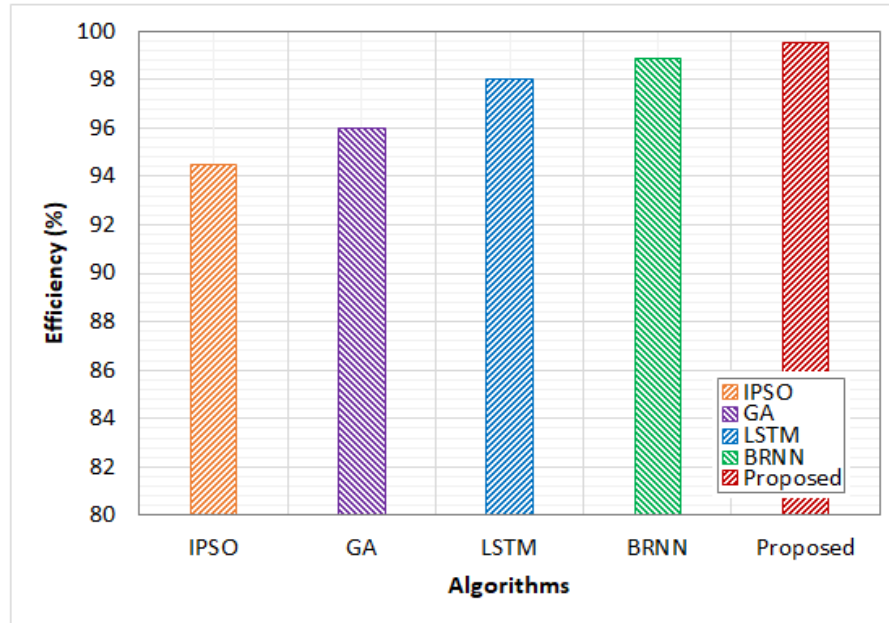
Figure 9: Efficiency Analysis

Figure 9 presents an effective comparison analysis of scheduling computations. The general effectiveness of the current and recommended models is evaluated using execution time, reaction time, resource consumption, and delay factors. Regardless of the activity, it is evident that the suggested model performs better, advancing the overall effectiveness of edge computing and IoT networks. The maximum efficacy of the suggested model, which is 99.48%, is significantly higher than the current scheduling methods.

Table 1: Performance Comparisons Analysis

Used Methods	Use of Resources (%)	Response Time (s)	Time for execution (s)	Average Delay (s)	Efficiency (%)
IPSO	95.83	2.22	26.01	5.40	94.46
GA	95.73	1.96	20.64	4.30	96.11
LSTM	98.57	1.68	17.45	3.14	97.91
BRNN	99.03	1.56	14.80	2.86	98.81
Proposed	**99.52**	**1.25**	**10.25**	**1.15**	**99.48**

The generally execution estimations for the examination of the proposed demonstrate with the current models are recorded in Table 1. The revelations outline: the proposed demonstrate contains a more critical level of asset utilization and capability than elective planning systems right now being utilized that. The proposed show moreover appears the least execution and response times, suggesting that the foremost perfect choice for steady applications require asset assignment to handle created or got data.

5. SUMMARY

This research presents a technique for concatenated deep learning for resource scheduling in edge-integrated Internet of Things networks. During the resource scheduling stage, the proposed work chooses the best features from the resource requests utilizing a one-layered CNN and a gated recurrent unit. The time-series requests are rapidly deconstructed and connected using deep learning models, followed by characterization to identify the optimal resources for scheduling. Reproduction analysis, which is necessary for better approval, demonstrates how the suggested model performs in comparison to various methods, including LSTM, BRNN, (GA), and (IPSO), with respect to resource consumption, execution time, reaction time, normal postponement, and proficiency. The base execution and reaction durations of the suggested model, along with its maximum resource utilization, further improve overall process effectiveness when compared to existing methods.

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4k Model of The Importance of Teamwork in Training it Professionals

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Abstract:

In this article, the benefits of the 4k model for developing the ability to work in a team, i.e. cooperation, and the aspects that the teacher should pay attention to in the teaching of information technologies are highlighted.

Keywords: Hackathon, competence, position, cooperation, STEAM, 4K, Independence, initiative.

Introduction

We all know that the 21st century is known as the age of information technologies. Information technologies in our country have developed rapidly over the last 5-8 years, if not from the beginning of this century. Nowadays, information technology is being integrated into almost every field. [2] We generally understand the automation of management organization, calculation and data storage operations with the help of computer programs and information systems. But developed countries are handing over many tasks performed by humans to artificial intelligence. The implementation of information technologies in the fields pays off and reduces time and costs. The development of information technologies causes the emergence of new professions, terms and technologies in society. An example of such new terms is the word hackathon. Hackathon is an English word that means to hack.[1]

A hackathon is organized by a company in order to create software to digitize its work. In this case, the programmers form a team depending on the direction. The company will announce the day and location of the hackathon, and all teams will meet at that time. The program of the issue will be created within the period specified by the company. The company selects the best projects created by the teams and the specified amount of money is awarded to the winning team. It is known that

programmers work as a team in other projects as well, and this is giving good results. It is known from such examples that the ability to work in a team is important in the training of personnel in the field of information technology and programming.

Within the framework of various competency models, the ability to cooperate enables active communication with others and effective team work in various areas.[7] Collaborative skills are skills such as listening to other people's opinions and agreeing with other suggestions even to the detriment of others, creating one's own part when the team is working on a task, working in the common work of the group, as well as identifying one's own contribution and evaluating the team. creates.[8]

The structure of this skill is as follows.

1. Acceptance of common goals:

• sharing team goals and putting them ahead of their own goals, ability to work in a team, unify team decisions as a result of work, manage emotions in team work.

2. Social communication:

• participate in discussions, conduct negotiations, interact with other team members with mutual respect, listen and accept other people's opinions, coordinate their actions with others;

• willingness to help them; readiness to take responsibility for the general.

3. Fulfillment of assumed obligations:

• willingness to take such a position in teamwork and accept a role that is effective;

• performing part of the work responsibly, achieving quality as a result.

4. Independence and initiative:

• ability to work independently and show initiative in performing assigned tasks;[5]

• the ability to involve all members of the team in solving the problem, to provide them with psychological support and motivation.

It should be noted that every time the teacher gives assignments to students, he has the opportunity to teach them to work in a team. It is necessary for the teacher to help repeat the basic rules of teamwork with students, and they are as follows:

• speak in turn and listen to everyone;

• consideration of all submitted proposals;

• do not give insulting comments to the proposals of group mates;

• first ask for help from team members and only then others or the teacher;

• consistent distribution of work among all team members;[6]

• if you wish, identify the persons responsible for a particular area of work.

The ability to work in a team, interact and cooperate is important for every profession. To develop this ability in future frames, it is necessary to use the 4K model. If we want to help students develop this important skill, we need to organize the educational process in such a way that we often assign them to work in a team. To do this, we need to answer three important questions:

- How can new competencies/skills be incorporated into programs?

- How to form them in a group?

- How to evaluate them?

Answers and solutions to the first question are being implemented. The use of STEAM and 4K models has been introduced in order to develop additional skills in many economic schools in our republic. The teacher will have to pay attention to the following questions and solve them.[15]

The 4K model is not new to education, but it is innovative. Teachers have always used 4K elements, probably use them every day. What can be changed is knowing how, when and why to use them.[13]

When in a larger group, we can sit in a circle and observe the possibilities of human cognitive development by sharing ideas, solving problems, and imagining solutions. Everyone in the team has the opportunity to strengthen and improve their social skills by respecting each other, listening to different points of view, waiting for our turn, and learning patience. All of these skills put into practice lead to greater tolerance, acceptance, and an open mind to different perspectives and ideas.[11]

In small groups we:

• Increase the possibility of understanding the didactic material due to different points of view in the group;

• Strengthen the sense of trust and confidence that comes from working together to achieve a common goal;

• We can build a foundation for mutual respect and accountability.

By engaging students more actively and allowing them to collaborate in the process of co-development, they will have to listen to each other rather than compete for the best answer and result.[9]

Well, the teacher might think, "I need to watch them work to make sure no one gets hurt." But not so! As a good art director, the teacher takes the time to organize the materials, carefully select the tasks assigned to the groups, as well as the tools they will need to achieve their tasks. Uses a clear and positive communication style when explaining ideas, before entering groups, to achieve our goal.

It is useful for the teacher to keep vigilance during the activity and give help and suggestions when necessary. As many authors of modern pedagogy have pointed out in their research, the concept of creating an environment following certain guidelines can have a significant impact on the learning process.

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Ionizing Rays its Sources and Medical Applications

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Abstract:

Ionizing radiation of the medium through which it passes is high-energy radiation that works to ionize the medium through which it passes due to the beam's collision with atoms. The medium leads to the expulsion of some electrons Atoms and the formation of ions in the middle. Of these rays are elementary particles Such as electrons, protons, neutrons, and alpha rays Which is the nucleus of a helium atom. It also exists among electromagnetic rays Types characterized by high energy, above several eV (such as X-rays and gamma rays). It causes ionization of the medium through which it passes, such as gases, liquids, solids, and the bodies of living organisms. Therefore, ionizing radiation is harmful to health if its quantity exceeds certain limits. This makes it necessary not to go overboard with X-ray medical examination.

1-The atom and the nucleus

An element is made up of similar, very small units called atoms. The elements differ depending on their atoms. The atom of the element is composed of a small central body known as the nucleus, around which a number of electrons revolve The mass of the atom is concentrated in the small nucleus -13 , which has a radius of about 10(cm). The electron It is a very small body whose mass at rest is 9.11 x coulomb.The proton proton meaning that it is approximately 1,839 times A small body with a rest mass of 1 gm, than 1.675 times the electron and carries an electrical charge exactly equal to the charge of the electron, but positive. It is a neutral body (i.e. it does not carry an electrical charge) and its rest mass is approximately equal to the mass of the proton. The neutron is often considered to be a union of a proton and an electron, as the free neutron (i.e. outside the nucleus) lives on average (15.2) A minute then it spontaneously disintegrates into a proton and an electron. Although solid matter appears solid, it is in fact considered a vacuum, but the ability of the human eye and modern optical magnification is unable to distinguish this vacuum. To understand this fact, we will assume for the sake of argument that there is a device capable of enlarging the atom by ten million times. Then the diameter of the nucleus, which carries all The mass of the atom

is approximately about 1 cm. That is, the size of an average round grape seed, while the closest orbit to the nucleus is the K orbital (which accommodates only two electrons) at a distance of tens of kilometers from the nucleus, and the farthest orbit, which is the seventh orbit, is hundreds or even thousands of kilometers from the nucleus. Thus, the atom is similar in its structure to a group. The solar system, where the sun occupies the center of the system and the nine planets affiliated with it revolve in orbits with a radius of the smallest, which is the orbit of Mercury (approximately 58 million km). With this method of analogy, the atom can be understood. As a real vacuum, Figure (1-1) formally shows a layout of a number of atoms, where the nucleus contains both protons and neutrons and the electrons rotate in external orbits, noting that the aspect ratios shown in the figure do not represent the realistic ratios.
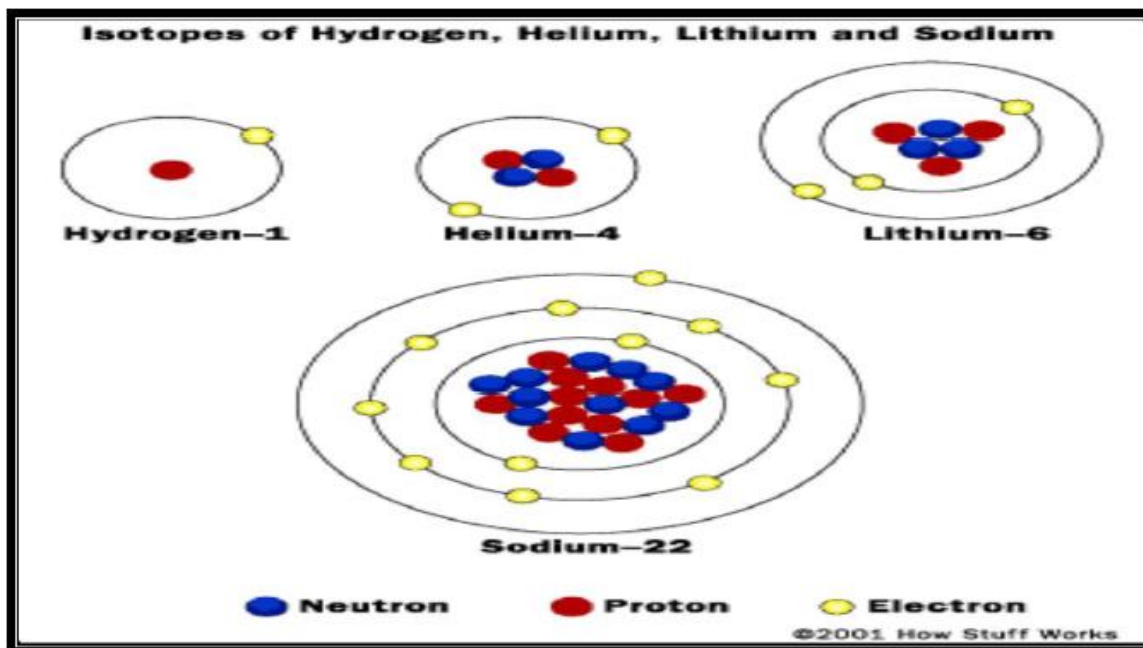

Figure (1) shows the atomic structure of a number of atoms (helium, hydrogen, sodium, lithium)

An electrically neutral atom, where the number of positive protons in the nucleus is equal to the number of negative electrons rotating around it, and the electrons rotate in orbits. Different orbits around the nucleus, and each orbit accommodates a certain number of electrons, so the orbit closest to the nucleus, known as the (k) orbit, accommodates two electrons, while the second, third orbit, known as the (M) orbit, accommodates eight. Known as the orbital (L) for eight and ten electrons, the fourth, known as the orbital (N) for thirty-two electrons, and so on. The mass number is The mass number of the atom is the sum of the numbers of protons and neutrons in the nucleus. This by the letter A. number shows the approximate mass of the atom. It is an integer and is symbolized.The atomic number atomic number: It is the number of protons in a particular atom, and it is symbolized by the symbol (Z). Elemental atoms are usually symbolized by the first letter of their Latin name (or two letters, sometimes the first is large and the mass number in thAend second is small). Then the atomic number is written on the left side, the bottom side on the top side. That is, it is symbolized by For example, the hydrogen atom is represented by the symbol H, since its atomic number = 1. As for the helium atom, it is symbolized by the symbol He, since its atomic number = 2 and its mass number = 4, as the helium nucleus (alpha particle) consists of two protons and two neutrons. Likewise, the uranium atom is symbolized by the symbol U, since its atomic number is 92 Its mass is 238, as the uranium nucleus contains 92 protons and 146 neutrons. Isotopes. The nucleus of a single element contains the same number of protons, but it can contain different numbers of neutrons. This means that the atomic number of a single element does not change, while its mass number changes. In this case, it is said that the element, for example hydrogen, has three isotopes:

one has several isotope 1-Hydrogen H, its nucleus consists of one proton and does not contain neutrons (1 = Z, 1 = A), and one electron revolves around the nucleus.(2)-Deuterium H, its nucleus consists of a proton and a neutron (Z = 1 2 = A) and one electron revolves around the nucleus. (3)Tritom H. Its nucleus consists of a proton and two neutrons (1=Z, 3=A) and one electron revolves around the nucleus. In general, each element has a number of isotopes that may sometimes reach more than fifty isotopes . And per element. Some of the nuclei of these other R isotopes are capable of disintegration. Therefore, these latter nuclei are radioactive and emit radiation in the form of alpha or beta particles or gamma radiation.The element exists in nature in the form of a mixture of some of its isotopes. There it does not exist, but it can be produced industrially using reactors or accelerators in general, in nature and nuclear. It is worth noting that isotopes of a single element are united in all their chemical properties, but are separated in ways, so isotopes cannot be separated from each other by chemical or other methods. They are generated between these. The nucleus of the atom contains a certain number of positively charged protons. The distance between the protons. The repulsive electrostatic forces are inversely proportional to the square. Since the distances between the protons in the nucleus are very small, it is one of the protons. It is expected that the repulsive forces will be so great that the nucleus must disintegrate quickly. Since the nucleus does not disintegrate into its components of protons, this means that there are forces. These attractive forces are what is known as other attractions, stronger than the aforementioned repulsive forces, and nuclear forces, and they affect the protons among themselves and the neutrons among themselves as long as this is the case between them. Both protons and neutrons, some, and the has been proven 10-13 2× particles are at a small distance from each other (less than a cm). It that the nuclear forces between protons and neutrons or protons between each other are from a nuclear perspective (and not from or neutrons between e.ach other are equivalent in charge) Both the proton and the neutron can be considered as a single particle called a nucleon. These nuclear forces lead to the bonding of the components of the nucleus, including protons and neutrons, and their disintegration. As a result of the bonding of these components of the nucleus, the actual mass of the nucleus is less than the sum of the masses of the nucleons that make up it, and this is the difference Between the actual mass of the nucleus and the masses of its components, it is equivalent to the bonding mass of the nucleus. By multiplying this difference in mass (10-) by the square of the speed of light, it is called the mass deficiency. It is possible to easily determine the energy that binds the nucleus, which is: B = ((NMn + ZMp) - M) C2 Where M is the actual mass of the nucleus , (Mp) and (Mn) the masses of the proton and neutron respectively, Z, N the number of protons and neutrons respectively, c the speed of light in a vacuum. When expressing the mass difference (m)ÿin atomic mass units (f. K. y (And converting this difference into energy, it is easy to determine the bonding energy B of the nucleus in megaelectron volts (m). A.F) from the following relationship: B = ÿm ×931 (Mev) The average bonding energy of one nucleon, F, is the bonding energy of nucleus B divided by the number of nucleons. The cohesion of the nucleus increases whenever the bonding energy of the nucleon is large, and its cohesion decreases whenever this value is small. The most closely connected nuclei are the nuclei with a medium atomic number, and the least connected are the nuclei with a very small or very large atomic number. Radioactivity Many isotopes, whether natural or artificial (i.e. prepared using the activity of accelerators or nuclear reactors), are characterized by a property known as radioactivity. Radioactivity is when the isotope nucleus spontaneously disintegrates (decays) into a smaller nucleus (or a nucleus with a lower energy value) with the release of the maternal nucleus It is the original radioactive nucleus that disintegrates, such as uranium-237 or polonium-218.The nascent nucleus It is the nucleus resulting from the disintegration, such as the nuclei of thorium-234 and lead-213, and for alpha decay to occur for a particular isotope, the mass of the nucleus of this parent isotope (MP) must be greater than the sum of the alpha (Mÿ) , meaning the condition must be met by the masses of both the daughter (Md) and the body. Mp -- (Md + Mÿ) > 0 Therefore, it is noted that this condition is met for many isotopes heavier than lead. It is noted that most of the isotopes heavier than lead are radioactive in relation to emitting alpha particles. Energy of alpha particles:The energy of alpha particles emitted by the same

isotope is equal and approximately equal in magnitude { Mp -- (Md + Mÿ) } C2 Therefore, alpha particles are considered an isotope fingerprint. By measuring the energy of alpha particles, its radioactive isotope can be determined.Alpha particles: It is the nucleus of the helium-4 atom, consisting of two protons and two neutrons. It is therefore a positively charged particle, with a charge twice that of a proton. Therefore, its path can be controlled using electric or magnetic fields, and it can also be accelerated (i.e. accelerated) using nuclear accelerators to high energy values. These heavy And charged nuclear particles belong to beta decay. In order for the nucleus of a particular isotope to be stable, the ratio between the number of neutrons and the number of protons in This nucleus is a certain ratio (Z/N). This ratio ranges between 1 for light isotopes and increases until it reaches 1.6 for heavy isotopes. For example, it is noted that the nucleus of the carbon isotope is 12. 12 (6) C is stable, as the ratio of neutrons to protons is 1=6/6=Z/N. As for the nucleus of the carbon 14 isotope, it is an unstable nucleus. This nucleus is one of the light nuclei. Note that the nucleus of the cesium isotope becomes 1.33=6. /8=Z/N as well 133 is stable because the ratio becomes 1.42 = 55/78, while the cesium 137 nucleus is unstable because the ratio becomes 1.49 = 55/82.

Electronic dissociation (negative beta dissociation): If the ratio of neutrons to protons exceeds the value specified from the stability curve for the isotope with a certain mass number, this means that the nucleus is trying to reach a state of stability by transforming a neutron (or more) inside the nucleus known as the antineutrino v . That is, the process of electron disintegration. It is the transformation of a neutron inside the nucleus into a proton and the release of an electron (beta particle) and an antineutrino. This disintegration is represented by the following equation (10). This type of disintegration occurs in hundreds of unstable (radioactive) isotopes, where the nucleus of a new element is formed as a result of increasing the number of protons in the nascent nucleus by one proton. For example, when the nucleus of carbon 14 disintegrates, the nucleus of a new element is formed, which is nitrogen 14, as a result of the transformation of one of the neutrons in the nucleus into A proton, and both the beta particle and the antineutrino are released externally from the nucleus. This disintegration is represented by the following equation.

146Cÿ 147N + e- + v-
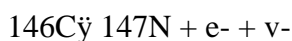
Cobalt-60 is also considered a radioactive isotope of beta particles, and it transforms into nickel-60 when the proportion of neutrons and protons is low. The nucleus can transform in another way. Where the mother nucleus captures one of the atomic electrons from the orbits close to it, then one of the protons of the nucleus, and this proton turns into a neutron. This electron combines with without any of the beta particles being released outside the nucleus, but the neutrino is released. The electronic household is represented by the following equation:{$^{60}27$Coÿ $^{60}28$Ni + e- + v }It should be noted that nuclei subject to positronic dissociation can experience electron capture. Beta particles: Beta particles are divided into two types: negative beta particles (electrons) and positive beta particles (positrons), but they have a positive charge. Since these particles are charged, their path can be controlled using electric or magnetic fields, and they can be accelerated to high energies. Beta particles belong to the class of p, articles Lightly charged.Neutrino: It does not carry any charge and is a particle with a rest mass approximately equal to zero Beta particle energy: The basic condition for any type of beta decay to occur is that the mass of the parent nucleus be greater than the total mass of the parent nucleus, and the sum of the resulting masses is the energy that both the beta particle and the neutrino (or antineutrino) are released, and this energy is distributed between each Of a beta particle and a neutrino (or antineutrino) in a random manner. To begin with, the energy of beta particles emitted by the same isotope takes different values From zero, but it does not exceed the value of the total energy resulting from disintegration, so measuring the energy of beta particles does not indicate the identity of the source that emits it. Gamma radiation: In most cases, the daughter nuclei resulting from alpha decay or beta decay are in an excited state. This means that the energy of the nucleus is higher than its energy in the stable (ground) state. The

nucleus cannot live in this excited state for long, but it soon moves to The state is less exciting or to the (ground) state, It gets rid of excess energy by emitting electromagnetic radiation known as stable nuclei. Stable nuclei can also be excited in various ways, such as nuclear reactions and gamma radiation. For example, these excited nuclei return to their ground state after their emission Excess energy in the form of gamma radiation. Gamma rays are photons (electromagnetic waves) like light photons, but their frequency is very high (that is, they have very high energy) compared to light radiation, which does not carry any charge. Since these radiations are not physical and electrical bodies, their path cannot be controlled or accelerated using fields. Electric or magnetic. There are many sources of gamma radiation, for example: Cobalt 60 and cesium 137 are sources of gamma radiation, as these isotopes disintegrate first through negative beta dissociation, thus forming the isotopes of nickel 60 and barium 137, respectively, in excited states, which results in the release of gamma radiation when these latter isotopes transform from the excited state to the ground state. The nickel-60 nucleus moves from the excited state to the less excited state with the lowest excitation energy, which is 1.332 MeV. As a result, gamma radiation is emitted, carrying the energy difference between the two states (1.332 = 0 - 1.332) Then the nickel nucleus moves from this last excited state to the stable (ground) state, and another gamma photon is released carrying the energy difference between ÿ (as a result of the transition of the two states (1.332). In general, the energyof the released photon is (E (to the less excited state with energy (Ef)i) the nucleus from the excited state with energy (E). Eÿ = Ei – Ef There are radioactive isotopes that emit gamma photons directly, without alpha or beta dissociation occurring, and one of these isotopes is the technetium 99 isotope, where the isotope results from the disintegration of the molybdenum 99 isotope through beta dissociation, and technetium 99 is formed in the excited state, to. Therefore, it is considered semi-stable, as the half-life of this state is 6 hours. Technetium-99 is a radioactive isotope of gamma photons. This isotope has multiple muses for narrowing arteries, clots, and blockagesIt is widely used in diagnosing a number of diseases and others, by injecting it into the patient and tracking the flow of the isotope in the blood vessels and various organs of the patient. **Gamma photons:** It should be noted that each radioactive isotope emits photons with a single energy or with specific values. As shown in the previous two examples, cesium 137 emits gamma photons witha single energy. AF, while cobalt 6 emits gamma photons with M One of 0.662 two energies, with two enetrhgeypmheotaosnusremenFts (-1.332 and 1.173) m. Therefore, the energies of emitted from a specific isotope facilitate the direct identification of this isotope. isotope is a fingerprint of Therefore, it is said that gamma radiation emanating from an that isotope. **Neutrons and their sources:** Neutrons, as we know, are neutral particles of charge. Therefore, it is not affected by fields, as there are no electrical or magnetic radioactive isotopes in nature. In general, however, it is possible to produce an artificial isotope used as a source of neutrons, which is neutrons, and the isotope californium 252, of which one microgram emits about 2 million neutrons per second. The energy of the neutrons released from them ranges between (1.1 - 7) M A. There are several other sources of neutrons. The most important of which are: Source Be – Ra The source of radium is beryllium: It is a mixture of both radium 226 and beryllium 9. Radium 226 is active with the beryllium 9 nucleus, creating radioactive alpha and emitting alpha particles. When a nuclear reaction particle collides, it results in the formation of a carbon nucleus and one neutron is released. Several grams of beryllium can be obtained, and when mixing one gram of radium with 7 a neutron source of varying energies, it gives about (10) neutrons per second. The . neutrons released from it range from about (1-10) m.

However, this type of neutron source is no longer in circulation because radium 226 and polonium 214 emit large quantities of gamma radiation through its nascent nuclides, such as lead 214. This source has now been replaced by sources of americium 241 and beryllium 9. B- The source of americium is beryllium -9Be-241-Am the number This source is prepared by grinding a specific amount of the isotope americium 241 with a limited number of grams of crushed beryllium 9.

Americium emits alpha particles that react from beryllium nuclei and emit neutrons with the same equation as before.

Americium 241 is distinguished over radium 226 in that it emits only a small amount of...This source gives the same gamma radiation with a small energy of 59.5 kF, the neutron yield of the radium-beryllium source, and a range of neutron energies that covers the F. M same range from 1 to about 10. The source of photoneutrons: In this type of neutron source, a gamma radiation source is used instead of an alpha particle source. When a gamma photon falls on the beryllium nucleus, this results in the formation of two alpha particles and the release of one neutron. In order for the reaction to occur, the energy of the gamma photon must not be less than 1.67 MeV. Therefore, a sodium 24 source can be used, which emits gamma radiation with an energy of 2.67 MeV. . By placing sodium 24 with beryllium 9, it is possible to obtain a neutron source that is distinguished from previous sources in that the neutron energy takes a single value instead of the continuous energy spectrum from previous sources.Charged particle accelerators: Neutrons with a specific energy can be obtained by bombarding some light nuclei with charged objects such as protons or deuterons, accelerating them to a specific energy.

$2_1H + 3_1H$ ÿÿ ÿÿHe + 1_0n + 17.6 MeV
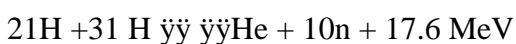
Among these interactions are:

$1_2H + 1_2H$ ÿÿ ÿÿHe + 1_0 n + 3.29 MeV
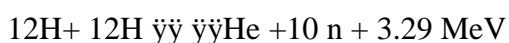
The use of which has spread, especially in various industrial applications, where deuterons are accelerated to an energy of 150 kiloelectron volts and are bombarded with a target made of tritium (the third isotope of hydrogen). Neutrons are released, and it is possible to obtain 11 (a neutron per second with a constant energy, which is a number of neutrons up to To about 10 A F of this generator m $^{14.1}$ reactors Nuclear E - Nuclear reactors Nuclear reactors are considered the largest sources of neutrons ever, as they can produce 19 13 (up to) 10 neutrons. The neutron flux density inside the reactor ranges between (10 Then Seconds.cm2). Neutrons inside the reactors are produced by the fission of uranium nuclei. When a uranium nucleus splits, two smaller nuclei are formed, and a limited number of eutrons are released as a result of this fission. When these released neutrons collide with other uranium nuclei, they can lead to their fission and the release of another number of neutrons. Thus, what is known as a chain reaction occurs , where one nucleus begins to fission, leading to the release of a certain number of neutrons, let this number be two, and these two neutrons lead to the fission of two new nuclei, so the number of neutrons becomes four, which in turn leads to the fission of four nuclei. New, the number increases Neutrons range to eight. Thus, until the number of neutrons reaches a certain limit, it must not exceed it, otherwise the reactor will explode.

2-Applied uses of radiation and radioisotopes

Application of radiation and radioactive isotopes With the development of nuclear physics, the fields of applied uses of radiation beams expanded. And radioactive isotopes. These uses included various fields such as agriculture and industry. Medicine and mining. The areas of use of radiation and radioactive isotopes have also expanded to include several other aspects, such as crime detection, studying the environment, determining the ages of antiquities, and others. This chapter presents some of these uses, especially in the field of agriculture and industry and medicine.

2-2 Uses of radiation and radioactive isotopes in medicine

In recent years, there has been a great development in the use of radiation and radioactive sources in medicine, whether in the field of diagnosis or treatment. Various types are used for these purposes Gamma rays, neutrons, and heavy ions. Radioactive isotopes are also used, such as Cobalt 60, radioactive iodine, tekenium, and others. Also, the use of nuclear methods became widespread Such as neutron activation analysis and others in performing many accurate medical tests. For the

purpose of proper diagnosis of the disease. To clarify the scope of the use of radiation In medical aspects, some of these areas can be reviewed as In recent years, many vaccines have been produced to protect animals from many deadly diseases. The effect of radiation on vaccines is reduced The time of the parasitic stage of the specific type of vaccine, without reducing the ability of this vaccine to generate immunity in sick animals. Also, a method has recently been developed that shows promising results Taiba Dhanna produces a vaccine against malaria. This method consists of irradiating the mosquitoes carrying the disease with a certain dose of radiation, and then allowing these irradiated mosquitoes to Some volunteers transmit the microbe to them, but it is in a weak state and unable to reproduce, so immunity is generated in the volunteer. However, it should be noted that this method does not It still needs more research to resolve it. Radiation and radioisotopes are used to treat some diseases. For example, radioactive iodine ablation is used to treat some cancerous tumors in the glands that cannot be removed. Or that grows repeatedly after surgery. The treatment process in this case is to drink An amount of water containing a certain dose of radioactive iodine. Radioactive iodine or radioactive neutrons, and heavy ions are phosphorus are also used to treat leukemia. Likewise, gamma radiation, used to treat some cancerous diseases, or to stop their growth. These radiations are also used in the post- cancer surgery stage. Products Use irradiation, prices, and basis for sterilizing many instruments Medical equipment that is difficult to sterilize with steam or heat, or that may be affected as a result of its sterilization by gases, high temperatures, or chemicals. For this purpose, gamma radiation emanating from a cobalt-60 source or from linear accelerators is used. Sterilization using radiation has several advantages compared to sterilization using traditional methods. Neutron activation analysis is one of the most accurate methods for determining environmental pollution with many substances. Toxic substances such as mercury and others, where the presence of such substances can be detected, no matter how small their percentage. Likewise, archaeologists use nuclear methods to determine the ages of discovered antiquities and for the general dating process, by measuring the radioactivity emitted by carbon-14 that is formed during the life of the object. Nuclear methods are also used to detect crimes. For example For example, neutron activation analysis is used to match paint residue left on With the painting of the car that may have been involved in the accident and whose driver lost the car as a result of a hit-and- run accident. There are many other uses for beams, such as searching for sources Groundwater, determining its flow, the direction of its flow, and the speed of this flow, as well as in There are many other areas that this booklet does not have room to list.

2-Ionizing Of Biological Effects-1-3 Biological Effects Of Harmful Radiation Radiation

Energy is transferred from ionizing radiation to the body of a living organism and leads to the ionization of atoms. Cells. Heavy charged particles and beta particles ionize cell atoms directly when Passing through it. The energy of gamma rays or X-rays is transferred to the electrons in the atoms of the cell, and these electrons perform ionization. As for the energy of neutrons The protons are then transferred to the hydrogen atoms through elastic collision, and then these protons ionize the cell atoms. Also, it is possible to absorb neutrons (especially thermal ones), which then leads to the formation of radioactive isotopes inside the body, and the radiations released from these isotopes lead to the ionization of cell atoms. Whether the ionizing radiations are Issuing from a source located outside the body or from contamination of the body from within with radioactive materials, this will not lead to the following biological effects in the body, which may appear later and later during the period. Clinical Symptoms sis Symptoms in the form of The time required for its appearance depends on the amount of absorbed radiation and the rate of its absorption. The biological effects of ionizing radiation on living organisms are divided into two types: A - Intrinsic effects: It has previously been shown that alpha particles emitted from all natural sources are absorbed in a thin M layer of air (the thickness does not exceed 4 cm). By studying the properties of beta particles, it becomes clear that to make an adequate shield for the sources of these particles, light solid materials must be used, that is, those characterized by small atomic numbers Z, since the use of materials with large atomic numbers produces km Large amounts of highly penetrating and

dangerous X-ray photons. The energy ratio of the transformed f particles is as follows X-rays a of these particles (in the unit Emax is determined in terms of both the maximum energy the atomic number Z of the reactant is given by the following relationship:f = 0.035 Z Emax % Although beta particles are characterized by a continuous energy spectrum, the range of these particles the mass in a substance can be calculated, easily, in terms of the maximum energy of this spectrum Particles Emax is in mV. The mass range and R (in g/cm2) for beta particles are determined from the source of these particles with a maximum energy of Emax , in terms of both the linear range R (i.e. the sufficient linear thickness off this... Particles (cm) and the density of the substance p. in (g/cm) with the following relationship: This leads to the two exponential relationships not being valid for attenuation or decreasing The average effective dose, to calculate the thickness of the armor, as they will give thicknesses less than Necessary to prevent intended sources. For this reason, it must be taken The accumulation factor is taken into account when calculating shield thicknesses for gamma rays and X-rays. This is done by entering this factor into the attenuation or absorption equation. Therefore, the formula that must be followed to calculate the correct thickness of the shield is the following relationship: Activity Radiological imaging of the radioactive source. Increasing the radioactive activity of the source requires increasing its thickness. Shield to reduce the dose outside it to the required amount. With Neutrons with energies of several megaelectron volts need about 18 collisions with protons (hydrogen nuclei) until they completely lose their energy and are transformed into neutrons. Thermal power 0.025 electron volt. As for light materials rich in hydrogen, Such as paraffin wax, plastic, water, etc., the thickness required to temper the Fast neutrons and converting them into thermal neutrons ranges between about 20-25. Poison. Therefore, such thicknesses are sufficient to absorb the energy of fast neutrons I hope not. One of the most important principles of shielding neutron sources is to dampen the fast neutrons emitted from these sources or from thermal and ventricular neutron generators. These thermal and ventricular neutrons are then absorbed by a material with a high capacitance coefficient. There is a large (absorption) of these neutrons, and then a layer of high-quality material is placed Atomic number (heavy), such as lead, absorption of instantaneous gamma photons emitted as a result of neutron capture of thermal or slow neutrons. There are some elements, such as edmium, boron, and others, which are characterized by a very large cross-section to absorb thermal or ventricular neutrons. Therefore, the source or neutron generator is not yet surrounded by a layer of sufficient thickness (-20 25 cm) of a substance with a low atomic number, such as wax, water, etc., this is surrounded by The moderator consists of a thin layer of cadmium metal, about 1 mm thick, which absorbs the majority of the thermal neutrons. And the absorption of gamma photons emitted by captivity Neutron in cadmium, this cadmium is surrounded by another layer of high-number material. Atomic like lead. Thus, the ideal shield for fast neutrons consists of three successive layers of different materials, with different thicknesses: about (20-25 cm) of wax, plastic, or mm of cadmium, which is then surrounded by a layer of water, surrounded by a slice about 1 mm thick of lead or any other material with a high atomic number. Likewise, a shield for sources or generators of fast neutrons can be made from a single layer of a material with a low atomic number, no Wax, plastic or water. This is due to the ability of the absorbed hydrogen nuclei Thermal neutrons, and the formation of the unsaturated isotope of deuterium (hydrogen isotope). The only requirement is to make a suitable shield from a light material without the use of cadmium. What about the bullets? The thickness of the light material must be sufficient to absorb the vast majority of cooled (i.e. thermal) neutrons. Examples of these neutron shields include howitzers. Hemispherical neutron, which is made of wax, and a neutron source or generator is placed in its center. For such a shield, the wax or water poison must be made of wax or water, depending on the neutron yield of the source. About -40 120 In the event of accidents related to neutron sources, a person can use any Light natural materials present and available in the environment, to create a suitable shield for neutron sources, including bags of water or sand, or even pieces of wood.

Conclusion:

These are very high-energy radiations that, during their passage through the physical environment, cause the expulsion of electrons from the atoms of the substance and turn them into ions. For this reason, they are very harmful to human health if they exceed their limit. This is why it is preferable not to neglect medical examinations through X-rays. Examples of ionizing rays are X-rays and gamma rays. Gamma rays are considered more dangerous than Other examples of Ionizing radiation: charged particles such as alpha particles (helium atom nuclei) and beta particles. Therefore, workers in this field are given medical care and very high protection from radiation to maintain their health. The permeability of these types differs from each other, as electromagnetic waves have a very high ability to penetrate in comparison. With the ability to penetrate the radiation of alpha and beta particles, as electromagnetic waves consist of photons of very high energy, while alpha and beta particles consist of electrons, beta can be stopped by a piece of paper whose energy is lower compared to the energy of photons, as alpha is thick paper or a thin strip of aluminum, while gamma rays have It has a high ability to penetrate objects, and it requires several centimeters of lead or several meters of water to stop it to reduce its danger. Through this information about radiation, its types, and the difference in its danger from one type to another, it is possible to give a simplified idea of how to prevent its danger. The influencing factors can be divided into three factors that differ in importance: exposure time, distance, Protective shields) Radiation is used in many fields, the most important of which is the medical field, where it is used in treating tumors, but with high energy, as it works to break up cancer cells and works to stop their growth. Radiation doses have limits, meaning that each type of cancer has an appropriate dose, so that it does not exceed its limits and negatively affect the body. Patient health. It is also used through low-level

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Measures for the Protection and Rational Use of Degraded Land

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Abstract:

The article analyzes the problems of rational organization of the use of agricultural land in conditions of ecological instability, increasing the efficiency of its use, maintaining, increasing the fertility of irrigated soils and their rational use, introduction of resurstejamkor technologies in the fight against secondary salinization processes.

Keywords: Land Fund, rural area, degradation, soil cover, salinity, erosion, desertification, Oasis, fertility, crop rotation, Reclamation, humus.

Relevance of the problem. In the following years, a number of measures were implemented in the organization of rational and effective use of land in our Republic, ensuring impressive control and in the complex regulation of relations in the field of land resources, Geodesy, cartography and state cadastre. Within the framework of the program of measures for systematic accounting and use of Land Resources, Regulation of State cadastres, improvement of the cartographic fund of the Republic of Uzbekistan, a system of continuous monitoring on the observance of land legislation was developed and introduced, gross misappropriation of real estate objects was organized, the organization of the National geoaxborotation system of the Republic of Uzbekistan

At the same time, the analysis of the state of land use shows that the work of ensuring regular state control over the use of land, the introduction of modern technologies, as well as systematized accounting of land resources are not becoming effective enough. The material and technical base of the network does not meet the requirements of today in the timely and high-quality implementation of the tasks assigned to the field, the rapid and effective implementation of scientific research work. The number of employees in force, especially in the lower tier, does not make it possible to control the use of land resources and maintain their full accounting.

There is insufficient attention to establishing close ties with leading foreign organizations of the industry, in-depth study and application of Advanced International experience, and the organization of professional internships and professional development. In order to strengthen control over the

protection and rational use of land, improve the activities of Geodesy and cartography, radically increase the efficiency of the activities of the state committee of land resources, Geodesy, cartography and state cadastre of the Republic of Uzbekistan:

The Ministry of Economy of the Republic of Uzbekistan, Ministry of Agriculture and Water Management, Ministry of Finance and State Committee on Land Resources, Geodesy, cartography and state cadastre: to introduce the post of deputy chairman of the State Committee on Land Resources, Geodesy, cartography and state cadastre, which is responsible for organizing and coordinating the activities of the state cadastre, ;

100% of fines imposed under the administrative responsibility code of the Republic of Uzbekistan for land resources, Geodesy, cartography and state cadastre state committee bodies using land without a farm or rendering them unusable, arbitrary deviations from land development projects within the farm, violation of state land cadastre rules, destruction or damage of border and restriction marks;10% of fines levied on the right of citizens to property on housing for timely non-formalization in the bodies carrying out the state registration of rights to Real Estate;100% of the funds (after the calculation of taxes) that fall due to a 25% increase in prices set for public services for the technical correspondence and registration of cadastral documents;

In the following years, the Republic implemented a number of measures aimed at organizing rational and effective use of land, ensuring impressive control and comprehensive regulation of relations in the areas of land resources, Geodesy, cartography and state cadastre. Irrigated land of extremely urgent importance for our republic is 4.3 million hectares, or 9.6% of the total area of the country, in which more than 95% of all agricultural products are grown.

Within the framework of the program measures, a system of continuous monitoring of compliance with land legislation has been developed in the field of systematic accounting of land resources and control of land use, real estate facilities, regulation of land relations in the field of cartographic fund improvement, work is underway to establish a national geoexborotation system of the Republic of Uzbekistan aimed at.

At the same time, the analyzes carried out indicate the following:

insufficient systematic work is not carried out in conjunction with self-governing bodies and other organizations for the timely prevention of rational land use in places;

regular monitoring of the use of land in rural settlements and neighborhoods, especially in remote areas, has not been carried out sufficiently;

the number of employees available makes it impossible to control the use of land resources and fully carry out their accounting. The above shortcomings make it impossible to ensure reasonable and targeted use of land, as well as full-fledged impressive control over compliance with legislation on the network.

Also, in 2017-2021, the program of measures to effectively organize the activities of the state committee of land resources, Geodesy, cartography and state cadastre of the Republic of Uzbekistan, introduce advanced scientific and technical achievements in the field, update the material and technical base, attract international grants to the network was approved.

In order to strengthen the material and technical base of the committee and its territorial units, it is established to provide district (city) land resources and state cadastre departments with service cars, modern measuring instruments for on-site specialists, service rooms. In order to carry out such basic tasks as ensuring the rational use of land resources and the control of compliance with legislation, the committee and its territorial bodies are exempt from paying the state duty on claims made to the courts within their competence.

The soil is an upper porous layer of Earth with a biogenic structure, which plays an important role in the course of life processes in nature, in ensuring the exchange of substances in the biosphere. Under the influence of moisture, heat and microorganisms, organic matter is constantly decomposed and synthesized in the soil. Organic matter in plant and animal remains mixed into the soil decomposes with the help of microorganisms-that is, rot. These formed lizards, on the other hand, pass along with mineral compounds in the soil to the plant's body, in which they enter into a reciprocal reaction, forming new organic matter. It uses organic matter as human and animal feed. In the future, they will return to the soil again with plant, human and animal remains and again undergo a decomposition process. On this basis, organic and mineral substances circulate in a closed loop in the "soil-plant-animal-soil" system. This, in turn, naturally underlies the preservation of soil fertility. Soil is a complex structured derivative of nature, consisting of solid, liquid, gaseous and living components. The solid part of the soil is composed mainly of mineral and organic matter and solid particles, which make up a certain part of the total mass of the soil. The rest of it is made up of water, air and living organisms that occupy the spaces between the particles. The ratio of these components determines the fertility of the soil. The fertility of the soil largely depends on the amount of Macroelements in it, that is, humus, which forms the basis of mineral substances found in it as a compound – aluminum, iron, potassium, magnesium, calcium, phosphorus, sulfur, silicon, as well as microelements and organic matter.

The importance of living beings in the soil was mentioned above. Among these animals there are especially many microorganisms, which are located in the spaces between the soil particles. Notable Uzbek scientist M.V. According to mukhamedzhonov,the number of micro-organisms in 1 hectare of fertile soil is 3-3.5 billion, and in 1 hectare of soil half a meter thick, their mass reaches 8-12 tons. During the year, the generation of these microorganisms alternates up to 18-27 times. Russian scientist V.A. Cowda estimates that the annual sum of the biomass of microorganisms in the soil is equal to the photomass of the plant grown in that area, while in some fertile lands it is even 1.5-2 times more. In black soils and other fertile land soils, the annual sum of biomass of microorganisms reaches 20-50 tons per hectare. Thus, all its components are involved in ensuring the fertility of the soil. That is why it can be safely said-that the soil, together with these components of itself, is a source of organic life, and at the same time it itself is also a derivative of organic life, consequently they are constantly in interaction with each other. In fact, the plant grows and develops by absorbing nutrients and water in the soil. Animals feed on plants. As a result, the consumed nutrients return to the soil again and break down in it and again turn into minerals that the plant absorbs. Thus, the soil is one of the important rings of the so-called" Life " chain. It is also a necessary factor for plants, so for animals and, ultimately, for Man.

Another importance of soil for humans and animals is that trace elements contained in soil are also found in living organisms. The current vaccine has been found to contain about 60 chemicals in plant and animal organisms. These chemicals pass through the soil to the human body with food as biomicroelements. All 24 different trace elements found in human blood and 30 different trace elements in breast milk are essential substances for humans, and a lack of one or another element in the soil leads to their deficiency in food and, therefore, in the human body. Under the influence of this, the metabolism in the body is disrupted, a person can develop various diseases.

During the analysis of the land use issue, another situation is also visible, according to which there is no possibility of expanding the areas of land to be farmed. For example, according to YUNEP, the appropriation of new land by 2000 amounted to 3.2 billion in total expropriated land area. if the hectares are reached, the land to be farmed will be practically doubled per capita than in 1975. This is because as the population increases, much land erodes and goes out of business, while a portion of land is spent on seeing cities and industrial communication. According to a prediction by American expert Brown (1978), between 1975 and 2000, the population of the city of the Earth approximately doubled to 3 billion. it exceeds, accordingly, an additional 63 million to urban

planning. hectares of land goes. Under the influence of human economic activity, the quality of the soil is disrupted, and the yield decreases. In its development history, the society has raised Rs. of land about an acre was decommissioned.

The impact of water and wind alone, sandblasting and salinization results in an annual total of 6-7 million tons on Earth. hectares of land are leaving the farm turnover. This situation ha already worried specialists. Because the decrease in its area goes thousands of times faster than the formation of the soil. For example, 10 cm. it takes 1400-1700 years for thick soil to form. Soil of such thickness can be decommissioned as early as 20-30 years of water erosion. Sometimes only one flood is sufficient for this process.

In general, the condition of the soil will depend on how much influence we have on it. In its agricultural activities, a person grows a crop in the soil and harvests it. This means-it takes organic matter grown in the soil and impoverishes it. At the same time, it converts the soil, applies crop rotation and other agrotechnical measures and, on this basis, enriches the soil and restores its fertility. Failure to perform such activities on time, with only the benefit of the day, can accelerate soil erosion, its failure due to salinity and waterlogging.Such bitter lessons are also found in Uzbek agriculture. Currently, the total area of the Republic is 44.9 million. ha, of which 28.1 Mt. hectares are farmed. The area of irrigated crops is 4.2 million. makes up a hectare. In previous years, the Republic was at the height of the development of steppe zones, the expansion of farming by opening new lands. During the period 1975-1985, 1 mln. hectares of new land were appropriated. The work had even gone so far as to be a slogan, "Hunter's good Lion otar, young man's Good Earth hungry". But the work did not pay off its expectations. The reason was that the attention to agricultural agrotechnics was not enough, the technology of crop rotation was replaced by the sole power of cotton.

The cards have grown larger than normal, the ixotazors have decreased, the melioration work has subsided. The resulting soil erosion, salinity, and waterlogging accelerated, the agricultural consumption of river water increased, the Aral Sea came to the brink of disaster, from which the spreading salt sand precipitated into the soil of surrounding areas. Thus, as a result of these mistakes made, 90-95% of the area of Karakalpakstan, Bukhara and Syrdarya regions was salted. Of the 270,000 hectares of irrigated land in the Bukhara region alone, 53,000 hectares were wind-eroded. Much of the area of the Fergana Valley and Tashkent region, located in the regions of the Highlands, was eroded by water. Currently, the Republican livestock industry is also severely affected by the misuse of land resources. 22 million, which is being used as pasture for livestock. 6 million hectares. hectares are subject to wind erosion and 3 million. hectares have been eroded by water.

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The Emergence and Stages of Development of the School of Clay Architecture in the Bronze Age in Uzbekistan

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Abstract:

The article analyzes the emergence and development stages of the school of clay architecture in the Bronze Age in Uzbekistan .

Keywords: Central Asia, Uzbekistan, Ustyurt, Lower Amudarya, Zarafshan, Tashkent, Fergana, Surkhan, Mesolithic, Sultan Uvais, Kyzylkum, Bozsuv, Joining, Obishir, Machai, Caspiboyi, Murgob River, Lower Amudarya, Yonboshkala, DJonbos-4, Old Asia, Kopetdog, Namozgoh, Altintep, Geoxur, Jarqoton, Grandfather, Sopollitepa, A.A.Marushenko., A. Kuftin., B.A.Litvinsky., V.M.Masson., V.I.Sarianidi., V.I.Xlopin., S.P.Tolstov., O.K.Berdiev., A. Askarov., Ya.Gulomov., U.Abdullayev.

Introduction

The geographical landscape of the Asian mainland is mainly divided into mountainous and plain parts as a result of several repetitions of paleotectonic movements. One of such plains is Uzbekistan, which is located in the Turan lowland. It is divided into natural geographical regions in terms of its geographical conditions, climate-landscape, and natural resources. In addition to the plains and mountainous regions, the following historical and cultural regions are distinguished from each other in terms of their unique geographical environment and nature, and have historically formed clear territorial boundaries: Ustyurt, Lower Amudarya, Zarafshan, Tashkent, Fergana. and the formation of oases such as Surkhan is a historical period, the economic development of the society during its stages determined the fate of the population[1]. The historical geographical location of Uzbekistan is not located in the same coordinates. This process did not happen in one

historical period or on a specific historical date. The masking process continued from the Stone Age to the Neolithic period.

The main part

It should be noted that in the Mesolithic period (12-7 thousand years ago) due to the retreat of the glacier to the north as a result of the rise in air temperature, the foothills and plains of Uzbekistan turned into water basins reflecting the geographical situation, their coastal foothills are full of flora - rich in the world of fauna, it differs from the Stone Age in many ways. Due to the geographical features of the Ustyurt region, climatic conditions, and the presence of natural resources, ethnic relations continued in the Neolithic and Eneolithic periods [2]. Such a historical process was carried out economically by the hunters who lived in Burli-3 settlement at the foothills of Sultan Uwais mountain. (Because Sultan Uwais Mountain does not have the status of a permanent water source like the mountains in the eastern and southeastern regions of our country). In the historical period, primitive people settled in the natural and economic regions of Uzbekistan along the coasts of natural caves, mountain gorges, tree hollows, streams, steppes and spring reservoirs. For example, in Ustyurt (Aydabol, Churuk, Oktoylik), Kyzylkum (Lavlakon, Dariosoy), Lower Zarafshan Valley (Sozogon, Chorbakti), Tashkent Valley (Bozsuv, Koshilish), Fergana Valley (Obishir, Toshko mir), in Surkhandarya (Machay). Economic factors were the basis for the occupation of hunter-gatherers who lived in the Caspian regions of northeastern Turkmenistan (Dam-Dam-Chashma, Kayli, Jebel), in southern Tajikistan (Chijor-Chashma, Dagana) [3]. One of the characteristic changes of the Mesolithic period is the differentiation of the daily activities of hunter-gatherers living in the mountains and plains, as well as the economic relations in society, that is, the mountain areas are hunting and gathering, plain water basins are steppes, and two types of hunting The uneven development of maskur continued even in the Neolithic period, as the field was fishing and hunting of wild animals, as well as thermal farming.

During the Neolithic period (the first half of the 6th-4th millennium BC) during the dark historical period, the clans and communities that lived in certain areas covered by the urbanization processes in the Central Asian region were involved in the construction of settlements and in the fields of material culture in the natural and economic spheres of Uzbekistan. There was a process of sharp differentiation from the activities of the population already settled in its territories. (Due to fundamental changes in the spiritual culture of the Joytun people who lived in the foothills of Kopetdog and around the Murgob river basin, they lived in houses made of straw and reeds during the construction of residences, carried out «kayr» farming, and made female figurines from clay indicates). Taking into account the above-mentioned information, changes in the Neolithic economy of the Central Asian region can be divided into two areas:

Region 1 is the historical and cultural regions of Uzbekistan (Ustyurt, Lower Amudarya, Zarafshan, Tashkent, Fergana Valley settlements in the form of a semi-basement, the main occupation of which is animal husbandry, hunting and herding).

Region 2 South Turkmenistan Capetdog foothills and Murgob river basin.

A large amount of bone remains were obtained from the cultural layers of DJonbos-4 site, built on the side of the Yonboshkala elevation of the lower Amudarya basin, including 86% of the bones were the bones of carp, carp, and carp. At the same time, the fact that turtles, bird eggshells, and seeds were obtained indicates

the breadth of the daily menu [4]. According to historical data, Ustyurt hunters conducted hunting training in open conditions when they lived in seasonal shelters [5]. Such economic directions have determined the fate of the clan communities of the Lower Zarafshan, Kyzylkum, Tashkent and Fergana valleys [6]. The economic factors that the Joytuns settled in the foothills of Kopetdog can be taken to the economic fields from Kopetdog from time to time (more than 2000 m) to the Karakum desert, such as Kaltachinor, Feruza, Oltiyob, Arvas, the depressions in the plains to water basins. Turned, of course these processes happened during the spring. The area of water basins is wet, rich in minerals, which made it possible to carry out agriculture [7]. According to the researchers, BC In the 7th millennium, clan-communities of Kyzylkum and Fergana valleys started production activities [8].

Researchers' comments are likely to be controversial. For example, in the dark historical period, seeds planted in the ground may germinate if the temperature is sufficient to allow it to develop, but warm weather does not allow grass to grow. At such a high temperature, clans of Bami, Chopondepa, and Togolokdepa settlements located in the foothills of Capetdog in Southern Turkmenistan lived in houses made of straw and adopted a production economy as a way of life [9]. In this way, the artisans of the Neolithic clans of the Joytun clans in Central Asia did not have precise knowledge in the field of residential planning, but in order to restore the mud-pakhs of the houses they lived in, 5-8 cm wide , restored with the help of 20-30 cm long logs, and based on this knowledge, Keying was the center of spreading the simple style of architectural knowledge to the neighboring regions in the historical period. The architectural knowledge of the Joytun people can be explained by the results of the urbanistic processes that took place in the south-eastern region of Asia Minor. For example, the settlements of Neolithic clans (Chatal Guyuk, Khadjilar) in the southeastern region of Asia Minor, Jericho in Old Asia, and the settlements in the Iraqi region (Jarma) have houses made of straw, from which stone weapons, lamps, stone sickles and deep warehouses were explored. It belongs to the VIII-VII millennia [10].

According to archeological data, the scene of the processes that took place in the society of the Eneolithic period in Central Asia is explained as follows:

1. Emergence of stable settled life and irrigated farming based on established agricultural and livestock farming.

2. Rapid development of large areas and growing density of territorial location.

3. Development of productive forces as a result of emergence and development of metallurgy.

4. Innovations and inventions (copper weapons and articles, steam rooms, multi-room houses, defensive walls, use of raw brick in construction and adherence to architectural planning) appeared in the fields of crafts and construction [11].

In our opinion, it is necessary to pay attention to the results of the socio-economic and ethno-cultural relations of the Eneolithic society, the harmony of life and creativity of the Joytun people. Information about the history of the population of the Eneolithic period in the foothills of Kopetdog in southern Turkmenistan and around the Murgob River is recorded in the works of A.A. Marushenko, B.A.Kuftin, B.A.Litvinsky, V.M.Masson, V.I.Sarianidi, V.I.Xlopin, O.K.Berdiev [12].

According to the publication of the researcher, Joytun people used to farm 7.5-15 hectares of sernam and seunum in the foothills of Capetdog between the Karakum mounds, and the descendants of Joytun people who had mastered the Geoksur oasis farmed on 50-75 hectares during the Eneolithic period [13]. The opinion of the researcher about the cultivation of the above-mentioned hectare area by Joytun people is doubtful, in fact, it is not possible to cultivate such an area with a stone scythe. This situation can also be observed in Geaxor oasis. Because the copper material is soft, it is known that it is not possible to process the above-mentioned areas.

Analysis of research literature

According to the conclusion of I.N.Xlopin, the results of the Eneolithic inhabitants of Kopetdog's foothills in the field of building knowledge are densely populated (2000-3000 inhabitants) in the monuments of Namozgoh, Oltintepa, Ulugtepa, such a historical process took place in Geoksur 1 settlement [14]. According to V.M.Masson's conclusion, in the Early Eneolithic and Bronze Age, the people of Namozgoh and Altintepa, located in the foothills of Kopetdog, were considered centers of agricultural culture based on artificial irrigation, and they were «capitals of ancient farmers or cities of Altintepa civilization» [15].

According to the archaeological publication, the geographical landscape of the Margyan and Bactrian cultures in the Bronze Age is reflected in the construction of settlements, architecture, and visual arts. rectangular and circular elements are noted on the defensive walls [16].

In the lower Amudarya, Zarafshan, Fergana, and Tashkent oasis, which are geologically connected to the Kopetdog foothills of southern Turkmenistan, Andronova tribes who moved from the northern (wooden tribes) and northeastern regions of Kazakhstan settled and mingled with the local population and started ethnic processes, those who took [17]. In the research of U.Abdullayev, the opinion that the population of the Bronze Age in the cultural and economic regions of Central Asia became the main power of livestock and agricultural production is reflected in the material and spiritual culture of the population in the Lower Amudarya and Western Zarafshan regions. z does not find its reflection [18].

A.Askarov, in the northern area of the Surkhan oasis, Sherabad district, Sopollitepa, in the plain of the lower basin of the Ulanbuloksoy tributary of the same river, in the height of the Bostonsoy tributary coastal area, which is active in the north of this river. recorded the data [19]. In the historical literature, the inhabitants of the Zamonbobo culture in the Lower Zarafshan region were engaged in sedentary cattle breeding and «kayr» farming in lemon lands, living in semi-basement-shaped settlements with wooden poles, continuing ethnic relations, and hunting and hunting were the leading products in their daily life. According to M.A.Itina's conclusion, BC. Noting the emergence of the Tozabogyob culture in connection with the mixing of the Andranova tribes who migrated to the Southern Aral Sea in the beginning and middle of the 2nd millennium BC with the indigenous people of the Bronze Age, the Suvyorgans, he notes the formation of the irrigated farming culture in Khorezm during the Bronze Age. noted that it is under the influence of the population of southern farming oases [21].

The researcher's information about the history of the emergence and development of the agricultural culture based on artificial irrigation networks in the Khorezm oasis during the Bronze Age did not find its meaning in archaeological research. At the same time, according to the sources obtained as a result of

archeological research in the Ustyurt region, the inhabitants of the Eneolithic period had ethnic relations, lived in cellars, and samples of hand-made pottery and bronze weapons were obtained [22].

The Fergana Valley has its own special features due to its geographical location, which is naturally separate from the main arable region of Uzbekistan. In this respect, the economic development of the Bronze Age society was avv. It is possible to observe the specific features of the development of primitive settlements of the beginning of the II millennium. This historical process can be attributed to the fact that the Andronova tribes living near the Ohangaron River in the Tashkent oasis mixed with the representatives of the local Neolithic clans. They placed the deceased in the graves after farming in the lemon lands (Burchmulla, Yangiyo'l) [23].

Yu.A. According to Zadneprovsky, in the Late Bronze Age, the inhabitants of the Eneolithic period founded the C hust settlement in the Central Fergana Plain. They settled with the Andronova tribes and the inhabitants of the Eneolithic period and founded the Chust settlement [24]. Based on the results of the archaeological research conducted in the Chust settlement, the researchers concluded that the Chust people lived in semi-basement dwellings, made pottery by hand, and although the main focus of their economy was cattle breeding, Tozabog in the Khorezm oasis area. The situation of differentiation from the culture carried out by the inhabitants of Yobkhoz is distinguished by the defensive walls surrounding the four sides of straw and raw bricks based on the knowledge of construction [25].

According to the researcher Yu.A.Zadneprovsky, he divided the population in the Fergana Valley into two types, who carried out economic activities in the last stage of the Bronze Age:

Type 1 settled farmers, including the Chust settlement located in the Central Fergana region;

The 2nd type was cattle ranching and «nomadic» agriculture on the banks of the riverbeds [26].

The economic development of the society, similar to the material culture of the settlements of the Tozabogyob and Suvyorgan tribes in Khorezm, also covered the Tashkent valley. At the end of the Bronze Age, the Tashkent valley was divided into two regions that differed in geographical features, natural conditions and resources:

In the lower part of the Ohangaron river, Borganli (Burgu culture) developed. The topographical structure of the monument is semi-basement dwellings, hand-made pottery, the inhabitants settled down and engaged in agriculture [27].

Research results

In the history of Central Asia of the X-VIII centuries, information about the transition from the Bronze Age to the Early Iron Age was recorded in the publications [28]. Researcher ASSagdullayev took into account the stage of transition from bronze to the first iron age, taking into account the iron weapons taken from the house rooms of Anovtepa located at the foothills of Kopetdog in South Turkmenistan, Dalvarzin in the Fergana valley, Jarqoton in the Surkhan oasis.

In the historical period of Maskur Kopetdog, the unique dishes made by the inhabitants of Murgob, Surkhan, Kashkadarya and middle Zarafshan natural and economic regions found similarities in the monuments of Yozdepa 1 in South Turkmenistan [29]. Khorezm expedition personnel in the southern region of the Aral Sea. The dwellings of the Yakka-Parson-2 settlement, built by the inhabitants of the 8th century, the interior, the structure of the houses and rooms, the shape of the half-cellars with wooden columns, the shape of the handmade ceramic vessels, repeated the economy carried out by the inhabitants of Tozabogyob. H.Matyokubov paid attention and recorded his opinions [30]. The archaeological team led by Khorezm expedition member M.A.Itina, along the Inkardarya and Jonidarya tributaries, where the middle part of the Syrdarya branched off to the left bank, was built by representatives of the Amirabad culture from pakhsa and raw bricks. In the IX-VII centuries, he had memory knowledge [31].

In the 10th-8th centuries, Odoytepa was surrounded by a wall on all four sides by the settled population in the area of the northern basin of Sarikamishboi on the middle coast of the Amudarya near the southern border of the Khorezm oasis, Yerkurgan, Sangirtepa, Orta in the Kashkadarya oasis. In the Zarafshan oasis, the settlements of Afrosiyab and Koktepa are surrounded by defensive walls on all four sides [32]. In S.P.Tolstov's monograph. By the middle of the 1st millennium, Chirikrabot, Babishmulla, Balandi, Baroqtom residential areas were built on the eastern Arolboi plain [33]. Under the leadership of Ya.G.Gulomov, the Mohandaryo archaeological group has archaeological monuments in the Lower Zarafshan valley, Katta Tuzkon-3, Poykent spaces, the inhabitants of the Burganli (Burguluq) culture continued their economic traditions in the Tashkent oasis [34]. According to ASSagdullayev, Kyziltepa irrigated land around it was more than 200 hectares [35]. Mil. avv. By the middle of the 1st millennium, as a result of the first breezes of the Khorezm oasis's urbanization process, the Dingilja monument was founded on the right bank of the Amudarya, in the Southern Okchadarya region [36].

In the development of socio-economic relations of the 7th century society, in addition to the settled agricultural population, nomadic and semi-nomadic livestock farming was distinguished in terms of geographical environment and natural resources, such as the Caspian Sea and the Aral Seas, the Pamirs, and the Tianshan Mountains. Those who have assimilated and formed geographical latitude [37]. Based on the information mentioned above. In the 10th-6th centuries, the population living in the historical and cultural regions of Central Asia showed differences in the economy, i.e., in the areas that were suitable for crops, they engaged in irrigated agriculture and animal husbandry. - it should be noted that the daily activities of tribes living in pastures and mountains were dominated by livestock farming. On the other hand, the population living in the oases under the leadership of the «city-state priest» formed producers, farmers, cattle breeders, and builders in connection with the development of the socio-economic system of the society and the division of tasks performed by the members of the community.

According to the information recorded in the archeological literature, the cities of Yerkurgan, Uzunkir, Afrosiyab, Koktepa in South Sugdiyan, Yerkurgan, Uzunkir, Afrosiyab, and Koktepa were cultural centers Jalik centers served as the main cities and were religious and ideological objects [38]. According to ASSagdullayev, miles in the territory of Uzbekistan. avv. In the IX-VIII centuries, it is possible to add to the information about the small states under the leadership of the rulers of the regions [39].

In the middle of the 7th century - in the middle of the 6th century, the administrative-territorial geographical boundaries of the agricultural oases of Bactria, Sughd historical and cultural regions, Kyziltepa in the Surkhan oasis, Yerkurgan in Kashkadarya, Uzunkir, Afrosiyab in the Zarafshan valley, Koktepa as city-states it can be observed that it has been determined.

Amudarya left bank, Sarikamishboi basin, in the middle part of Davdon tributary of Amudarya, the Charmanyob irrigation facility was built on the north side, and at the foot of the network, which was built to the west in the direction of the north, there is a fortress with the name of Kozalikir. It is known that its construction was It corresponds to the borders of VII-VI centuries. The topographical location of the monument is 25 hectares, surrounded on four sides by a two-line defensive wall, and the outer wall has defensive elements. The interval of the semicircular towers along the side of the wall is 36 meters. The monument served as the first city in the middle part of Sarikamishboi. When the time comes, it should be noted that historical information about Kozalikir being the first capital of the Khorezm oasis is widely included in the researchers' publications. However, the geographical location of the Kozalikir monument has nothing to do with the Khorezm oasis.

Conclusion.

In conclusion, it can be noted that the «oasis-states» of the Bronze Age (the first cities, houses of farmers around temples and palaces surrounded by defensive walls, production facilities, artificial irrigation networks and agriculture In relation to the system of lands used for the purposes of the Early Iron Age, the ancient Bactrian confederation, a political association uniting various regions in the south of Central Asia, was formed. It included farmers' houses and fortresses, military fortifications, and oasis centers such as Oltindiyar, Kyziltepa, Yerkurgan, Uzunqir, Afrosiyob, and Koktepa. In the north-eastern regions of the region, military alliances and political associations of cattle-breeding tribes were formed in the steppe and mountainous regions.

Thus, based on the above-mentioned opinions, it is possible to come to the following final conclusion:

- BC In the first quarter of the second half of the 2nd millennium, an architectural and stylistic school was established in the history of Uzbekistan at Sopollitepa, Chust in the Fergana Valley, in the second half of the Maskur region, based on the knowledge of architecture. The representatives of the Maskur school of construction carried out the task of spreading construction knowledge to the neighboring areas.

- BC Due to the increase in population of Sopollitepa in the 9th century, as a result of migration policy towards the northern part of the Sherabad River at the initiative of the tribal chief, it became one of the centers of the Zharqoton architectural school, which covered the area of the left bank of the Bostonsoy tributary. was It was during this historical period that the people of Fergana valley founded the Dalvarzintepa monument in the geographical location of the Chust monument, and an architectural school was formed in Central Fergana based on the knowledge of architecture.

- BC In the middle of the second half of the 7th - 6th centuries, the fortresses of Jondavlattepa, Qiziltepa, Haytabad and Bandikhon 2 were formed as an architectural school in the Surkhan oasis in the historical and

cultural regions of Uzbekistan. Yerkurgan, Karshi, Uzunqir, Orta Zarafshonda, Smarakanda, Koktepa fortresses operated as architectural schools in the Kashkadarya oasis.

- BC The last quarter of the 6th century - the 5th century architectural schools: Bozorkala in the Khorezm oasis, Ko'zalikir in the Sarikamish basin, Qal'alikir, Oyboyirkala in the Ustyurt area, Hazorasp on the plain of the Heykanik canal irrigation facility, this canal adog in Ichan castle (Khiva).

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Some Comments on the Location and Structure of Ancient Stone Age Settlements in the Territory of Uzbekistan

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Abstract:

Central Asia region medium in the part is located in Uzbekistan ancient from the period starting from of the East different regions in line population certain mountainous , mountain ranges , gorges and in the plains are located .

Keywords: Central Asia, Uzbekistan, Ustyurt, Lower Amudarya, Zarafshan, Tashkent, Fergana, Surkhan, Mesolithic, Sultan Uvais, Kyzylkum, Bozsuv, Joining, Obishir, Machai, Caspiboyi, Murgob River, Lower Amudarya, Yonboshkala, DJonbos-4, Old Asia, Kopetdog, Namozgoh, Altintep, Geoxur, Jarqoton, Grandfather, Sopollitepa, A.A.Marushenko., A. Kuftin., B.A.Litvinsky., V.M.Masson., V.I.Sarianidi., V.I.Xlopin., S.P.Tolstov., O.K.Berdiev., A. Askarov., Ya.Gulomov., U.Abdullayev.

Introduction

Our country area surface geological progress during paleotectonic processes as a result in places natural Caves , ridges springs and in the plains sinkholes image did Maskur in the regions mother-in-law era quaternary period in their heads ashel in the early stages of the period climate conditions Hot because it was , the population to the location possibility gave Achel period lower first iron from the stage until the period

Uzbekistan in the area population straw and raw brick knowledge in residential areas reflection that it will generalization look received

Main part

Uzbekistan in the area antiquarians in publications natural in terms of to the body came mountain eels , springs the beach to the skirt connected in the regions of humanity to live huts structure about historical data reflection reached of Uzbekistan certain in the regions the population residence of residences topographical location and internal structure geographical to the seat depends was

Historical to information according to Uzbekistan certain areas from the Stone Age bronze period until the end the population residences location characteristics , to the population service to do issues lighting look received The result of the 20th century books and national independence years in publications note done information theoretical and comparative from the analysis come came out makes sense to the conclusion based on without ashel period lower from the stage bronze century until the end our ancestors residences location , interior structure , they in construction used items application results note done

Summary in the part and Uzbekistan mountains , mountain gorges , plains of mankind living , natural and economic from sources profession set received of the population residences its location structure characteristics changes input and straw-raw brick of knowledge houses in construction manifestation to be about feedback is summarized . Union scientific to the center and an antiquarian of scientists Uzbekistan in the area archaeological the field practice during to the list received mountainous in the regions tectonic actions as a result harvest has been in caves , spring , water basins the beach at the foot of the Stone Age about in settlements excavation their work take to go as a result received items , specific the first man in the regions representatives is located ashel period lower to the stage about addresses archaeological to the map placed

Stone Age ashel to the first stage of the period belongs to Ferghana valley Soh river in the system Driver in the village Fountain village in the area , the river 2000 m above sea level Selangor cave-space settling down , his internal part length 120 m, width 34 m wide , 25 m high . Address internal structure 5 cultural from the layer consists of , his thickness 30 cm - 1 meter organize reached [1. 2000-B 36].

Such mountainous in the area ashel period lower stage man for space has been The belly Iron man valley Chotkal mountain in the south Reddish left the beach at the end The belly the term historical as in the literature done Fountain the beach to the skirt open without man by big an animal kings , bones , tree and his thin layers using land level built Address location geographical place circular in the form of , his internal 49 structures cultural layer image reached [1972-C 5-12].

Iron man in the valley The belly hunter-gatherers people new descendants the population rinse volume on demand answer not giving , mining industry raw material reserve decrease situation look took it and moved to its surroundings , Kizilolmasoy-2, Ghishtsoy , Karabogsoy , Jarsoy such as addresses open to places who built

Uchtut-Ijand-Vaush addresses Southern Karatog on the slope is located being their hunters Cavobi flint material work weapons prepared hunting take those who went [3. 1990-B 20].

Uzbekistan in the area middle stone age addresses archaeological in terms of wide in a sense learned relationship with of the population wide in the regions location about in publications data geographical information wide note done from the data known ashel period addresses geographical location volume preserved the rest , but history at the request of according to hunter gatherers from the composition separate came out representatives next door migration to regions policy take to go history requirement reached

Researchers note according to Kolbulok hunters and spa occupation by doing received one group representatives , population density growth , near in the area in ecology shaky of the situation to the body coming new natural regions mastering own practical profession take to go on the hook Western Tianshan Chotkal in the ridge Poltov number is located cave-space width 20 m, volume arcuate in the form of , his internal part 21 with a thickness of 10 m from the layer consists of was Hunters two group representatives Rotten river left the beach at the bottom is located caves will be mastered . Of abundance the third group representatives Rotten the river Koksuv , Pskom , Chimyon , Ugom tributaries those who have mastered their surroundings . Burchmulla village surroundings natural to resources organic , ecological situation stability Khojakent because it was hunters representatives come settling down Thank you , Yusufkhana in the surroundings , Chotkal-1 , 2 , Kokayaylov , Aktash , Khojakent-2 and Rotten water warehouses surroundings they are mastered by that's it done addresses open way was [4. 1972-C 10-25].

That's it with together , the Middle Stone Age hunters Tashkent city around them to Texas is located Zogariq , Karakamish , Shoyimkoprik , Bozsuv 1-6 settlements population the number density growth all around around them ecological reserve decrease status food the problem to the body brought look received of hunters one group representatives Thank you , Tianshan mountain in the system natural cave-space as moved came to the hunters service did

Tianshan-Boisun on the mountain land 2600 m above sea level located A cave height 7 m, depth 21 m, width 20 m [5. 1940-C 5-8]. Urgut mountain To the board in the area is located Survivor in the village that's it in term cave-space located A cave corridor in the form to the plan has , length 29.5 m, height 15 m. Internal from the part oven , bonfire remains preserved the rest [6.1949-C 105-119].

The last stone age medium Zarafshona, Samarkand area archaeological in terms of studied . Address area 100 m 2 , plan right corner in the form

That's it method , above note done historical from the data come out , the following to the conclusion to arrive can

Uzbekistan geology development during land surface geographical landscape plain and mountainous from parts consists of was

Stone Age Achel from the first stage considering mountainous , mountainous systems , gorges and spring around them is located of addresses geographical place land vibrations result was

During the Late Stone Age, it was possible for hunters to open their farms in areas where the interior of the settlements was much wider.

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Review Article about the Use of Lasers in Ophthalmology

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Abstract:

It has now been more than twenty-five years since the invention of the laser using a ruby crystal as a laser medium. During that time, the laser was not limited to just being used in our daily conversation, but rather it began to develop from a scientific curiosity of limited use until it became one of the most important inventions of our time. The laser is now an important tool in various fields such as industry and medicine, and represents the basic tool in communications and holographic systems, as well as the solid basis for many scientific measurements and research programs. . In any case, everyone uses laser as a general term for different types of lasers with different characteristics. Lasers emit radiation that has special characteristics, which helps in their use in a wide range of applications other than ordinary light sources. In light of the wide applications of lasers, it is clear that non-physicist users need to acquire new information about lasers so that they can understand the specific applications that interest them, as well as realize the advantages of this knowledge, which will of course enable them to make a rational choice of lasers, auxiliary compounds, and the limitations of laser use. others that they wish to purchase. The list of users includes mechanical engineers, electronics specialists, civil engineers, communications engineers, chemists, surgical life scientists, military personnel, artists, and others. Tasks: The la Bseecrauhsaesoef nitsteprreodpemrtiaens, yitacraenabseoufsleifdeabseactaouolsfeorlamsaenry rpaeyosplaere ordinary light rays. The laser is a double- edged weapon used in peace as well as in war. It is electromagnetic with a known energy and a selective ability directed to specific targets. The uses of lasers cover various aspects of life, so the laser today is one of the most important and most widely used tools of modern life. There is no doubt that the great development in laser surgery has brought about a qualitative leap in the treatment of many medical problems, such as eye surgery and the treatment of various skin disorders. Laser belts have replaced the surgical scalpel in some operations because of their high accuracy in cutting tissue and reducing postoperative bleeding.

Introduction

It has now been more than twenty-five years since the invention of the laser using a ruby crystal: As a laser medium. Since that time, the laser has not only been limited to its use in our daily speech, but rather one of the most important inventions has begun to develop from a scientific curiosity of limited use until it has become in our time. Lasers are now an important tool in various fields such as industry and medicine, and represent the basic tool in communications and holographic systems, as well as the solid basis for many scientific measurements and research programs. Laser is used as a general term for different types of lasers

It has special features that help in its use with different characteristics. However, all lasers emit radiation

Wide range of applications beyond ordinary light sources. In light of the wide applications of lasers, it is clear that users who are not physicists need to acquire new information about lasers so that they can understand the specific applications that interest them. This knowledge will of course enable them to perform as well as understand the advantages and limitations of using lasers. Rational selection of the lasers and other ancillary compounds they wish to purchase. The list of users includes mechanical engineers, electronics specialists, civil engineers, communications engineers, chemists, life scientists, surgeons, military personnel, and artists [1]. Laser propertiesو Monochromatic: (single-frequency) which means that the laser beam has only one wavelength, i.e. a single frequency. Laser light differs from other types of light in that it consists of a band of narrow optical frequencies where the laser light appears. In one color and with a high degree of purity, while other types of light consist of the colors of the visible spectrum. This property is also exploited and laser light is used in fiber optic communications systems as a carrier of directionality .It is one of the most important characteristics of the laser, as the angle of exposure of the laser beams is very small, and thus it can travel long distances without dispersing its energy or changing its direction. This property is used in many applications that depend on measuring near and long distances and identifying targets with extreme accuracy, such as systems. Space Coherency; The optical frequencies produced by laser rays are characterized by the fact that the photons of these rays are interconnected and cohesive and do not have the same structural phase and the same size of polarization. These are properties that do not exist in any other type of light. This property is used in optical interference, three- dimensional imaging , studying the composition of materials, and measuring speed and distance.
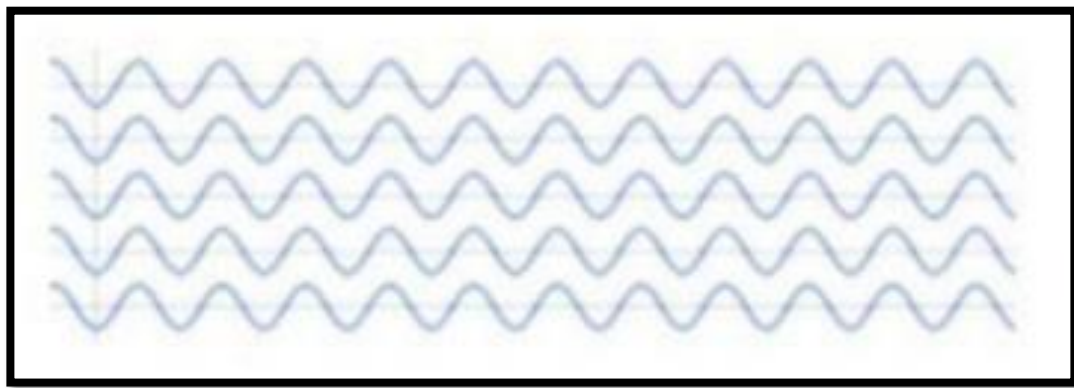
**(Figure 1-1) (Waves in the same phase as in a laser)**

The basic processes of laser interaction with tissue. Absorption and scattering are two physical phenomena that have an important effect on the spread of light through tissues. However, scattering is vital and will be discussed in this section, although both are the most important mechanical processes. The relative degree of these processes depends on the type of tissue. For example, in the skin, these processes differ according to the condition of the skin (Figure 1-2). The basic phenomena accompanying the interaction of light with tissue [2].
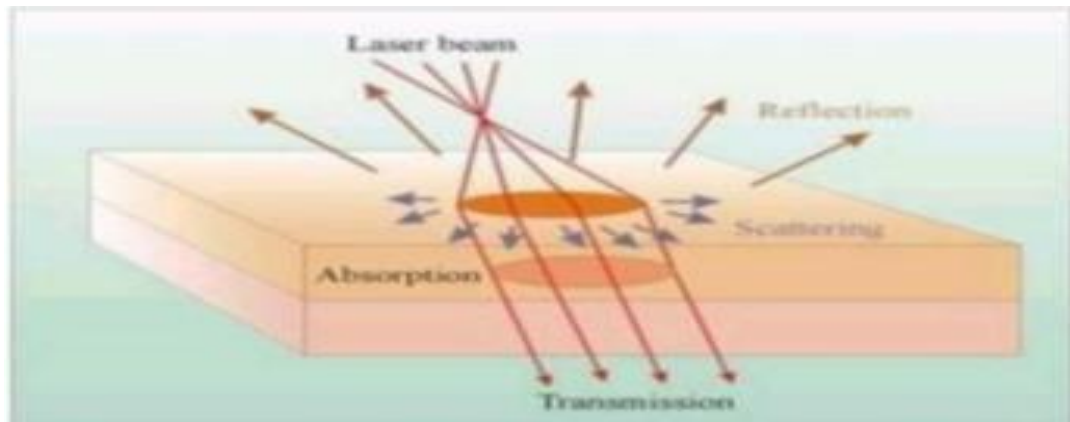
(Figure 2-1) The basic phenomena accompanying the interaction of light with tissue [2]

Scattering

The transmission of radiation through complex models such as biological tissues can be controlled by light scattering interactions in the medium. Scattering is essentially a physical process that occurs within tissue and in a manner Particularly within delicate structures such as cell membranes, it occurs as a result of the interaction of radiation randomly and mediated by small atoms in the medium, and as a result, light is scattered in all directions with different refractive indices. Vital tissues scatter light strongly in the frontal direction (Figure 3-1). Between multiple scattering in tissue [3]
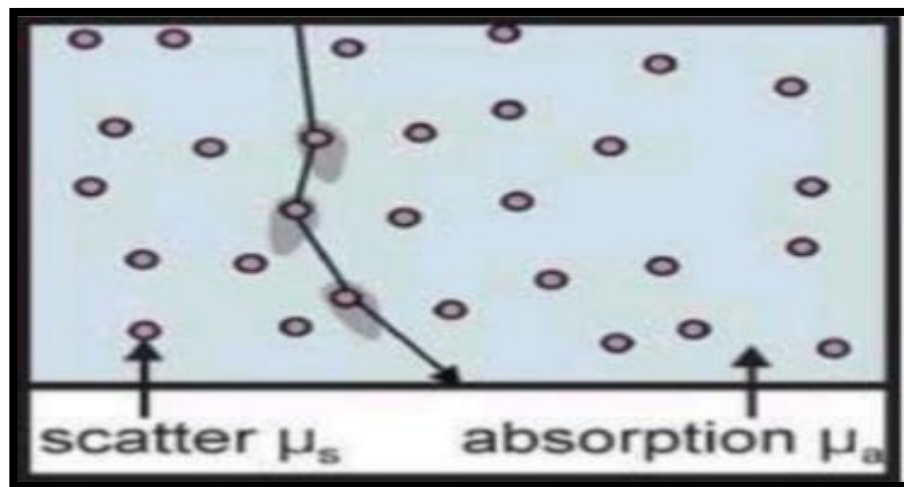
(Figure 3-1) between multiple scattering in tissue [3].

Penetration and Absorption of the laser Different lasers are characterized by wavelength, which is an important parameter. The density of the beam passing through the medium will decrease due to absorption, which determines the penetration distance that occurs. Bouguer was the first to establish in 1729 a relationship linking the absorption of light in a completely absorbing medium and the thickness of that medium. After that, Lambert derived the expression (1760). The athlete For the relationship known as Law 102. (Bouguer-Lambert) $dI/I = \mu_a \, dL$… (1-1)

Which describes how each successive layer (dl) of the medium absorbs the same part (I/dl) of the incident intensity (Io) for the constant (1). (l) over the distance) L (incident intensity)

I=loe ÿI =Ioe-ÿat… (2-1)

After that, Beer (in 1852) issued a law that stipulated the following: The absorption coefficient of a compound has a linear relationship with the concentration of the non-absorbing medium,

μa=ÿc) 3-1)

Where (a) represents the specific absorption coefficient. This law was applied in the same year by Bernard, and by substituting the value of (ÿa) into the Bougueer- Lambert law, what is known as the Bouguere-

I=I0e-Ac (4-1)

Lambert law produces what is known as the Beer-Lambert law. This law is valid only under specific conditions. When light enters the medium, this light must completely and completelyIdeally, the medium itself is absorbent It is single-wavelength and permeable unified; Therefore, some errors will appear when applying the law to practical spectra. [4] Reflection occurs at the boundaries between media with different optical properties, and the amount of reflected light depends on the incident light and the refractive index of each medium [5]. Some different types of lasers in medicine .arbon Dioxide Laser (2Co) It is a molecular laser that is issued according to a continuous or pulsed system. It is one of the most powerful lasers that emits an infrared field. It is the oldest laser used in the medical field, and working with it requires experience, precision, and skill. This laser was more common in the past, but its uses have decreased in the field of medicine. Teeth in recent years due to the emergence of more effective and sensitive types. The reason for its medical uses is due to the following: [6] A - The absorption of the energy of the CO2 laser beam is good by soft tissues with a high water content. As for the tissues adjacent to the targeted tissue to be treated, their absorption of laser rays is minimal, and this feature is considered one of the important advantages of the laser. 2CO is important in oral and facial soft tissue surgery (quick and deep cutting of tissue and bone with minimal blood bleeding). B - A CO2 laser beam enables the doctor to reach the most difficult areas in the mouth and pharynx. T - The 2CO laser beam is emitted continuously or in a pulsed manner as required by the work approach.For my surgeon, D - The use of the 2CO laser in the field of orthopedic surgery, including jaw bone surgery. Microscopic examinations and study of radiographs of bones treated with a 2CO laser beam showed that bone restoration. In the incision area, bone repair was either equal to or faster than in similar bone incisions healed in bone with conventional surgical instruments. It should be noted that the carbon dioxide laser and the neodymium-back laser are also useful in treating the following diseases: A - Gingivitis, nerve inflammation and engorgement, periodontal infections, osteomalacia. B - cysts. T - Removal of salivary stones in the salivary glands. D - Surgery before prosthesis (denture). C - Soft tissue tumors. H - In reconstructive surgery. C- Dental implants and periodontal surgeries [6]. Excim laser It means dimer-excited complex, which is a new class of pulsed molecular lasers that emit in the field of ultraviolet radiation and are commonly used in eye surgery. In the typical case, the excimer laser combines an inert gas (such as argon and xenon in specific proportions) and an active gas (such as fluorine and chlorine), the most famous of which is composed of chlorxenon (xe - Cl). It has the property of photoresection, not burning[7]. YaG-Nd laser: It is the most common type of solid-state laser, and the active medium simply consists of glass, which acts as a host medium for the active laser ions, Nd tri-ionization ions (called Ndmium laser: glass ** Also, a pottium aluminum garnet crystal (12ALO3Y) may work), which It is called abbreviated as "Nyak" as a host medium for nydmium ions (3Nd*). The resulting laser is called a nedmium laser: "Nyak" *" The nydium ions present in the crystalline environment give multiple laser transitions, but the most intense occurs at the transition, which has a wavelength equal to 1,064 micrometers between the two energy levels. 2/111 - 32F. This transition is prohibited according to the selection rules for

the electric dipole, so the average lifetime of the upper level of transmission (laser) is relatively long (T = 0.23 milliseconds). As for the upper level of pumping, it is represented by the ground level 12 with two spectral bands around the length. The wavelengths are 0.73 and 0.8 micrometers. The many levels used for pumping and using a light source with a wide spectral range increase the efficiency of the pumping. The upper levels of pumping are emptied quickly and with non-radiative transitions to the upper level of laser transmission (32F), and the lower level For laser transmission (level 2/111) it also empties quickly and with non-radiative transitions also to the ground level Ne-He helium laser: Of the gas lasers, the active medium of this laser consists of a mixture of neon gas and helium gas in proportions. The Under low pressure, the pumping process is carried out by: And mixture is placed in the closed tube, a high potential difference estimated at several thousand volts is applied, and a small current (several milliamperes) is applied between the cathode and the anode to cause the electrical discharge process. The process takes place by colliding with the helium atoms4, resulting from the passage of current through an electrical discharge, where they are excited to the energy level, and because the higher energy levels of helium are adjacent (close to) the upper levels of neon, so = n. Energy can be transferred from helium atoms to neon atoms as a result of colliding with them to move them from the ground level, thus achieving the inverse distribution for the neon atoms n = 3 to the higher level 2 for the neon atom so that the atom moves to the n = 3 level. Then the stimulated emission occurs at the nanometer level. 336 Emits a red laser beam with wavelength n= The atoms may fall to n = 1, and the atoms fall quickly and automatically to the ground level by colliding with the walls of the tube. The efficiency of this laser is considered very low and does not exceed the maximum power that can be obtained from this type of laser (50 milliwatts). Its uses are very many, especially in paving And operations in aircraft and ship construction, laying oil pipelines, and building roads and bridges. All this is due to its visible wavelength, its small diffraction, and its high conformation. [7,8] .Ruby laser: The ruby laser (or ruby laser) is a type of solid-state laser that uses a crystal of artificial ruby (produced according to the Verneuil process) as the effective medium for the laser. This form was one of the first forms of obtaining a laser, through the efforts of the scientist Theodor Harold Meinma n .0691 year HRL Laboratories Theodore Harold Maiman's laboratories The ruby laser emits pulses that are visible in the visible field at a wavelength of 3.694 nanometers. It has a red color, and the duration of a single pulse is on the order of milliseconds[9]. Presenter. the human eye is considered one of the most important senses, as it takes a large part of a person's vital energy. Therefore, this chapter is concerned with the properties of the human eye, its diseases, and its treatment. The human eye and its properties: The human eye is like a camera, and it never stops capturing as long as it is open. At its front there is a slight bulge, and its width in a newborn child is about three-quarters of an inch, increasing to an inch. The outer covering of the eyeball is white except at the front bulge, where it is transparent in an adult and thus allows light to enter the eye. This transparent bulge is called the cornea and its function. Basic protection of the eye. Its color ranges from blue to gray to hazel, and the color of the back side of the iris is always chrysanthemum. In the middle of the iris is a round hole called the "oculum." Its width is controlled by two groups of muscles. In strong light, the diameter of the hole expands, while in strong light it narrows. The lens is located behind the human eye. Directly to the eye, it is a fine disc with a diameter of a third of an inch. It is thin at the edges and thick in the middle. There is a circular muscle around the lens that, by . contracting it, can make the lens smaller in diameter and larger in thickness. In this way, the eye can see strange objects with complete clarity. When the muscle relaxes, the eye can see distant objects clearly. The space between the cornea and the lens is filled with a liquid, most of which is water, called (aqueous fluid). These things appear at the back of the eye, covered by a thin membrane called (aqueous fluid). The retina (contains light-sensitive nerve endings. Two types of light-sensitive cells enter the retina. About six million cone cells and silver-shaped cells, numbering approximately one hundred and twenty million. The function of cone and satellite cells in... Receiving light pulses, converting them into electrical currents, and sending them to the brain via optical fibers to translate them into what you call vision. Cone cells are responsible for the process of vision in daylight. Color vision is

the retina's ability to distinguish between different colors Eye diseases: Eye diseases are considered among the most dangerous diseases that affect the human eye, and they are many, but some of them are studied, such as cataracts, glaucoma, retinal detachment, and visual defects. Vision defects, such as long and short vision, are not diseases, but defects in vision. They do not occur Caused by microorganisms, but it often occurs as a result of a deformity in the shape of the eye. Myopia occurs in front of the retina, so clear vision occurs only when the visible object is close to the eye. Myopia occurs as a result of the elongation of the eye or the extreme curvature of the cornea. The light is focused at a point that when the light reaches . it, it does not become focused in front of the retina. However, in the case of farsightedness, the image is formed behind the retina, and then the object cannot be seen clearly unless it is moved away from the eye by a sufficient distance, and this occurs. Long-sightedness due to short-sightedness or flattening of the cornea. Light is concentrated at a point located behind the rim of the retina. Therefore, the light effectively reaching the retina is not concentrated as in the case of astigmatism (astigmatism is the strength of the cornea of the eye). It is not equal in all axes, because the cornea takes a non-spherical shape, meaning it is completely round The light is refracted in one direction by a different amount than in another direction, and therefore the light is not focused accurately at one point on the retina, and this leads to blurred vision. Also in the case of weakness of the focusing muscles (presbyopia) the concentration of light due to aging. This progression is due to the eye lenses losing their elasticity that they had in early life and assuming that there are no eye health problems such as the formation of cataracts, glaucoma, or retinal detachment... Etc., the main reason for blurred vision is due to a defect in the process of refraction of light as it passes through the eye, and that is, the light reflected from visible objects is not focused on a specific point on the retina. Scientists have been able to use the argon laser in treating age-related blindness, which means... And recently: The part gradually atrophyes with age, and doctors advise everyone to do early detection and take into account early warning signs, the most important of which is seeing straight lines bent or distorted. The role of the laser becomes effective, so the more it is done! By detecting the disease early, Then it is possible to successfully treat it within two weeks of the onset of symptoms. Even in this case, the success rate is 85% of cases, and this percentage drops to 10% if symptoms have passed. Cataracts: The lens of the eye focuses light on the retina just as the lens of a camera focuses light reflected from the body onto sensitive film. If the lens of the camera is not clean or clear, the image captured by this machine will be unclear and blurry. This is very similar to what happens when cataracts form in the eye. Since cataracts mean the formation of clouds on the lens of the eye, which is clear in its natural state, this leads to blurring of the light images formed on the retina, and the retina converts the light images into electrical signals that are transmitted. To the brain through the optic nerve, and again, if these optical images are blurry, it causes the formation of cataracts, and the vision that is clear is usually due to the process of natural aging, which affects the eye. Cataract eye disease is still the primary cause of vision loss, but with practical (scientific) and medical progress, it has been possible to successfully restore sight to those who lost it for this reason. In recent years, a method of breaking up this water with light waves has emerged through a small surgical hole. This method results in... It does not fit all eyes and its twilight and implanting a soft, flexible lens in its place, but To dissolve cataracts with laser, which is a method that hasit eismaerngeedw, more advanced method. Finally, it is safe and can be intervened in all cases. It is done through a smaller opening than in the case of ultrasound. It takes less time during the procedure and is even easier to practice than ultrasound. Cataracts affect the transparent lens of the eye, which is responsible for focusing the image on a surface. Therefore, the patient complains of blurred vision, and the condition gradually worsens with the retina over time. This disease can affect the eye at any time of life. It can appear after birth in the eye or in one eye, and is caused by a deficiency of (vitamin S) during pregnancy or the mother's infection with some viral diseases. Cataracts also occur as a result of complications of diabetes, especially if it is not controlled for several years. Cataracts often spread more among children. The elderly, and science . has not been able to prove the reason for the spread of this eye disease throughout the world. However, there is evidence of a deficiency in some

enzymes necessary for the metabolism of food in the lens of the eye, but this is not conclusive eviden Glaucoma: Glaucoma is a disease that affects the human eye and can rob it of vision within an adult without realizing the depth of the problem. It often reaches a certain point after which it is difficult for eyesight to return to its previous state. The problem It is related to high intraocular pressure to the extent that it destroys the delicate nerve fibers in the optic nerve. The level of high intraocular pressure that causes the destruction of nerve fibers varies from one person to another, and the amount of damage that occurs does not depend only on the level of high intraocular pressure, but on the sensitivity of the optic nerve to the process of destruction. A moderate increase in The internal pressure of one person's eyes may not cause destruction of nerve fibers, while this same increase in another person's eye pressure makes his optic nerve more sensitive. Vision loss can also be caused by the formation of glaucoma due to taking certain drugs or infections, such as cortisone, and specific causes of blood pooling in the blood vessels of the eye and narrowing of the eye. Gradual in the fluid drainage channels of the eye for no known reason, and this is more likely inside any eye where there is a watery fluid with a normal pressure. The most common causes of glaucoma. To maintain the eye in a healthy condition. Scientific research indicates that the dominant factor causing increased pressure inside the eye is the gradual obstruction of the drainage channels of the eye, known as the (septal network), if the pressure remains high enough and for a relatively long period, the delicate nerve fibers in the optic nerve will be destroyed. If they are destroyed, the optic fibers will not be generated. Again, for this reason, the key to treating glaucoma can be in early diagnosis, so that measures are taken to reduce intraocular pressure before destruction occurs : Retinal detach; The retina plays an important role in the vision process as it is responsible for receiving light falling on it, so it helps early detection of eye symptoms thanks to the millions of visual cells it contains. Retinal detachment that occurs unnoticed may protect against vision loss. Light. reaches the eye through the pupil

Just like what happens inside photographic cameras, the visible image is reflected on the annular wall of the eye. The classic view is that the retina does not stick to the eye permanently, but rather sticks to its annular wall through the Contribute vitreous being a transparent gelatinous material similar to the Vicro adhesive, indicating It makes the retina adhere to the back wall of the eye, which helps supply it with important nutrients through the layers of skin underneath. But when retinal detachment occurs, this supply does not reach the visual cells in the retina, leading to congenital eye their death in the worst cases. Retinal detachment is also due to many causes, including a simple weakness. People with nearsightedness are more susceptible to retinal detachment. Symptoms of retinal detachment include seeing flashes of light and moving black spots in one eye. may be Treatment of eye diseases with laser: Lasers are used to treat many diseases, perhaps the most important of which are retinal vein blockages, treatment of high intraocular pressure (glaucoma), treatment of long and short sightedness, astigmatism, treatment of blockages in blood channels, treatment of some diseases inside the eye, and water therapy is also used. Cataracts, glaucoma, and other diseases. Below we review some of them in detail Treatment of eyes and eyesight: Vision defects are treated using a concave lens in the case of nearsightedness, but in the case of farsightedness (farsightedness) using a convex lens, and in the case of astigmatism (astigmatism), a laser is used in operations to tear up liquid opacity, and medical glasses with cylindrical lenses. Vitreous or cutting threads of vitreous fluid, and performing operations such as peripheral corneal incision, cutting adhesions, and lifting some implanted materials, as well as cutting the nooses and cannulas from the eye in case of weak focusing muscles (presbyopia).Cataract treatment: 31 A more advanced method has emerged for treating cataracts, using an arbium YAG laser beam, which works to dissolve cataracts through a very small opening that does not exceed 2 mm, compared to an opening of up to 4 mm in the case of The use of ultrasound waves, which takes time to dissolve and suction out the water. Laser rays are characterized by the absence of high-frequency oscillations and affect only the white matter of about a quarter of the eye. Using a laser is much easier than ultrasound in training and learning

because it is safer, and therefore it can be intervened in all cases. It is used Lasers body. They are the same soft lenses that have become more advanced and have less interactions with the are more efficient, and the laser beam dissolves at a depth of less than one millimeter, where the cataracts are dissolved and suctioned out layer by layer. (3-4-3) Treatment of glaucoma: The use of an argon laser (green light) for many years in the treatment of chronic open-angle glaucoma. In this process, a closed-mounted lens is used, placed in front of the eye, and through it, the laser beam is focused in the area of the barrier mesh (drainage canal). The laser beam is directed several times around the area of the septal mesh with the aim of widening its openings, clearing the drainage channels and thus reducing the pressure inside the eye. This operation is not accompanied by any feeling or feeling that there is no surgery, and he completed. The lasbeer gisinaslsto ucaserrdy.out his usual activity immediately after the operation is The patient is able to have an iridotomy in the case of narrow-angle cataracts, and because there is a defect in the structure of the eye, the passage leading to the septal mesh is very narrow and may be closed. The laser is used efficiently and painlessly to make an opening in the pupil to open the passage leading to the septal mesh. (4-4-3) Treatment of retinal detachment with laser: In cases of retinal detachment in the human eye, i.e. tearing, which may cause loss of vision, precise laser beams can be used. After greatly reducing its capacity, the retina was welded in small points at the back of the eye, and then it was possible to restore sight to people who were suffering from retinal detachment or from diabetic retinal detachment, which may result in chronic diabetes. The laser beams are directed into the patient's eye through the lens of the eye, without causing any damage, as it is transparent. The heat of the laser helps in welding the retina back to its original position. Refractive surgery: Refractive surgery is a practical term used to describe a group of different surgical operations that change the relationships between the light-concentrating components of the eye. This is in an attempt to collect light in a specific focus on the retina without being exposed to the difficulties that may result from wearing prescription glasses or eyeglasses. In the following paragraphs, we review some refractive surgeries. Contact lenses, radial corneal incision: This process involves using a diamond blade to make radial incisions in the peripheral and central part of the cornea to a depth of about 90%. This causes flattening of the central part of the cornea by weakening the surrounding parts that support the corneal structure and thus reduces or eliminates myopia. Astigmatic keratotomy: In this case, incisions are made in the peripheral tangential part of the cornea or partial incisions are made. One of the advantages of incision surgery that can remove the circumferential convex part of the cornea and make it spherical in shape is that it is relatively low-cost and produces good results for people who suffer from short-sightedness. It has many disadvantages, including that the incisions may be larger than what is required, leading to farsightedness that exceeds three amputees. There is a possibility of scarring resulting from wounds, and this procedure may also lead to a general . weakness in the structure of the cornea and blurred vision at high altitudes.

Automated lamellar keratomileusis: However, significant progress has only occurred in recent years. This operation has been performed since 1949 AD. The equipment used is used in this operation. A complex performance is used as a result of the tremendous progress in devices and installation called (automated microkeratome). The superficial part of the cornea is opened and is called (the corneal cap). (Then a certain portion of the tissue is removed from the center of the cornea. Then the corneal cap is put back in place without the need for surgical suturing. Removing this central tissue from the cornea allows it to flatten and reduce its convexity, and thus to reduce and remove short-sightedness. One of the advantages of this operation is that it allows for the correction of severe short-sightedness. (up to 18 diopters) and also allows for rapid recovery and the patient's return to his usual activity in a short time. Its disadvantages may result in technical problems as a result of the mechanical removal of corneal tissue, which may cause scarring or unexpected results. This is why the excimer laser has replaced this technology. A laser device is used. Excimer lasers produce high-energy pulses of ultraviolet rays that cut the partial bonds between corneal cells with high precision. The excimer laser differs from other types in that it emits

(cold) or non-thermal light rays. Therefore, this technique is ideal for reshaping the cornea, as it does not cause any damage to the cells. Surrounding the operation area. 34 A complex computer is used to accurately control and direct the laser beam. In the process, the laser beam destroys a small (microscopic) amount of corneal tissue located on the front surface of the central part of the cornea, which makes this central area flatter and thus allows the light to be focused precisely on the retina. Among the advantages of the operation is that it achieves good results for mild myopia (up to three diopters), and that it is more accurate after the operation is than the operation and the patient can resume his normal life within two or three days performed. As for its disadvantages, the recovery period is relatively long for cases of myopia that exceed four. Diopter and the eye may water for three days until the wounds

Conclusion

This research aims to study lasers in terms of the principles of lasers, their foundations, stages of development, and the most important applications, and the major role that lasers have come to represent and the uses of lasers in the medical field and in the eye in particular recently, as it has greatly reduced the risks and costs of surgical operations. And periods of recovery that the patient needed after undergoing this type of surgical operation. Our research, Nephi, devoted a large amount of space to studying the eye and the diseases that afflict it due to the importance of the sense of sight, which is considered the most important of the senses for man. God Almighty said: (And He brought you out of your mothers' wombs knowing nothing, and made for you Hearing, sight, and hearts, so that you may be grateful.) The problem of the research: The problem of this research is that can lasers be used in surgery and ophthalmology? We will discuss in particular eye injuries such as cataracts, glaucoma, and the retina, and how to treat them using lasers. Research Content In this research, we will discuss the introduction in the first chapter, the basics of lasers, safety factors, and the harms of medical lasers in the second chapter, and the human eye and how it works in the third chapter.

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