

The Modern Technology Used to Reduce Effort and Time Using Automatic Bell Ringing by Arduino

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Abstract:

An automatic school bell system is a technological solution designed to automate the process of ringing school bells at pre-determined times throughout the school day. This system is comprised of a central control unit, a bell or series of bells, and software that allows for the scheduling of bell ringing times. The system can be programmed to ring bells at specific intervals, such as the beginning and end of class periods, lunch breaks, and other important times in the school day. The primary benefits of an automatic school bell system include greater efficiency, consistency, and accuracy in ringing school bells, as well as reduced workload for school administrators and staff who would otherwise need to manually operate a bell system. Additionally, the system can be customized to meet the specific needs and schedules of individual schools.

Keywords: Relay, Timer, Electric, buzzer.

1-1-Introduction to automatic school bell

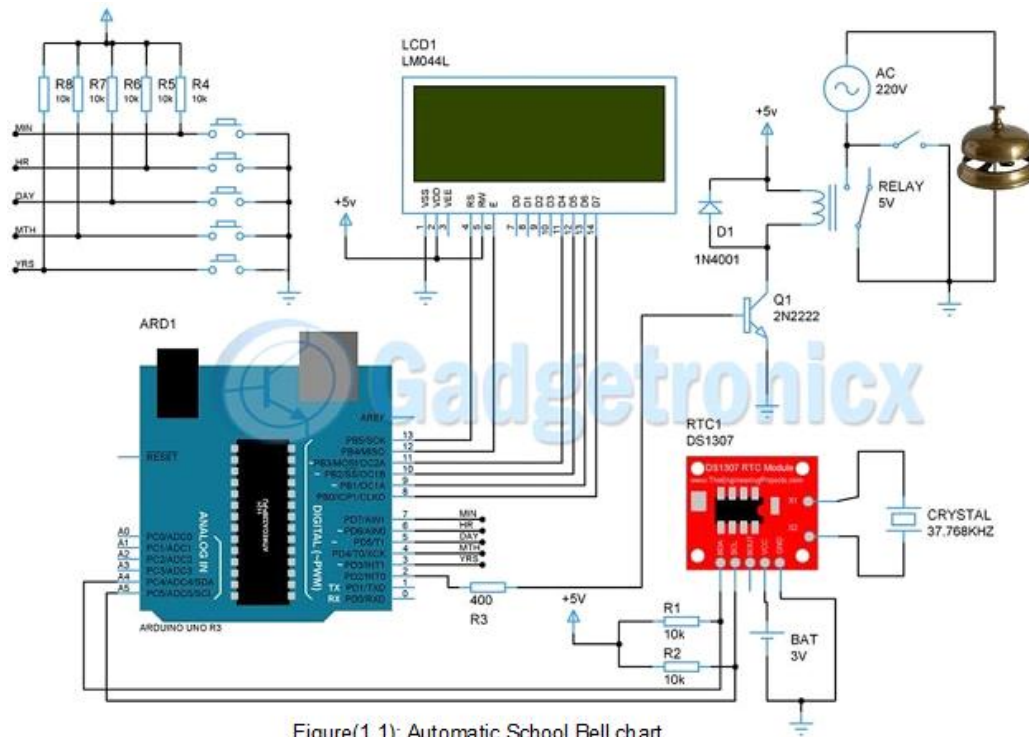
An automatic school bell project is an electronic device designed to ring bells or play tones at predetermined times to indicate the start and end of classes, recess, lunch breaks, and other school-related activities. It is a time management system that helps schools and educational institutions run efficiently by ensuring that classes start and end on time.

The project typically uses a microcontroller, real-time clock (RTC) module, relay module, bells or speakers, power supply, and wiring and cabling to create a system that can ring bells or play tones at specific times. The microcontroller controls the timing and activation of the bells or tones, while the RTC module ensures that the bells or tones are activated at the correct times. The relay module

allows the microcontroller to control high voltage devices such as bells or speakers, and the power supply provides the necessary power to the project.

The automatic school bell project has several benefits, including reducing the workload of teachers and administrators, improving punctuality and discipline among students, and ensuring that the school timetable is adhered to. It also helps to maintain a structured and organized learning environment that is conducive to effective teaching and learning.

Overall, an automatic school bell project is an important tool for managing time and maintaining order in schools and other educational institutions. By providing a reliable and efficient time management solution, it ensures that classes start and end on time and that students and teachers are able to follow the school timetable effectively.



Figure(1.1): Automatic School Bell chart

1-2- The aim of the research

There are several reasons why an automatic school bell system may be chosen as a project.

One reason is that it can greatly enhance the efficiency and productivity of the school day.

By automating the process of ringing bells, school staff can focus on other tasks and responsibilities without worrying about being late for class changes or other important events. Additionally, an automatic system can help ensure that bells are consistently and accurately rung, which can prevent confusion and disruptions in the classroom.

Another reason for choosing an automatic school bell system as a project is that it can be relatively easy and inexpensive to implement.

Depending on the specific system and components selected, installation and setup can be completed quickly and at a reasonable cost.

Additionally, automatic school bell systems are highly customizable, allowing schools to tailor the system to their specific needs and schedules.

Finally, an automatic school bell system can improve the overall safety and security of a school. By eliminating the need for manual bell ringing, staff members can remain in secure locations during class changes and other events. This can reduce the risk of accidents, injuries, or other incidents that

may occur when staff members are outside of secure areas.

1-3- Disadvantages of School Bell project

While there are many benefits to implementing an automatic school bell project, there are also a few disadvantages to consider. Here are some of the potential drawbacks:

- **Initial cost:** Depending on the type and complexity of the system, the initial cost of installing an automatic school bell project can be relatively high. However, in the long run, it can be cost-effective due to reduced labor costs and increased efficiency.
- **Technical issues:** Like any electronic system, an automatic school bell project may experience technical issues from time to time, such as software bugs or hardware malfunctions. These issues may require the expertise of a technician to resolve, which can be costly.
- **Power outages:** In the event of a power outage, the automatic school bell project may stop functioning until power is restored. This can disrupt the normal routine of the school day and cause confusion among students and staff.
- **Maintenance:** Regular maintenance is required to ensure that the automatic school bell project is functioning correctly. This can involve tasks such as checking connections, replacing batteries, and updating software, which can be time-consuming and require technical expertise.
- **Security:** In some cases, an automatic school bell project may be vulnerable to hacking or unauthorized access, which could disrupt the normal functioning of the system.

Despite these potential disadvantages, the benefits of an automatic school bell project typically outweigh the drawbacks, and with proper planning and maintenance, the system can be highly reliable and efficient.

2-1-Timer Relay

A timer relay in an automatic school bell project is a type of relay that includes a timing function or a timer circuit. The timer relay is used to control the school bell based on a pre-set timing sequence or delay.

In an automatic school bell project, the timer relay is connected to a timer that controls the on/off intervals of the school bell. The timer sends a signal to the timer relay to switch the school bell on or off based on the pre-set timing sequence.

For example, if the school schedule requires the bell to ring for 5 seconds every hour, the timer relay would be programmed to turn on the school bell for 5 seconds at the top of every hour. The timer relay would receive a signal from the timer and energize the circuit that controls the school bell, allowing the bell to ring for the desired duration.

Overall, the timer relay plays a crucial role in an automatic school bell project by providing precise and accurate control of the school bell according to the pre-set schedule.

- **points of timer relay:**

open contact point:



Figure (2.1): open contact point

It is the point that is in its normal state open, that is, it does not conduct an electric current, and it is symbolized by the two letters NO, which is an abbreviation for Normally Open, and it is numbered with the following numbers: 13-14 or the following numbers starting with the number 3. The NO points are closed when feeding the relay coil with electric current

closed contact point of timer relay:

They are the points that are in their natural state closed, i.e. connected when the relay coil is not fed with current, and open when the relay coil is fed with current.

Closed points are symbolized by the letters NC, which is an abbreviation for Normally Closed, and are numbered with the following numbers: 11- 12 or the following numbers starting with the number 1.

.common point:

Refers to the common end of the relay, and represents the end of the output point, which is connected to the load or to any other circuit, and is connected either to the closed or open point depending on the state of the relay, and the common point is symbolized by the letter C.

➤ **Key points for relay:**

Most relays that use digital control panels have 5 basic points as follows:

- ✓ Two points for the relay file
- ✓ Open point NO.
- ✓ closed point NC.
- ✓ common point C.

You may find relays with 8 points and 11 points, whichever you choose according to your need.

➤ **Relay contact points**

As shown in front of us are the contact points and the ends of the coil for one of the relays, you will find that the scheme is a little complicated for beginners, but it is actually very easy to understand and clear, and it only needs some practice.

We note that the numbers written in red, 11, 21, and 31, are common points, that is, output points, while points 12, 22, and 32 are closed points NC, and points 14, 24, and 34 are open points NO.

Finally, points A1 and A2 or 2 and 10 are the relay coil points

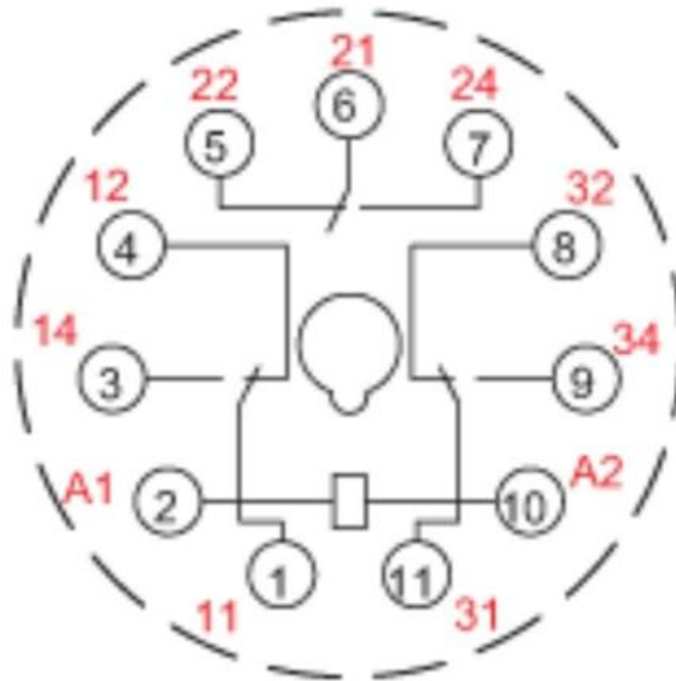


Figure (2.2): Relay contact points

2.1.1- How its work

The operation of a timer relay depends on the specific type of timer relay being used. However, in general, timer relays work by receiving an input signal that triggers a timing function, which then controls the output circuit of the relay.

For example, let's consider an on-delay timer relay. When an input signal is received, the relay's timing circuit is activated, and the output circuit is energized after a pre-set delay. This delay time is usually adjustable and can be set using a knob or a digital display. Once the delay time has elapsed, the output circuit is de-energized.

In the case of an off-delay timer relay, the input signal triggers the timing circuit, and the output circuit is energized immediately. However, when the input signal is removed, the timing circuit is activated again, and the output circuit remains energized for a pre-set delay time before it is de-energized.

Interval timer relays and recycle timer relays work by using a combination of on-delay and off-delay timing sequences to provide repeatable timing cycles. Programmable timer relays can be customized to provide various timing sequences and can be programmed using a keypad or a computer interface.

In an automatic school bell project, the timer relay would receive an input signal from a timer, which would activate the timing circuit and control the output circuit that controls the school bell. The timer relay would then turn the school bell on or off based on the pre-set timing sequence.

2.2-Timer

timer is an electronic device or circuit that measures time intervals and triggers events based on those intervals. Timers are widely used in various applications, including automatic control systems, appliances, lighting, and more.

A timer typically consists of a clock generator, a counter, and a comparator. The clock generator provides a clock signal that drives the counter, which counts the clock cycles and produces an output signal when a pre-set number of cycles have occurred. The comparator compares the count value with a pre-set value and triggers an event or output signal when the count value matches the pre-set value.

There are two types of timers: digital and analog. Digital timers use electronic circuits to count and measure time intervals, while analog timers use mechanical components such as gears and springs to provide timing functions.

The working principle of a timer involves setting a pre-determined time interval using the timer's control interface. Once the timer is activated, it begins counting time intervals based on the pre-set value. When the elapsed time matches the pre-set time, the timer triggers an event or output signal, such as turning on or off a load.

For example, in an automatic school bell project, a timer would be used to control the ringing of the bell at specific intervals. The timer would be pre-set to the desired intervals and would activate the timer relay, which controls the bell circuit based on the pre-set timing sequence.

Overall, timers are essential components in many electronic systems, providing accurate and reliable timing functions to trigger events or control processes based on time intervals.

➤ **Timer contact points:**

Normally Open NO: In the normal state, it is open, and when feeding the timer, it counts until the end of the preset time, and then changes the open contact points to closed ones.

1. **Normally Closed NC:** In the normal state, it is closed, and when the timer is fed, it waits until the pre-set time expires and changes the closed contact points to open ones.
2. **common point:** It is the point where the electric current is connected.

2.3- Selector switch

A selector switch is a type of switch used in electrical circuits to select one of multiple options or functions. It consists of a rotary knob or lever that can be rotated to different positions, each corresponding to a different option or function.

Selector switches are commonly used in control panels, machinery, and other electrical applications where different options or functions need to be selected. For example, a selector switch may be used to select the speed of a motor, the operating mode of a machine, or the source of power supply.



Figure (2.3): Selector switch

The operation of a selector switch is straightforward. When the knob or lever is rotated to a different position, the switch contacts inside the switch change their state, connecting or disconnecting different parts of the circuit. This allows the circuit to be reconfigured for a different option or function.

For example, in an automatic school bell project, a selector switch can be used to select between different timing modes or bell schedules.

When the switch is rotated to a different position, it connects a different set of contacts, which configures the timer and relay circuits to activate the school bell according to the selected schedule.

Overall, selector switches are essential components in many electrical circuits, providing a simple and reliable way to select between different options or functions. They are available in various sizes, shapes, and configurations to suit different applications and can be used in combination with other switches, relays, and controllers to create complex control systems.

2.4- bell (Buzzer)

Electric bell: An electric bell is a device that produces a sound by using an electromagnet to strike a metal gong or bell. In the Auto School Bell project, an electric bell is used to produce the ringing sound at the scheduled time.

An electric bell is a type of mechanical bell that produces a ringing sound by using an electromagnet to strike a metal gong or bell. The bell consists of two main components: the electromagnetic coil and the metal bell or gong.

When an electric current flows through the coil, it creates a magnetic field that pulls a metal armature towards the coil. The armature is attached to a hammer, which strikes the metal bell or gong, producing the ringing sound. When the current is turned off, a spring pulls the armature back to its original position, and the hammer disengages from the bell.

In the Auto School Bell project, an electric bell is used to produce the ringing sound at the scheduled time. The bell is connected to a relay module, which is controlled by the microcontroller to activate or deactivate the bell circuit.

Electric bells are commonly used in various applications, such as alarm systems, doorbells, and telephones. They are relatively simple and reliable, and they produce a distinct and loud sound that is easily recognizable. However, they can be relatively loud and may not be suitable for some applications where a more subtle sound is desired.



Figure (2.4): bell (Buzzer)

2.5- Wire

The conductive material used to connect the different components together. In this project, wires would be used to connect the timer, time relay, selector switch, and bell in the appropriate way.

2.6- Board

A platform used to mount and organize the different components of the project. In this project, a board could be used to mount the timer, time relay, selector switch, and other components, and to provide a safe and convenient way to connect them together.

Results

The Parts of Auto School Bell project and its work

- Five Timer relay pieces : A specialized relay that includes a timer circuit. In this project, the time relay would be used to turn the school bell on and off based on a pre-set timer.
- Four Timer pieces: A device that can measure and control time intervals. In this project, the timer could be used to set the time intervals for the time relay, which would in turn control the school bell.
- Selector switch: A switch that can be used to select between different options or modes. In this project, the selector switch could be used to choose between different bell schedules or to enable/disable the bell.
- Bell(Buzzer): The sound-making device that signals the start and end of classes. In this project, the bell would be connected to the time
- Wire: The conductive material used to connect the different components together. In this project, wires would be used to connect the timer, timer relay, selector switch, and bell in the appropriate way.
- Board: A platform used to mount and organize the different components of the project. In this project, a board could be used to mount the timer, time relay, selector switch, and other components, and to provide a safe and convenient way to connect them together.

2.1. Hardware Working

For the purpose of making the automatic bell, five relays and four timers are used as shown in figure (3.1). And because there is more than one different time period, this requires the presence of a timer for each time period, as well as a relay for the purpose of controlling and controlling these times, in addition to the electric switch and also the electric buzzer as shown in figure (3.2).



Figure (3.1): The Number of Relays and Timers used



Figure (3.2): The Electric Switch and also The Electric Buzzer

2.2. Electronic Circuit Working

For the purpose of drawing and simulating electrical circuits and automatic control circuits, there are several programs for that

In this project, the **AutoCAD** program was used to draw the electrical circuit diagram and to explain the connection method. As it is certified in drawing classic control circuits as shown in figure (3.3).

we have three different times:

First: the duration of the bell (usually takes one minute) Second: Lesson duration (usually takes 35 minutes)

Third: the duration of the break (usually it takes five minutes) The fourth timer is used to restart the cycle again

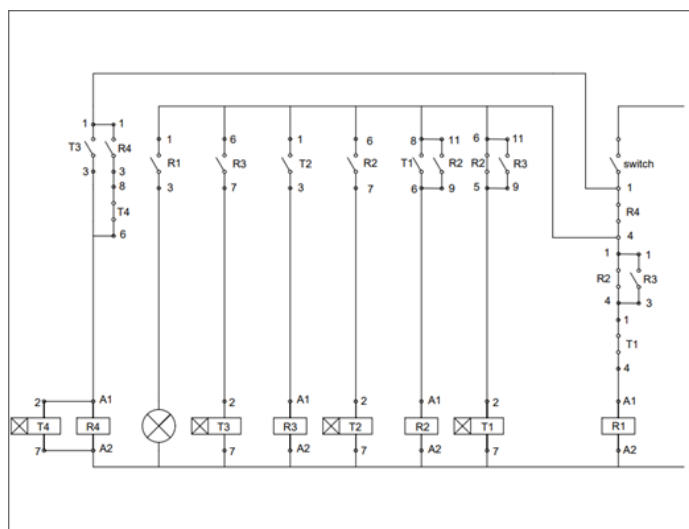


Figure (3.3): Electrical Circuit Diagram of the Automatic School bell

In the above **Figure (3.3)**, it refers to the sequence diagram of connecting the project elements, as we will explain in several steps as follows:

- The relay responsible for operating the buzzer [R1] by the open point [1-3]

- The timer [T1] turns off the buzzer by the close point [1-4]
- The timer [T1] turns off Relay [R1] through the close point [1-4] and at the same time it turns on [R2] via the open point [6-8]
- [R2] It continues to work by feeding itself by point [9-11] Then it stops [T1] and [R1] and the lesson begins for 35 minutes (in this project a six-minute timer was used because a 35-minute timer was not available at the moment).
- The timer [T2] starts to work, which was turned on [R2] by the point [7-6], and starts counting the lesson time
- After the end of the 35-minute lesson time, it [R2] turns off [T2] at the point [1-3] and turns on [R3]
- When you turn on [R3] it closes [R1] through the point [1-3] in the coil line (R1) (which is responsible for turning on the buzzer) and also closes the point [9-11] to run the timer again [T1] its responsible for the running time the buzzer, at the same time [R3] you turn on [7-6] to turn on the timer [T3]
- When the timer is running [T3] at the same time, the timer is running [T3] at the coil line (coil 4), which is responsible for the time of break.
- When the duration of the break is complete, the timer [T3] closes the point [1-3] which in turn turns on [R4] and also [T4]
- When you turn on [R4] on the coil line, it will open [R4] (normally close) on the switch line, and the circuit is restarted.

2.3. The Result

An automatic school bell was made by some parts of the classic control circuits (timers as well as relays in addition to the switch and the electric buzzer). It has been found that it is possible to control the time period for each timing according to the control of the existing timers, where for each time there is a timer (break time and lesson in addition to the duration of the bell ringing and also re-circuiting again) The electrical circuit has been connected to the school bell According to the above steps.

4.1. Conclusion

The idea of an automatic bell has been used recently in schools for the purpose of facilitating students' guidance to the start time of the lesson and the start time of the break without human intervention in that. Therefore, the benefit of this project is for the purpose of facilitating this task for the school administration, as well as the accuracy of the automatic system compared to human reliance on that. In this project, 4 timers were used, 3 timers, one for the purpose of ringing the bell, two for the timing of the lesson and opportunity, and the fourth for the purpose of repeating the cycle again, in addition to the number of 5 relays for the purpose of controlling these timers, In addition to that, there is an electric buzzer and a switch for the purpose of turning on and off the electrical circuit. Drawing a classic control circle in this project, AutoCAD program was used in that.

4.2. Recommendations

For the purpose of improving this project and making its use and implementation easier can use programmable logic controllers (PLC)

Or it is possible to use the flashing timer and program it to work instead of using the number of timers that we mentioned in this project

Or we can also use the Arduino device to improve the work of this project.

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