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I2C Based Real Time-Clock College Bell Automation

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Abstract: *The College Bell Automation System is a smart solution designed to automate the ringing of bells in educational institutions, ensuring precise and timely management of daily schedules. Utilizing an ESP32 microcontroller, the system integrates advanced timekeeping and control features to replace traditional manual bell systems. This project focuses on enhancing the efficiency of school operations by automating bell rings according to a predefined schedule, which can be easily modified through a web interface or mobile application. The ESP32's connectivity options enable remote updates and synchronization with internet time servers for accuracy. This system not only reduces the need for manual intervention but also improves punctuality and organization within the institution. Additionally, the system is scalable, allowing for integration with multiple bells across different locations, and customizable to meet the specific needs of any educational environment. The College Bell Automation System represents a cost-effective, reliable, and future-proof approach to managing school timetables, contributing to a more disciplined and structured academic environment.*

I.INTRODUCTION

In educational institutions, maintaining punctuality and organization is crucial for smooth operations and effective learning. One of the fundamental components in achieving this is the reliable management of bell schedules, ensuring timely transitions between classes and activities throughout the day. Traditional methods of bell scheduling often rely on manual intervention or basic timer circuits, which can be prone to inaccuracies and require frequent adjustments. By leveraging RTC modules via I2C communication, colleges can implement sophisticated bell automation systems that offer programmable scheduling, automatic adjustments for seasonal time changes, and centralized control over bell ringing sequences. These capabilities not only streamline administrative tasks associated with bell management but also enhance overall operational efficiency and reliability.

This introduction sets the stage for exploring how I2C-based RTC technology revolutionizes college bell automation, offering a scalable and dependable solution tailored to the dynamic scheduling needs of educational institutions. The following sections will delve deeper into the technical aspects, benefits, and implementation considerations of integrating I2C-based RTC systems for efficient and effective college bell automation.

II. LITERATURE REVIEW

This Project takes over the task of Ringing the Bell in schools and Colleges. It replaces the Manual Switching of the Bell in schools and Colleges. Here we are going to employ ESP32 microcontroller. esp32 microcontroller has inbuilt EEPROM in which timings can be stored. Once the timings are loaded in RTC it automatically ticks every second. The PIC microcontroller reads the data from the RTC via I2C bus and compares it with the pre stored ones. If the value matches the controller initiates the buzzer. The exact timing will be displayed on the LCD and we also provide the keypad to change the timings. we are using IOT module to provide the flexibility by controlling the circuit using a smartphone.

Survey On Automated College Bell Systems

An automated college bell system is a modern solution designed to replace traditional manual bell systems in educational institutions. This system is primarily aimed at improving the efficiency and accuracy of signalling the start and end of classes, breaks, and other scheduled activities within a college. The implementation of such systems involves the use of hardware (such as microcontrollers, relays, and speakers) and software (for scheduling and control). Below is a literature review summarizing key findings and research related to automated college bell systems**.**

Advantages of Automated Bell Systems:

- Consistency and Accuracy: Automated systems ensure that bells ring at exactly the same time every day, minimizing disruptions caused by human error.

- Reduced Labor Costs: Once installed, these systems require minimal human intervention, reducing the need for dedicated personnel to manage the bell system.
- Customization: The schedule can be easily modified to accommodate special events, holidays, or changes in the academic timetable.
- Energy Efficiency: Some systems are designed to operate efficiently, minimizing electricity usage, especially when compared to older, mechanical systems

III. PROPOSED SYSTEM

A proposed system for an automated college bell system would aim to enhance the efficiency, accuracy, and flexibility of the bell-ringing process while addressing the limitations of existing systems. Below is a detailed outline of what a proposed modern, fully automated college bell system might look like.

1. System Overview

The proposed system is a fully automated, IoT-enabled college bell system designed to manage and control the ringing of bells across the college campus. This system would be centralized, allowing administrators to schedule and manage bell timings through a user-friendly interface. The system would incorporate advanced technologies such as microcontrollers, real-time clocks, cloud connectivity, and integration with other campus management systems.

2. Key Features

- **Centralized Control**: A web-based or mobile application interface allows administrators to configure, monitor, and adjust the bell schedule remotely from any device with internet access.
- **Real-Time Clock (RTC) Integration**: The system uses an RTC module to maintain accurate timing, ensuring that the bell rings at the exact scheduled time, regardless of power outages or network issues.
- **IoT Integration**: The system is part of the college's IoT ecosystem, enabling it to communicate with other systems (such as lighting, HVAC, and security systems) for coordinated operations.
- **Cloud Connectivity**: Data related to the bell schedule, logs, and system status is stored in the cloud, allowing for easy access, backup, and real-time updates.
- In the suggested system, we will use Solar based charging system for providing the power to charge the vehicle. It employs a microcontroller-based sensor-monitoring and controlling system, as well as operation control. Through this sensors and circuit efficient monitoring and controlling can be done. The system uses IOT based monitoring for the power monitoring. The charging units and the amount of charge the EV vehicle is holding is maintained in the IOT Application.

IV. BLOCK DIAGRAM

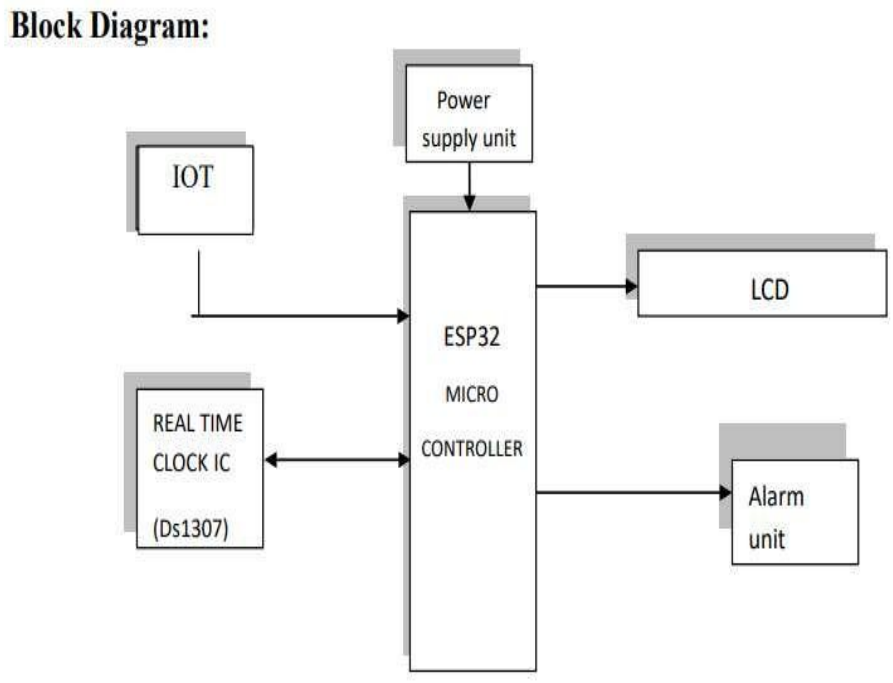


***Fig 1**- Block diagram for Inter integrated Circuits (I2C) Based Real Time Clock for College Bell Automation*

V. HARDWARE COMPONENTS

Power Supply:

The power supply section is the section which provides +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.The ac voltage, typically 220V, is connected to a transformer, which steps down the ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

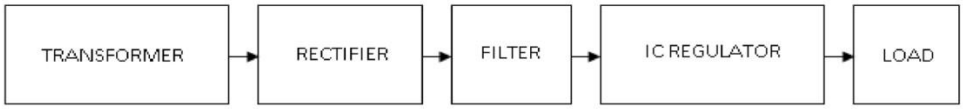


***Fig 2**-Block diagram of power supply*

Esp32 Module:

Wi- The ESP32 module is a low-cost, low-power system-on-chip (SoC) microcontroller with integrated Wi-Fi and Bluetooth capabilities. It is manufactured by Espressif Systems, and is designed for use in a variety of applications, including Internet of Things (IoT) devices, wearable electronics, and other embedded systems. The ESP32 module features dual-core processors running at up to 240 MHz, as well as a variety of built-in peripherals, including touch sensors, analog-to-digital converters, and pulse width modulation (PWM) controllers. It also includes support for a wide range of communication protocols, including Fi, Bluetooth, and Ethernet.

***Fig 3**- Esp32 Module*

Voltage sensor

This sensor is used to monitor, calculate and determine the voltage supply. This sensor can determine the AC or DC voltage level. The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal, etc. Some sensors provide sine waveforms or pulse waveforms like output & others can generate outputs like AM (Amplitude Modulation), PWM (Pulse Width Modulation) or FM (Frequency Modulation). The measurement of these sensors can depend on the voltage divider.

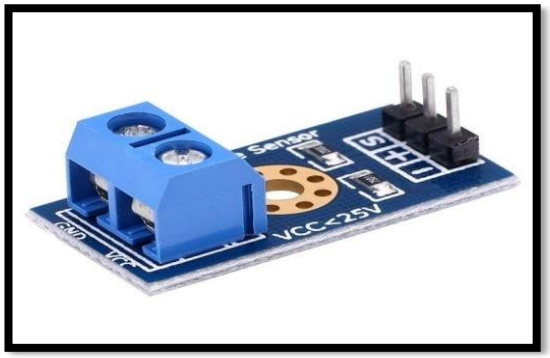


***Fig 4**-voltage sensor*

This sensor includes input and output. The input side mainly includes two pins namely positive and negative pins. The two pins of the device can be connected to the positive & negative pins of the sensor. The device positive & negative pins can be connected to the positive & negative pins of the sensor. The output of this sensor mainly includes supply voltage (VCC), ground (GND), analog o/p data. Types of Voltage Sensors: These sensors are classified into two types like a resistive type sensor and capacitive type sensor.

1) **Resistive Type Sensor**: This sensor mainly includes two circuits like a voltage divider & bridge circuit. The resistor in the circuit works as a sensing element. The voltage can be separated into two resistors like a reference voltage & variable resistor

to make a circuit of the voltage divider. A voltage supply is applied to this circuit. The output voltage can be decided by the resistance used in the circuit. So the voltage change can be amplified.

2) **Capacitive Type Sensor**: This type of sensor consists of an insulator and two conductors within the center. As the capacitor is power-driven with 5 Volt, then the flow of current will be there in the capacitor. This can create revulsion of electrons within the capacitor. The difference in capacitance indicates the voltage and the capacitor can be connected within the series.

Current Sensor:

A device that is used to detect & also change current to assessable output voltage is known as a current sensor. This output voltage is simply proportional to the current flow throughout the measured path. After that, this output voltage signal is used to display the current measured within an ammeter, for controlling purposes or simply stored for more analysis within a data acquisition system. So this is the function of a current sensor.

Fig 5- *Current sensor*

Relay:

A relay is an electromechanical switch, which perform ON and OFF operations without any human interaction. General representation of double contact relay is shown in fig. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal

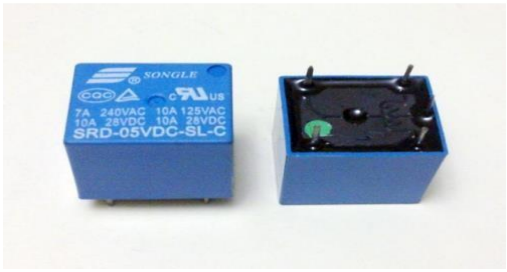


Fig 6- *Relay*

Real Time Clock:

A real time clock is a clock that keeps track of the time even when the system is turned off. Real time clocks run on a special battery that is not connected to the normal power supply of the system. In contrast, clocks that are not real-time do not function when the system is off.

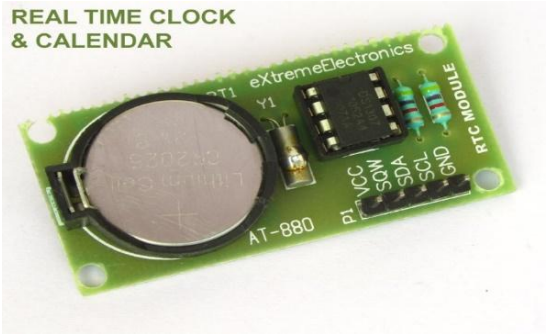


Fig-7 *RTC IC*

Liquid crystal display:

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this tutorial, we will discuss about character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these simple looking LCDs which can give a new look to your application

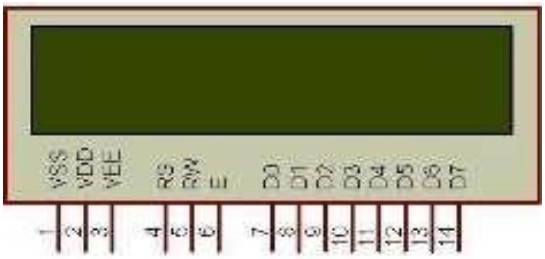


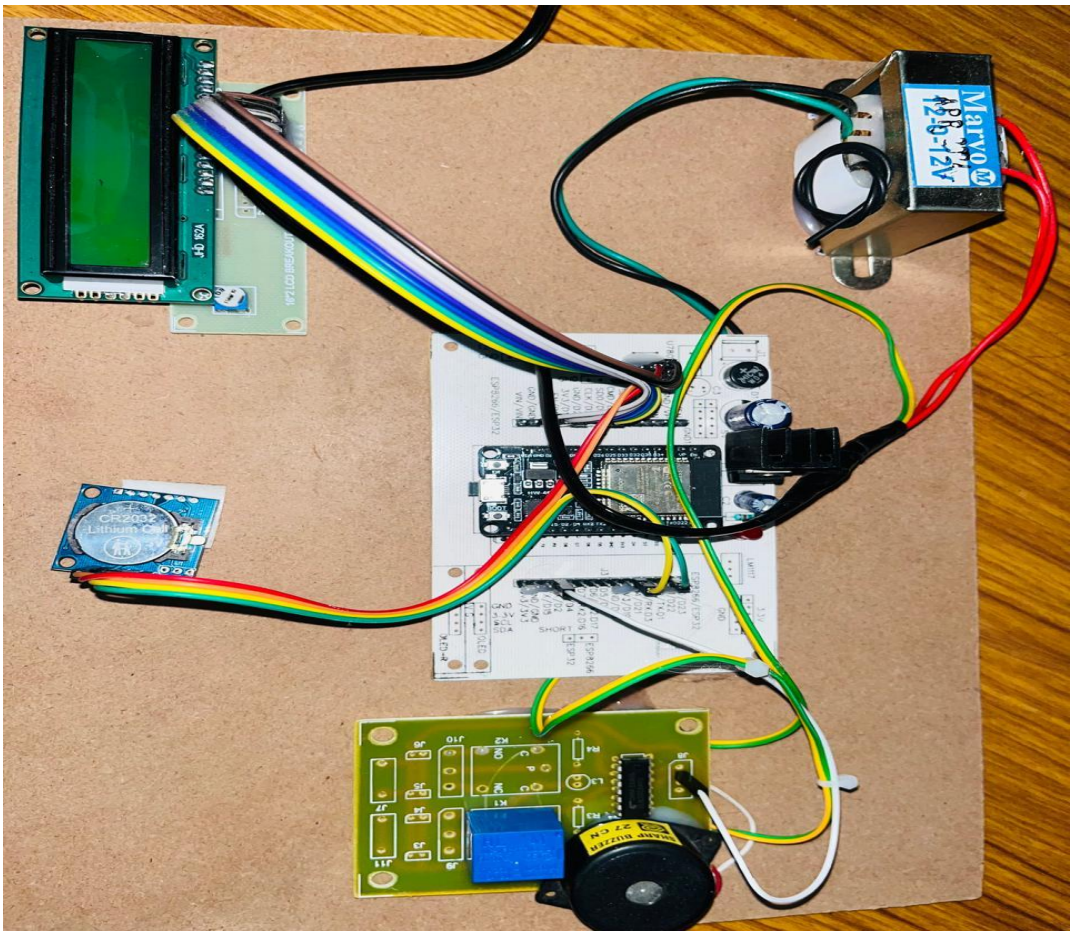
Fig 8 *- Character LCD type HD44780 Pin diagram*

Alarm Unit:

An audio signalling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren

Fig 9*- Buzzer*

Result:



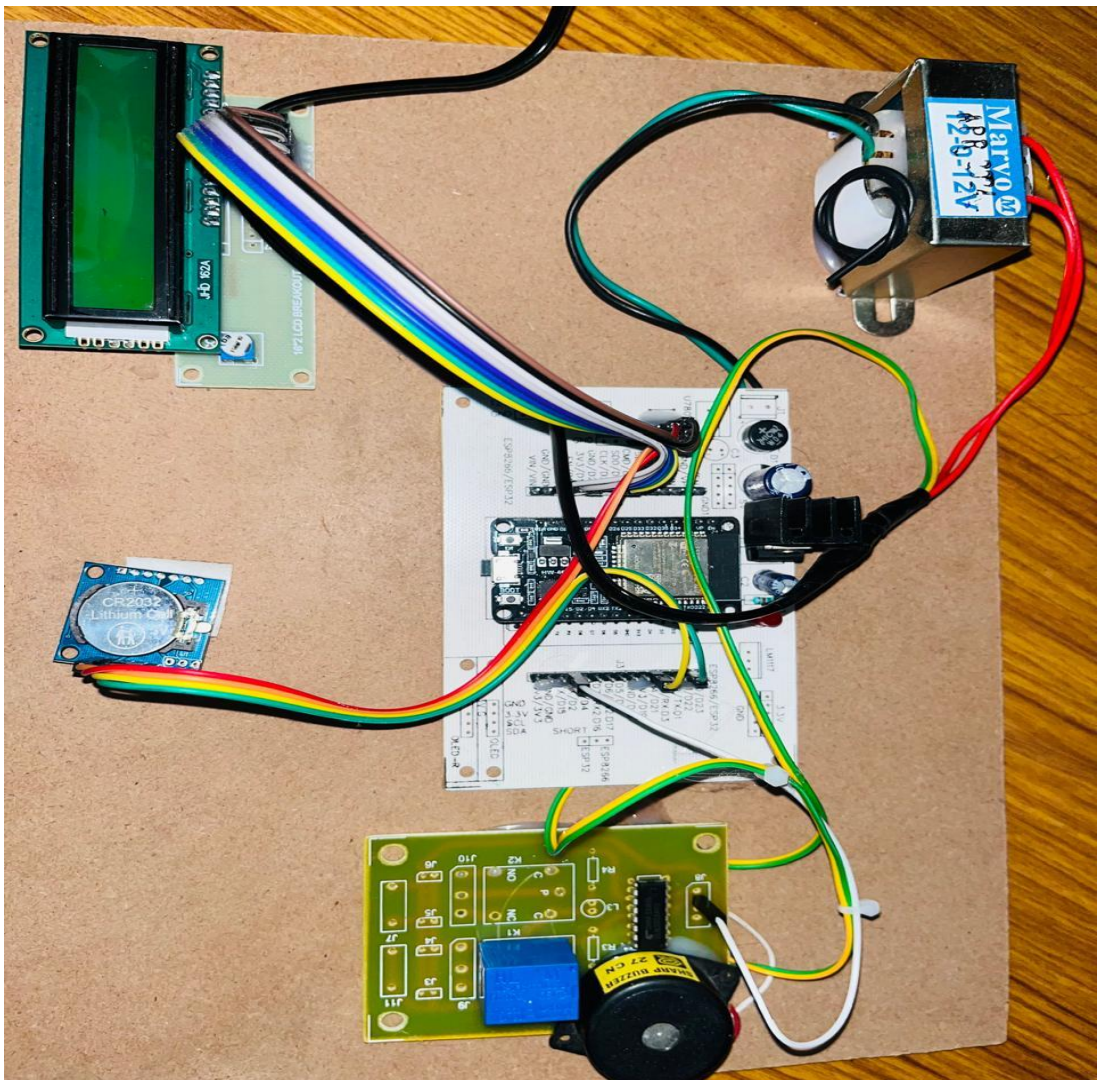


***Fig 10**-Hardware kit*

VI.RESULT

A college automated bell system using an ESP32 microcontroller automatically rings bells according to a predefined schedule. The ESP32 controls a relay that activates the bell at the scheduled times. It can be programmed or updated via Wi-Fi, with the option to synchronize time using RTC for accuracy. The system can also be manually overridden and expanded to control multiple bells or integrate additional sensors. This setup enhances efficiency by automating the bell-ringing process.

Simplified Scheduling: The ESP32-based college automated bell system simplifies the process of managing school schedules by automating bell ringing according to a set timetable. This reduces the need for manual intervention and ensures that the schedule is consistently followed.

Accurate Timing: The system provides precise and consistent bell ringing by utilizing the ESP32's internal clock or synchronizing with internet time servers via NTP. This ensures that the bells ring exactly on time, enhancing punctuality throughout the institution.

VII.CONCLUSION

In conclusion, the college automated bell system using an ESP32 microcontroller offers a reliable and efficient solution for automating bell schedules. By leveraging the ESP32's capabilities, the system ensures precise time management and ease of configuration through a web interface or mobile app. The integration of a relay module for bell control and the ability to expand the system for multiple bells or additional features make it highly adaptable to various institutional needs. This project reduces manual intervention, improves time management, and contributes to a more organized and timelier environment in the college.

Cost-Effective and Scalable: The automated bell system built with the ESP32 microcontroller is a cost- effective solution that can be easily scaled to meet the needs of any educational institution. Its flexibility and ease of programming make it suitable for both small and large campuses, providing a consistent and accurate way to manage daily schedules.

Enhanced Operational Efficiency: Implementing an automated bell system significantly enhances the operational efficiency of a college. By automating the bell-ringing process, the system reduces the burden on staff and ensures that classes and breaks begin and end precisely on time, promoting better time management and discipline.

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