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Automated Bell and LED Display System

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Abstract:- Traditional school bell systems and manual scheduling methods often lead to inefficiencies, inaccuracies, and confusion, resulting in operational delays and unclear communication regarding class timings. To address these issues, this project introduces an automated school bell system with a digital display that provides real-time updates on current periods, upcoming classes, and accurate time. Our system utilizes an Arduino microcontroller to automate the ringing of classroom bells based on a pre-set schedule. The bell timing can be easily programmed and adjusted through a user interface, ensuring precise synchronization with the academic timetable. Additionally, an integrated LED display provides real-time visual cues, indicating the current period and upcoming period. This feature helps to minimize confusion and ensure that both students and faculty are consistently informed of schedule changes. This will enable easy management and scheduling updates, reducing the likelihood of errors and improving overall operational efficiency. By streamlining scheduling and enhancing communication clarity, this solution aims to create a more organized and efficient school environment.

Keywords:- *Arduino Uno, Embedded Systems, IoT, Atmega328p, ESP8266 NodeMCU.*

I. INTRODUCTION

In contemporary educational settings, managing classroom schedules and ensuring timely transitions between periods often relies on traditional bell systems. Whether manual or electric, these systems require human intervention to signal the end of a class, which can lead to potential oversights or inaccuracies. Such reliance on manual or semi-automated systems can introduce problems, including delays in signaling, lack of synchronization, and resultant confusion among students and faculty.

The challenge lies in creating a reliable mechanism that ensures accurate and timely notifications without depending on human intervention. To address these issues, our project aims to develop an automated system integrating both a bell mechanism and a display system. The bell will signal the transition between periods automatically, while the display will provide real-time updates on the current period, next period, and current time. This system is designed to reduce confusion, especially in the absence of a teacher, and to enhance overall schedule management by providing clear and accurate information.

II. LITERATURE SURVEY

In this section we discuss about the existing works in the field being carried out from the recent years.

- *Rizka Anggia Dinda:*

The focuses on the implementation of an automatic school bell system as a step toward modernizing educational infrastructure in alignment with the needs of the Industrial 4.0 revolution. The study highlights the importance of upgrading traditional school facilities to support the efficiency of teaching and learning processes. Using the System Development Life Cycle (SDLC) methodology, the research develops an Arduino-based automatic school bell, which enhances the accuracy and convenience of notifying school schedules compared to manual systems. The system's sound output ensures timely adherence to schedules, with performance metrics showing voltage and current ranges between 4.17 to 5.90 volts and 488 to 602 mA, respectively, and power consumption between 2.07 to 3.38 Watts. These findings suggest that the system not only ensures punctual transitions between classes and breaks but also optimizes electricity usage.

This paper provides a valuable reference for integrating automated solutions into traditional school environments to improve operational efficiency.

- *Suman Poudyal:*

This paper presents the development of an advanced wireless notice board system aimed at improving the efficiency of displaying information on a dot matrix display using a Wi-Fi module and mobile phone. The literature highlights the challenges associated with the manual process of sending and monitoring notices daily, emphasizing the

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need for a more efficient and flexible approach. By transmitting notices wirelessly, the proposed system offers a significant improvement over traditional methods. The scrolling display system is particularly suitable for educational institutions, such as schools and colleges, to continuously provide updates but is versatile enough for use in public spaces like hospitals, railway stations, hotels, and malls. The system architecture includes a receiver and display toolkit, where messages are received through a serial port and then converted for display on the dot matrix. This study contributes to the growing body of research on automating communication systems through wireless technologies, offering a practical solution to simplify notice dissemination.

- *Syed Naveed Uddin:*

This paper introduces a cost-effective design for an automatic school/college bell system, developed to meet the need for precise timekeeping and eliminate the challenges of manual operation. The literature survey highlights existing systems' limitations in accuracy and operational efficiency, addressing these concerns with a design that utilizes a Real-Time Clock (DS1307) to ensure precise bell ringing at the start of each period. The system is controlled by an ATmega2560 microcontroller, which operates the bell via a relay for a predefined duration. Flexibility in operation is enhanced through the ability to edit ringing schedules, including during exam periods. Additionally, the system includes password protection to prevent unauthorized access, ensuring security and reliability. The microcontroller is programmed in C or assembly language, which enables the system to store and manage schedules efficiently. This paper adds to the body of research on automated school systems, offering a practical solution that combines accuracy, security, and operational ease.

- *Nalini:*

This paper discusses the implementation of an IoT-based bell ringing system aimed at automating and synchronizing bell operations across multiple blocks of a college. The literature highlights the need for improved synchronization and flexibility in traditional bell systems, particularly in educational settings. The system is composed of four key components: an IC Real-Time Clock (RTC), an Arduino Uno Board, 16x2 LCD modules, and an input provision for adjusting bell timings, particularly during exams. The Arduino reads the current time from the RTC and displays it on the LCD while controlling an electric bell that rings every 50 minutes, continuing for 10 seconds as per the college schedule. The integration of IoT technology ensures that bell ringing is synchronized across all college blocks, providing simultaneous notifications to both students and faculty about session completions. This study contributes to the advancement of IoT-based systems in educational institutions by improving operational efficiency and accuracy in time-based notifications.

- *Joseph Habiyaremye:*

This paper presents a LabVIEW-based school bell control system, designed to provide head teachers with the flexibility to manage bell ringing either automatically or manually. The literature survey explores the limitations of traditional bell systems and highlights the benefits of integrating programmable solutions for enhanced control and customization. In this system, bell timings and durations are predefined according to the school's type and organizational needs, with settings configured in LabVIEW's block diagram. The user interface allows the head teacher to input the current time, manually trigger the bell, monitor the ongoing teaching period, and check the bell's status. LabVIEW generates control signals at specified time slots, which are transmitted via an Arduino microcontroller to a Zigbee transceiver. This transceiver communicates with a remote Zigbee unit connected to an AC bell, controlled through a MOSFET and relay. The ringing duration of the bell is set within the LabVIEW environment, ensuring accurate and flexible bell management. This study contributes to the development of automated school systems by leveraging LabVIEW's programming capabilities for efficient time management and control.

- *Zhiyoung Zou:*

This paper introduces a wireless bell control system designed to overcome the challenges of installation and wiring in traditional bell systems. The literature review emphasizes the need for wireless solutions in environments where extensive wiring is impractical. The system is centered around the AT89S52 microcontroller and employs a 315MHz wireless transmission chip, enabling long-range communication without the need for complex wiring. The hardware design consists of several key components, including a power circuit, microcontroller minimum system circuit, keyboard circuit, wireless transmission circuit, LCD display circuit, real-time clock circuit, EEPROM memory circuit, and a ringing drive circuit. The software aspect incorporates programs for controlling the microcontroller, managing the real-time clock, reading and writing to EEPROM memory, and displaying information on the LCD. Testing results show that the real-time clock operates with high accuracy, and the wireless communication range extends up to 1.2 km, making it suitable for large-scale deployments. This study contributes to the growing field of wireless automation systems, offering a cost-effective and efficient solution for school and college bell management.

- *Burgoji Santhosh Kumar:*

This paper describes the development of an Arduino-based bell system aimed at automating the notification process in educational institutions. The literature highlights the growing need for automated bell systems to ensure timely and accurate session management. The system utilizes three primary components: the IC RTC DS1307 for real-time tracking, an Arduino Uno Board for control, and 16x2 LCD modules for displaying time-related information. The DS1307 communicates time and date data to the Arduino via two lines, which is then displayed on the LCD. The system includes a buzzer that rings every 50 minutes according to the college schedule, with each bell lasting for 50 seconds. Additionally, a voice module is integrated to announce the session completion, offering an audio notification for both students and faculty. This combination of visual and auditory alerts ensures effective communication of session transitions. This research provides a useful reference for developing automated

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bell systems with real-time tracking and user-friendly notifications in academic environments.

- *Sanaha Patan:*

This paper discusses the implementation of an automatic scheduling system using Programmable Logic Control (PLC) to manage time and break periods, addressing the limitations of manual intervention in traditional systems. The literature highlights the advantages of PLC systems in ensuring precision and reliability, particularly in environments where multiple periods and breaks need to be managed efficiently. The system is designed to automatically ring a siren at the start and end of each period, eliminating the need for human involvement and maintaining high accuracy. The PLC 14SSR is responsible for controlling all system functions, while an HMI DOP103BQ provides an intuitive interface for user interaction. The system's schedule is continually compared with a clock to ensure alignment and precision, making it suitable for both educational and industrial settings. This research contributes to the field by offering a reliable, automated solution that enhances time management across various applications, reducing errors and increasing operational efficiency.

III. PROPOSED METHODOLOGY

An automated bell and display system integrates an Arduino Uno, a Wi-Fi module, and a central server to manage the ringing of the bell and display relevant information on a P10 LED display. This innovative system significantly enhances communication and scheduling efficiency within educational institutions by ensuring timely notifications and visual updates for students and faculty alike. The seamless integration of technology into everyday school operations not only simplifies the management of schedules but also fosters a more organized and responsive educational environment.

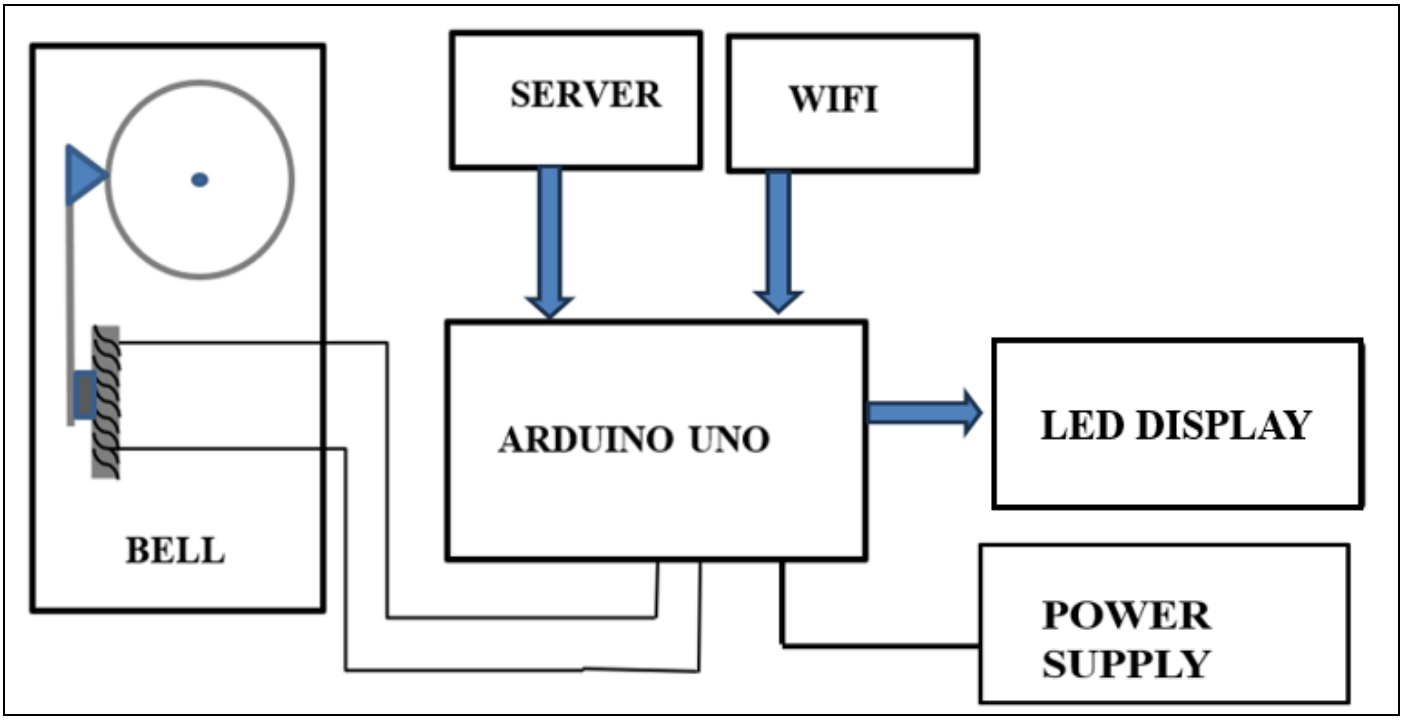

Fig 1 Block Diagram of the Automated bell and display system

The project consists of two primary units, each serving a crucial role in the system's functionality. The first is the control unit, which employs the Arduino Uno as the central processing unit responsible for executing all system functions. The Arduino is connected to the ESP32 Wi-Fi module, which facilitates the connection to a central server. This setup allows the Arduino to obtain real-time updates and synchronize the system time with the actual time. The precise synchronization ensures that the bell rings at designated times for each class period or break. By automating the ringing of the bell, the system eliminates the need for manual intervention, significantly enhancing the overall efficiency of classroom transitions.

The ESP32 module serves as the critical link between the system's time and the real-time clock, allowing the Arduino to access accurate timing information. This capability is essential for ensuring that the bell operates on a precise schedule, ringing exactly when needed. The synchronization between the system time and the actual time is displayed on the P10 LED display, which serves as a dynamic visual interface within the school. This display shows crucial information, including the current time, ongoing class periods, and upcoming sessions, thereby minimizing confusion during transitions.

Complementing these components is the bell mechanism**,** which is directly connected to the Arduino. The electric bell rings according to the schedule obtained from the microcontroller, ensuring that it activates for a predetermined duration to signal the start or end of class periods.

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IV. RESULTS

The implementation of the automated classroom bell and LED display system yielded significant advancements in classroom management, enhancing both efficiency and functionality. The system, designed to provide timely notifications and visual cues, proved effective in integrating auditory and visual components, ultimately leading to a more organized educational environment.

Fig 2 Results with LED Displaying the current Time and Period

- *Automated Electric Bell System*

Automated Electric Bell System: The electric bell system was successfully implemented, operating seamlessly based on predefined time intervals programmed into the microcontroller. Through a well-defined algorithm, the bell rings at the specified times without the need for manual intervention, effectively eliminating the challenges associated with traditional bell systems. The reliability of the system was validated through rigorous testing, confirming that it consistently adhered to the established schedule. As a result, teachers and students experienced improved transitions between periods, reducing disruptions and enhancing the overall learning atmosphere.

- *Display System Integration*

The integration of the P10 LED matrix display with the automated bell system significantly improved the communication of schedule-related information within the classroom. The display system accurately presents real-time data, including the current class period, the upcoming period, and the current time. This integration has been successfully programmed with the timetable for the 7th semester, demonstrating precise schedule management. The LED display not only enhances visibility for students and faculty but also aids in reducing confusion during class changes. Feedback from users indicated a notable increase in awareness of session timings, further promoting punctuality and effective classroom management.

The automated classroom bell and LED display system has successfully met its objectives of improving efficiency and operational accuracy in educational settings. By automating the bell ringing process and providing real-time updates through the LED display, the system enhances both the auditory and visual communication of time notifications, contributing to a more effective learning environment. The results of this project indicate a positive impact on classroom management, and future iterations may explore further enhancements, including mobile app integration for remote notifications and additional customization features to meet diverse educational needs.

V. CONCLUSION

The automated classroom bell and LED display system represents a significant advancement in classroom management technology, combining both auditory and visual notification mechanisms to enhance operational efficiency. The system is designed around an Arduino platform, which serves as the central controller for managing the timings of the electric bell and the LED display. This integration allows for automated notifications at predetermined intervals, effectively reducing the reliance on manual operation and ensuring timely transitions between class periods.

The electric bell operates according to a specified algorithm programmed into the microcontroller, ensuring that it rings accurately at designated times. This feature not only streamlines the classroom environment but also promotes punctuality among students and faculty. The incorporation of a P10 LED matrix display further enriches the system by providing real-time updates on the current class period, the upcoming period, and the exact time. This dual approach of auditory and visual cues enhances user experience, as both students and instructors are continuously informed about the schedule.

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Overall, the automatic classroom bell and LED display system offers a robust and efficient solution for managing classroom transitions, fostering a more organized learning environment. Its successful implementation underscores the importance of automated systems in modern education, paving the way for further advancements in educational technology.

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