International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Automatic Configurable Classroom Timer

Darpan S. Ghanekar, Puru D. Jathar, Chaitanya V. Chavan,
Department of Electronics and Telecommunication Engineering
Finolex Academy of Management and Technology, Ratnagiri, Maharashtra, India
Prof.A.R.Sutar
Professor, Department of Electronics and Telecommunication Engineering
Finolex Academy of Management and Technology, Ratnagiri,
Maharashtra, India

Abstract – The Automatic configurable Classroom Timer is an IoT-based system developed to streamline time management within educational institutions by automating the bell-ringing process for class schedules. Traditionally, schools rely on manual bell systems, which are prone to inconsistencies, delays, and human error. This system reduces such issues by leveraging microcontrollers and wireless communication. The primary components include an ESP32 microcontroller with built-in Wi-Fi and Bluetooth, which acts as the master controller, and an Arduino Nano, functioning as the receiver. The system uses a Real-Time Clock (RTC) module to track time, and a buzzer and LCD display to notify users of schedule changes through audio and visual alerts. A mobile app is used for schedule configuration, enabling administrators to modify bell times remotely. Overall, the system offers a reliable, low-cost, and scalable solution for modern smart classrooms.

Keywords: *ESP32, Arduino nano, Mobile Application, , ESP32, Time Management, Buzzer Notification*

I. INTRODUCTION

In educational institutions, maintaining discipline and ensuring timely transitions between classroom sessions are essential for productive learning. However, in many schools and colleges, the process of signaling class changes is still handled through manual or semi-automated bell systems. These systems often lack flexibility, are prone to human error, and require continuous oversight from faculty or administrative staff. In larger institutions or those with complex timetables, these issues can lead to confusion, delays, and overall inefficiency.

With the advancement of Internet of Things (IoT) technologies, there is a growing opportunity to modernize routine administrative tasks such as classroom scheduling. The Automatic configurable Classroom Timer project aims to address these challenges by providing a fully automated, smart bell system that eliminates the need for manual operation and ensures consistent timekeeping throughout the academic day.

At the heart of the system is an ESP32 microcontroller, which manages the schedule using a high-precision DS3231 Real-Time Clock (RTC) module. A Bluetooth-enabled mobile application

allows users to easily input and modify bell schedules, offering a user-friendly interface for non-technical staff. When the current time matches a programmed event, the system wirelessly triggers a buzzer via an HC-12 transceiver and provides real-time status updates through LCD displays on both transmitter and receiver ends.

This project not only reduces the administrative burden on staff but also increases the reliability and accuracy of school bell systems. It provides a scalable and cost-effective solution for modernizing time management in educational settings. By integrating embedded systems with wireless communication and remote scheduling, the Automatic configurable Classroom Timer exemplifies how IoT can be used to enhance traditional processes and improve overall operational efficiency.

1. *Objective: The objective of this project is to design an IoT-based Automatic configurable Classroom Timer that automates bell ringing through accurate time management and remote scheduling, aiming to improve efficiency and reduce manual intervention in educational institutions.*
2. *Function: The Automatic configurable Classroom Timer continuously monitors real-time clock data and, based on pre-set schedules received via a mobile app, triggers a buzzer and displays updates on an LCD screen to signal the start and end of classroom sessions without manual input.*
3. *Technology: The project leverages an ESP32 microcontroller for processing and Bluetooth communication, a DS3231 Real-Time Clock (RTC) module for precise timekeeping, and an HC-12 wireless transceiver for transmitting signals. It also integrates an Arduino Nano, LCD displays, and buzzers to provide real-time audio-visual alerts based on user-configured schedules through a mobile application.*
4. *Processes: The system begins by setting bell schedules through a mobile application connected to the ESP32 via Bluetooth. The ESP32 continuously monitors the time using the RTC module. When the current time matches a scheduled event, it sends a wireless signal through the HC-12 transceiver to the Arduino Nano, which then activates a buzzer and updates the LCD display to notify the class of session changes.*
5. *Implementation: The system uses an ESP32 to manage schedules via a mobile app and RTC module. When the set time matches, it sends a wireless signal to an Arduino Nano, which triggers a buzzer and updates an LCD display, automating the bell ringing process efficiently.*

II. LITERATURE SURVEY

Paper1: The paper presents on project involves designing and implementing a microcontroller-based lowcost automatic college bell ringing system. Utilizing a microcontroller, the system automates bell schedules, ensuring timely signaling for class changes. This cost-effective solution enhances efficiency and reduces manual intervention. The microcontroller coordinates with a real-time clock, allowing for customizable programming of bell timings. The system's affordability makes it accessible for educational institutions seeking an automated timekeeping solution. Overall, this project combines technology and practicality to streamline daily operations in a college environment through an automated bell ringing system.[1]

Paper 2: This paper presents a study on online exams with timers and performance analysis are becoming increasingly popular in educational and professional settings. These exams are typically administered through digital platforms or learning management systems, allowing students or participants to complete assessments from the convenience of their own devices. The inclusion of timers adds an element of time management, encouraging test-takers to allocate their time wisely. Performance analysis features provide valuable insights into individual and group performance, including areas where participants excel and areas that may require improvement. This data can be used to tailor instruction or training more effectively. Overall, online exams with timers and performance analysis enhance the assessment process, making it more efficient and informative for both educators and learners [2]

Paper 3: This paper presents on a Smart Programmable Timer. This is a versatile device that automates scheduling for various electrical appliances. It typically integrates with smartphones or other smart devices, allowing users to set customized on/off schedules remotely. These timers often employ IoT technology for connectivity, enabling users to control their devices from anywhere. The programmability feature enhances energy efficiency and convenience, making it an ideal solution for home automation. The project involves microcontroller programming, sensor integration, and app development for a seamless user

experience. Components may include microcontrollers like Arduino or Raspberry Pi, relays, and connectivity modules like Wi-Fi or Bluetooth.[3]

Paper 4: This paper presents on Solar Powered College Bell project utilizes a microcontroller to efficiently manage and automate bell ringing in educational institutions. Harnessing solar energy ensures sustainability and reduces dependency on conventional power sources. The microcontroller coordinates with a real-time clock for precise scheduling, optimizing energy usage. This ecofriendly solution not only streamlines daily schedules but also promotes environmental consciousness. The system's modular design allows for easy integration and scalability, making it a cost-effective and innovative choice for educational institutions seeking energy-efficient solutions.[4]

Paper 5: This paper presents an embedded automatic scheduling system. This is a sophisticated project that streamlines task management by autonomously organizing and optimizing schedules. Leveraging embedded systems, it efficiently allocates resources, considers task dependencies, and adapts to dynamic changes. This project integrates with diverse environments, enhancing productivity by automating scheduling complexities. With real-time updates and user-friendly interfaces, it ensures seamless coordination and resource utilization. The system caters to various industries, from manufacturing to project management, offering a robust solution for time-sensitive operations.[5]

Paper 6: This paper presents a study on Automatic College Bell System. This project successfully addressed the challenges associated with manual bell systems in educational institutions. By embracing automation, precision timing, and user-friendly controls, the system has significantly contributed to the overall efficiency and organization of the college environment. As a result, this project stands as a testament to the practical application of technology in streamlining routine tasks and fostering a conducive atmosphere for both students and staff. [6]

Paper 7: This paper present on Department Announcement System using Arduino is a project designed to streamline communication within a department. Employing Arduino microcontrollers, it integrates sensors and a display system to broadcast announcements. The system can be programmed to relay important information, meeting schedules, or emergency alerts. Users can update content remotely, enhancing flexibility. The Arduino's versatility allows for easy customization, and the project fosters efficient internal communication within a department, reducing reliance on traditional methods. This innovation showcases the intersection of technology and organizational communication, offering a practical and adaptable solution for modern workplaces.[7]

III. PROPOSED SYSTEM

3.1 Methodology

The Automatic configurable Classroom Timer system is designed to address the inefficiencies of traditional bell systems by integrating hardware and software components into a seamless, automated solution. The methodology behind the system revolves around the central coordination of time, user input, and remote communication—all handled efficiently through IoT-based technologies.

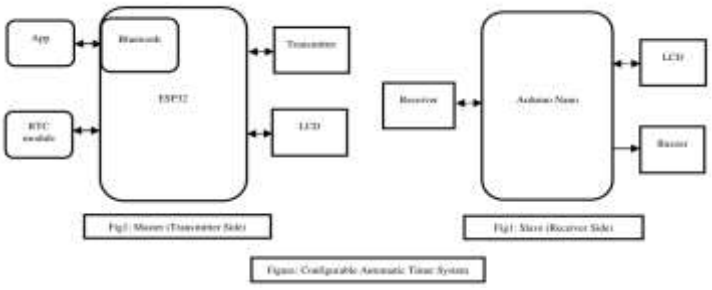

Figure 1: Block Diagram

3.2 Details of Hardware and Software

a) Hardware Components

ESP 32: The ESP32 is a low-cost microcontroller with dual-core 32-bit processors up to 240 MHz, 520 KB RAM, and built-in Wi-Fi (2.4 GHz) and Bluetooth (Classic + BLE). It supports multiple interfaces like UART, SPI, I2C, and has up to 34 GPIOs with ADC, DAC, PWM, and touch input. Running at 3.3V, it features deep-sleep modes for low power and can be programmed with ESP-IDF or Arduino IDE.

Arduino Nano: The Arduino Nano is a small, compact microcontroller board based on the ATmega328P chip. It runs at 16 MHz, has 32 KB of flash memory, 2 KB of SRAM, and 1 KB of EEPROM. It offers 14 digital I/O pins (6 capable of PWM output) and 8 analog input pins. The board operates at 5V (can accept 7–12V input), and communicates using UART, SPI, and I2C protocols. It is typically programmed using the Arduino IDE and is ideal for breadboard-based projects due to its small size and USB Mini-B interface for uploading code.

Buzzer: A buzzer is a small sound-producing device that converts electrical signals into sound, often used for alarms, timers, or notifications. It operates typically on 5V or 12V, and comes in two types: active buzzers (which produce sound when powered) and passive buzzers (which need a signal or frequency to produce sound). Buzzers are easy to control using microcontrollers like Arduino with simple HIGH/LOW digital signals.

LCD Display: An LCD display (Liquid Crystal Display) is a flat-panel screen that uses liquid crystals to display characters, numbers, or graphics. A common type in electronics projects is the 16x2 LCD, which shows 16 characters per line on 2 lines. It operates typically at 5V, uses a parallel interface (like 4-bit or 8-bit modes), and communicates with microcontrollers through pins like RS, RW, E, and data pins (D0–D7). It can also be easily controlled using an I2C module to reduce wiring.

HC-12: The HC-12 is a long-range wireless serial communication module that operates in the 433 MHz band. It supports a range of up to 1 km (in open space) and works with UART (serial communication) at adjustable baud rates. It operates at 3.2V to 5.5V, with low power consumption, and allows changing settings like channel, baud rate, and transmission power using AT commands. The HC-12 is commonly used for remote data transmission between microcontrollers like Arduino.

b) Software Components

Arduino IDE: The Arduino IDE (Integrated Development Environment) is a software platform used to write, compile, and upload code to Arduino boards and compatible microcontrollers like the Node MCU ESP8266. It supports programming in C/C++ and provides a simple interface with features like a code editor, serial monitor, and library manager. The IDE includes built-in libraries for sensors, displays, and Wi-Fi modules, making it easy to develop IoT projects. It is open-source, lightweight, and widely used for prototyping and educational purposes.

3.3 Design Details

1. **Input:**

- **Mobile Application (User Input):** A mobile application was developed to interact with the ESP32, allowing users to easily send data such as the timetable, time settings, and other control commands wirelessly. The application connects to the ESP32 using Wi-Fi or Bluetooth, providing a user-friendly interface to update and manage information remotely. This setup ensures flexibility and convenience.

2. Processing:

• **ESP32:** In this system, the ESP32 acts as the master controller, receiving signals from the mobile application through wireless communication (Wi-Fi or Bluetooth). Once the ESP32 receives the data, it transfers the signal to the Arduino Nano via serial communication. The Arduino Nano processes the received information and accordingly controls the LCD display to show the timetable or time updates. Additionally, the buzzer is activated when needed, based on the processed signals, to provide audio alerts or notifications.

3. Output:

• **LCD Display:** The system's output consists of the LCD display and the buzzer. After processing the data received from the mobile application, the Arduino Nano displays the timetable or time updates on the LCD.

• **Buzzer**: The buzzer is triggered when a lecture ends, providing an audio alert to notify users. This ensures timely notifications for lecture transitions, enhancing the overall user experience with both visual and auditory feedback..

IV. EXPERIMENTAL RESULTS

Input: Mobile Application

Output: On Hardware

CONCLUSION

In conclusion, the Automatic Configurable Classroom Timer project effectively utilizes the ESP32 as the master and the Arduino Nano as the slave to manage the classroom schedule. The ESP32 receives configuration data from the mobile application, allowing users to set the timetable and other parameters wirelessly. The Arduino Nano processes this information and controls the LCD display to show the time and schedule, while the buzzer signals the end of each lecture. This project showcases the potential of combining wireless communication and microcontroller systems to create a flexible, automated solution for classroom time management, providing real-time updates and alerts for improved efficiency in an educational setting.

REFERENCES

[1]. Sruthi.P C Periasamy, V.Krishnapriya, Nirmin Raheem V, "Design and Implementation of Microcontroller Based Low Cost Automatic College Bell Ringing System", International Research Journal of Modernization in Engineering Technology and Science March-2023.

[2]. B. Sathyabam. N.Senbagapriya, "Online Exam With Timer and Performance Analysis, "International Journal of Creative Research Thoughts (IJCRT), December 2021..

[3]. Santosh Laxman Kulang Dr.Mrs.P.Malathi, "Smart Programmable Timer", International Journal of Electrical and Electronics Research, June-2014.

.

[4]. Ramesh Harajibhai Chaudhari1 Bhagyalaxmi R. Rajgor1V.M. Modi1Vinay Patel1, Dhaval Chaudhari1 and Alok Gora2, "Design and Development of Microcontroller based Solar Powered College Bell", International Journal of Current Microbiology and Applied Sciences ISSN: 2319- 7706 Volume 8 Number 04 (2019).

[5]. Damir Bilic, "Embedded automatic scheduling system", Conference: 2016 XI International Symposium on Telecommunications – BIHTEL, October-2016

[6]. Shennu Choudhary,"Automatic College bell System,"International Journal of scientific research and management (IJSRM), 2014

[7]. H Venkatesh Kumar, “Department Announcement System Using Arduino”, International Journal of Scientific Research in Science and Technology, May 2021