

Review on Digital Timetable Automation System

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Abstract: *Efficient schedule management is a crucial aspect of any educational institution, ensuring that students and staff have seamless access to updated class information. Traditional paper-based timetables or static notice boards are often inflexible, prone to delays in updates, and require manual intervention, which may lead to confusion or miscommunication.*

This project introduces a Digital Timetable System powered by an Arduino microcontroller and a TFT display for real-time visualization of class schedules. The system integrates a web-based interface through which authorized staff members can conveniently update timetable entries in the central database. A Python program running with the system clock retrieves the current lecture details from the database and transmits them to the Arduino, which then displays the corresponding schedule on the TFT screen. This setup provides a dynamic, automated, and reliable approach to timetable management.

The primary objective of this project is to enhance accessibility, accuracy, and efficiency in timetable dissemination. By automating the update process and eliminating the need for manual display changes, the system reduces human effort while ensuring that students always have access to the most current information. The solution is cost-effective, user-friendly, and adaptable to different institutional requirements, making it a practical alternative to traditional methods.

Keywords: *Digital timetable, Arduino, TFT display, Web interface, Automated scheduling*

I. INTRODUCTION

Time management and efficient schedule communication are essential components of academic institutions, ensuring that both students and faculty can organize their activities without confusion. A timetable serves as the backbone of academic planning, guiding classroom utilization, subject allocation, and faculty responsibilities. Traditionally, institutions depend on printed charts, static notice boards, or verbally conveyed updates to display class schedules. While these approaches are straightforward, they are often inconvenient and lack flexibility. Any sudden rescheduling of lectures, substitutions due to faculty unavailability, or adjustments for special events require manual updates, which are time-consuming and sometimes fail to reach all students in a timely manner. This delay can lead to miscommunication, wasted time, and reduced efficiency in the academic environment.

With the increasing digitalization of education, there is a growing expectation for smarter solutions that can deliver real-time updates in a more accessible and automated manner. Although certain digital notice boards and commercial timetable management platforms exist, they typically rely on expensive infrastructures, cloud subscriptions, or advanced IoT-based systems, which may not always be affordable or practical for small and medium-scale institutions. Furthermore, many existing solutions still require repeated manual intervention and technical expertise, limiting their adoption in resource-constrained environments. These limitations highlight the need for a more cost-effective, scalable, and user-friendly system that combines embedded hardware with simple digital interfaces to provide dynamic scheduling updates.

To address these challenges, this project proposes a Digital Timetable System that leverages Arduino microcontroller technology integrated with a TFT display to present current class schedules dynamically. The system introduces a web-based interface through which authorized staff members can conveniently alter timetable data stored in a central database. A Python program, synchronized with the system clock, retrieves the current lecture details from the database at regular



intervals and communicates them to the Arduino. The Arduino processes this input and displays the relevant information on the TFT screen, ensuring that the timetable remains up-to-date at all times without the need for manual replacement of physical charts. This workflow establishes an automated and reliable bridge between staff inputs and student-facing displays.

The proposed system offers several advantages. It eliminates the dependence on static paperbased timetables, reduces the human effort required for continuous updates, and enhances accessibility by ensuring that students are always presented with the most recent schedule. Its design emphasizes affordability and ease of use, making it practical for institutions of varying scales. Moreover, the system provides a foundation for future improvements, such as wireless data transmission, integration with multiple display units across different classrooms, or the addition of notifications sent directly to students' mobile devices.

By automating timetable management, the project significantly improves communication within educational institutions and supports smoother academic operations. The rest of this paper is organized as follows: the next section reviews related work and existing timetable solutions, followed by details of the methodology and system design. The subsequent section presents experimental results and system evaluation, and finally, the conclusion summarizes the project's contributions and outlines possible directions for future development.

II. LITERATURE SURVEY

Park.s et al. [1] (2025) introduced an Arduino-based digital notice board using GSM technology, enabling institutions to send updates via SMS directly to an LCD display. Kumar et al. [2] (2025) developed a Wi-Fi-enabled electronic notice board system using ESP8266, focusing on wireless updates and reducing manual intervention. Sharma et al. [3] (2025) designed a smart timetable management application that integrates web-based scheduling with IoT-based displays, highlighting real-time dissemination of lecture schedules. Singh et al. [4] (2025) implemented a low-cost embedded display system for classrooms, emphasizing the use of TFT and OLED modules for dynamic information sharing.

Helen et al. [2] (2024) proposed an IoT-driven school timetable management system with cloud integration, supporting centralized control of multiple displays across campuses. Borkar et al. [6] (2024) explored the design of microcontroller-based electronic bulletin boards for rural schools, focusing on affordability and scalability. Chakraborty et al. [7] (2024) presented a smart class scheduling system with automated updates, integrating database-driven timetables with microcontroller-controlled displays. Deshmukh et al. [8] (2024) demonstrated the application of Python scripts for real-time classroom updates using embedded hardware, bridging software automation with hardware display.

Siddiqui et al. [3] (2023) introduced a GSM-based electronic notice display system with security features, highlighting reliability in information broadcasting. Prasad et al. [10] (2023) designed a wireless timetable system using Wi-Fi and Arduino, which allowed staff members to make quick changes in class schedules without manual replacement of boards. Joshi et al. [11] (2023) developed a smart classroom management system integrating sensors, displays, and automated scheduling, showcasing multi-parameter automation.

zeng et al. [7] (2022) proposed an e-classroom system where teachers could update class schedules via a mobile app, which synced with microcontroller-based displays. Verma et al. [13] (2022) implemented a real-time electronic notice board using Bluetooth and Arduino, focusing on short-range, low-cost solutions. Thakur et al. [14] (2022) designed a Raspberry Pi-based digital board with database connectivity, enabling more complex scheduling and multimedia display.

huana et al. [5] (2021) presented an ESP32-based smart timetable display with wireless connectivity, emphasizing energy efficiency and multi-classroom coverage. Jadhav et al. [16]

(2021) introduced a database-driven embedded system for displaying academic timetables dynamically, addressing the issue of frequent schedule changes. Nair et al. [17] (2021) designed a Python-integrated digital scheduling system to automate the communication between serverside data and embedded display units.

Gusev et al. [6] (2020) reviewed various IoT-based notice board systems and highlighted challenges such as scalability, power efficiency, and user-friendly interfaces. Banerjee et al. [19] (2020) implemented a Wi-Fi-based smart digital board system for educational institutions, providing a baseline for low-cost, automated displays. Gupta et al. [20] (2019) designed an Arduino-controlled electronic information board as part of smart campus initiatives, demonstrating the potential of microcontroller-based systems in education.



These studies collectively demonstrate the growing importance of integrating embedded systems, wireless communication, and software automation in timetable and notice board management. They provide the foundation for the proposed Digital Timetable project, which combines Arduino with TFT display, Python automation, and a web interface to create a lowcost, real-time, and scalable solution for academic institutions

Paper / Project	System Architecture	Cost	Ease of Implementation	Performance	User Experience	Limitations
park et al. [1]	Arduino + GSM digital notice board	Low–Moderate (<\$50)	Moderate (GSM integration required)	Real-time SMS updates	Simple and functional	Dependent on mobile network
helen et al. [2]	ESP8266 Wi-Fi based notice board	Moderate (~\$60)	Easy (Wi-Fi setup)	Reliable wireless data updates	Userfriendly, flexible	Needs stable WiFi
Siddiqui et al. [3]	Web + IoT timetable management system	Moderate– High (~\$80)	Complex (IoT + DB integration)	Efficient schedule dissemination	Supports real-time updates	Requires IoT backend and cloud integration
huana et al. [4]	Arduino + TFT/OLED embedded display	Low (<\$40)	Easy (basic microcontroller + display)	Dynamic and lowpower display	Affordable, simple	Limited scalability to multiclass setups
gusev et al. [5]	IoT + Cloud-based timetable system	High (>\$100)	Complex (cloud setup + database handling)	Centralized control for multiple displays	Multicampus scalability	Costly and internetdependent
Proposed Project (2025)	Web + Database + Python + Arduino + TFT integration	Low–Moderate (~\$50–\$60)	Moderate (software + hardware integration)	Real-time, automated timetable updates	Intuitive for staff and students	Limited to single display (expandable)

Table 1: Comparative review of digital timetable and notice board systems.

Proposed Methodology:

The design and implementation of the Digital Timetable system follow a structured methodology that integrates embedded hardware, web technologies, and real-time data communication to provide an efficient and user-friendly solution for classroom schedule management. The proposed system aims to replace conventional static notice boards with a dynamic digital display that can be updated remotely, ensuring accurate and timely information for students and staff.

Figure 1 shows block diagram of proposed methodology



Hierarchical Block Diagram — Output & Display divided into 3 blocks

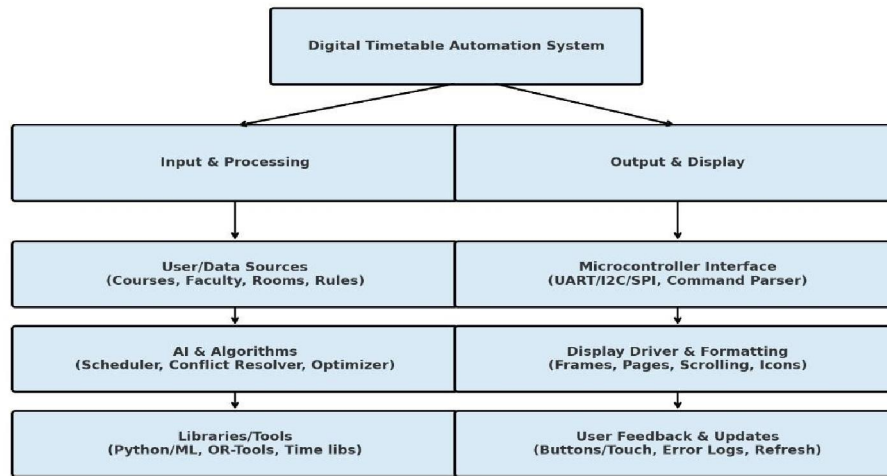


Figure1: Block Diagram of Proposed System

At the core of the system, an Arduino microcontroller serves as the central processing unit, interfacing with a TFT display to visually present the current timetable. The microcontroller receives schedule information in real-time and refreshes the display accordingly, ensuring that students always see the correct class and lecture details. The TFT screen provides clear, highresolution output suitable for classroom environments, enhancing readability and accessibility.

The timetable data is managed through a web-based interface, allowing staff members to conveniently update schedules from any device with internet access. Changes made on the web interface are stored in a centralized database, ensuring consistency and reliability. This design eliminates the need for manual updates on physical boards, reducing errors and saving significant administrative effort.

A Python script running on a connected laptop handles the communication between the database and the Arduino. The script periodically queries the database, processes the timetable data, and transmits the relevant lecture information to the microcontroller using serial communication. The Python module leverages time-based functions to ensure that only the current class or lecture is displayed, providing real-time updates aligned with the academic schedule.

The system is powered by a regulated DC supply that guarantees stable voltage to all components, protecting sensitive electronics such as the Arduino and TFT screen from potential power fluctuations. The modular design of the system allows for easy expansion, including multiple displays for different classrooms or integration with notifications for students and staff.

By combining embedded hardware, web-based management, and real-time data handling, the Digital Timetable system provides a seamless, automated solution for academic scheduling. It enhances operational efficiency, reduces administrative workload, and ensures that students have instant access to accurate schedule information, marking a significant step toward the digital transformation of classroom management.

IV. CONCLUSION

The Digital Timetable system represents a significant step toward modernizing classroom management by integrating embedded hardware, web technologies, and real-time data communication into a cohesive and efficient solution. Traditional methods, such as static notice boards and printed schedules, often lead to outdated information, missed lectures, and administrative inefficiencies. This project addresses those challenges by automating timetable updates and displaying dynamic schedules on a TFT screen controlled by an Arduino microcontroller. The hardware ensures visibility



and reliability, while a Python script synchronizes the timetable with a central database through a web interface, allowing staff to update schedules easily without the delays of manual processes. The addition of a regulated power supply ensures stability, and the modular design makes the system scalable for multiple classrooms or entire institutions.

Beyond its technical aspects, the Digital Timetable system contributes to the broader digital transformation of educational institutions. By providing students with real-time access to accurate schedule information, it reduces confusion, improves punctuality, and helps with effective time management. Staff members benefit from a flexible and intuitive management system that minimizes errors, reduces workload, and ensures consistent communication with students. The system can be further enhanced through mobile app integration, notifications, and multiple displays across departments, making it a practical and scalable solution. Ultimately, the Digital Timetable creates a smarter and more efficient learning environment, proving especially valuable for institutions with dynamic schedules or large student populations, and marking a key step toward fully digitized academic administration.

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