Digital Notice Board

for

Mini Project-II
of

Third Year (Semester-VI)

Bachelors in Engineering

by

Arya Deshmukh	D14B 08
Supriya Kharade	D14B 16
Shailey Mahato	D14B 21
Krishna Tuwar	D14B 50

Supervisor
Dr. Monali Chaudari Assistant
Professor

Department of Electronics and Telecommunication Engineering
Vivekanand Education Society's Institute of Technology
An Autonomous Institute Affiliated to University of Mumbai

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Mini Project-II Approval

Project titled by Digital Notice Board ESP32, RTC Module by Arya Deshmukh, Supriya Kharade, Shailey Mahato, Krishna Tuwar is approved for the Third year of Engineering.

1. Examiners

_____

2. Supervisors

_____

Date:
Place:

Certificate

This is to certify that Arya Deshmukh, Supriya Kharade, Shailey Mahato, Krishna Tuwar have completed the project report on the topic Digital Notice Board using ESP32, RTC Module satisfactorily m partial fulfillment of the requirements for Mini Project-II of Third Year, (Semester-VI) Electronics and Telecommunication under the guidance of Dr. Monali Chaudari during the year 2024-2025.

Supervisor
Dr. Monali Chaudari

Head of Department
Dr. Chandansingh Rawat

Principal
Dr. (Mrs.) Jayalekshmi Nair

Examiner 1

Examiner 2

Declaration

We declare that this written submission represents our ideas in our words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misinterpreted or fabricated or falsified any idea/data/fact/source in my submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Arya Deshmukh

Supriya Kharade

Shailey Mahato

Krishna Tuwar

Date:

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Abstract

Effective communication within educational institutions is crucial for efficient academic operations. Traditional notice boards require manual updates, leading to delays, outdated information, and difficulty in managing multiple announcements. To streamline this process, we introduce the Remote Controlled Notice Board, an ESP32-based digital display system that allows faculty to remotely manage and update notices in real time.

The system enables faculty members to log into a web interface, enter notices, and store them in Firebase. Once added, notices are displayed on an LCD screen connected to the ESP32, ensuring instant visibility. To enhance usability, the system includes buzzer alerts to notify faculty when a new notice is successfully uploaded. Notices automatically expire after a predefined duration to keep content relevant, and scheduled notices can be programmed for specific dates. Urgent notices trigger a distinct buzzer sound to grab attention. Additionally, the system features power control with buzzer feedback to indicate its status.

By eliminating the need for manual updates, the system ensures that students have immediate access to the latest information. The integration of ESP32 with Firebase offers a low-cost, efficient, and scalable solution for real-time notice management.

As a future enhancement, the system can be expanded to integrate a chatbot, allowing students to access specific information through a web-based interface. However, the primary focus remains on developing the Remote Controlled Notice Board, ensuring a fully functional, real-time display system that simplifies departmental communication.

This project is designed to be scalable, budget-friendly, and easy to implement, making it a practical solution for educational institutions looking to modernize their information dissemination systems.

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Chapter 1
Introduction

Communication plays a vital role in the smooth functioning of educational institutions, especially when it comes to disseminating important announcements, schedules, and updates. Traditionally, notice boards have been used as the primary medium for communication within campuses. However, these conventional boards require manual updates, which often lead to outdated information, delays in dissemination, and limited accessibility. The need for a more efficient and timely method of sharing information has led to the development of digital alternatives.

In recent years, advancements in embedded systems and cloud technologies have enabled smarter solutions that are not only reliable but also cost-effective. This project introduces a Remote Controlled Digital Notice Board designed using the ESP32 microcontroller and integrated with Firebase, a cloud-based platform. The system allows faculty members or administrators to remotely upload and manage notices in real-time through a secure web interface. Once uploaded, the notices are instantly displayed on an LCD screen connected to the ESP32 module, ensuring that students and staff have immediate access to the latest information.

To enhance interactivity and reliability, the system includes features such as buzzer alerts to confirm successful notice uploads and to emphasize urgent announcements with a distinct sound. It also supports scheduled notices, automatic expiry of outdated content, and power control feedback, making it a fully automated and user-friendly communication tool.

This project aims to modernize the way information is conveyed across departments, ensuring timely updates, reducing manual effort, and improving the overall communication flow within institutions. With its scalable design and low-cost implementation, the Remote Controlled Digital Notice Board serves as a practical solution adaptable to various organizational settings.

Chapter 2
Review of Literature

This literature survey highlights various innovations in digital notice board systems aimed at replacing traditional manual boards with wireless, smart alternatives. Earlier works by researchers like Gaykwad et al. and Shraddha et al. introduced wireless and multifunctional displays using platforms like Raspberry Pi and GSM. These systems aimed to simplify the process of delivering announcements by eliminating paper-based communication and human intervention. Several IoT-based models were proposed, allowing real-time updates and user-friendly interfaces, with security features such as login systems to restrict access. Common challenges identified in traditional systems include time consumption, lack of automation, and limited scalability, all of which are addressed in modern cloud-connected and web-controlled notice board systems. [1].

The literature survey explores various implementations of remotely controlled notice boards using IoT technologies, particularly focusing on the NodeMCU ESP8266 microcontroller and 8x8 LED matrix displays. Researchers have contributed to both hardware and software aspects, covering component selection, circuit design, and wireless communication protocols like HTTP and MQTT. Prior works demonstrate the system's effectiveness in educational and public settings for displaying real-time messages and updates. Key improvements include Wi-Fi-based remote control, user-friendly web interfaces, error handling mechanisms, and enhanced display functionality. Overall, the survey highlights the growing relevance and adaptability of such systems in modern communication, while also suggesting future enhancements like mobile apps, cloud integration, and improved security for broader, scalable applications. [2].

The literature survey in this study emphasizes the evolution of intuitive and intelligent remote control systems in smart home environments. Traditional universal remotes, often overloaded with buttons and functions, lack user-friendliness and contribute to operational errors. Existing solutions like XML-based systems and RF4CE approaches either consume excessive bandwidth or fail to offer intuitive control. To address these limitations, the authors propose "Point-n-Press," a context-aware system that allows users to control home appliances by simply pointing at them. The system uses infrared directionality, finite state machines (FSM), and bit-string encoding to ensure only relevant functional buttons are displayed, thereby reducing user confusion and bandwidth usage. Compared to conventional methods, Point-n-Press significantly improves control accuracy, reduces bandwidth consumption by over 94%, and delivers a streamlined user experience. [3].

Chapter 3
Project Description

Problem Statement:

Effective communication within educational institutions is crucial for efficient academic operations. Traditional notice boards require manual updates, leading to delays, outdated information, and difficulty in managing multiple announcements. To streamline this process, we introduce the Remote Controlled Notice Board, an ESP32-based digital display system that allows faculty to remotely manage and update notices in real time.

Block Diagram of proposed project:

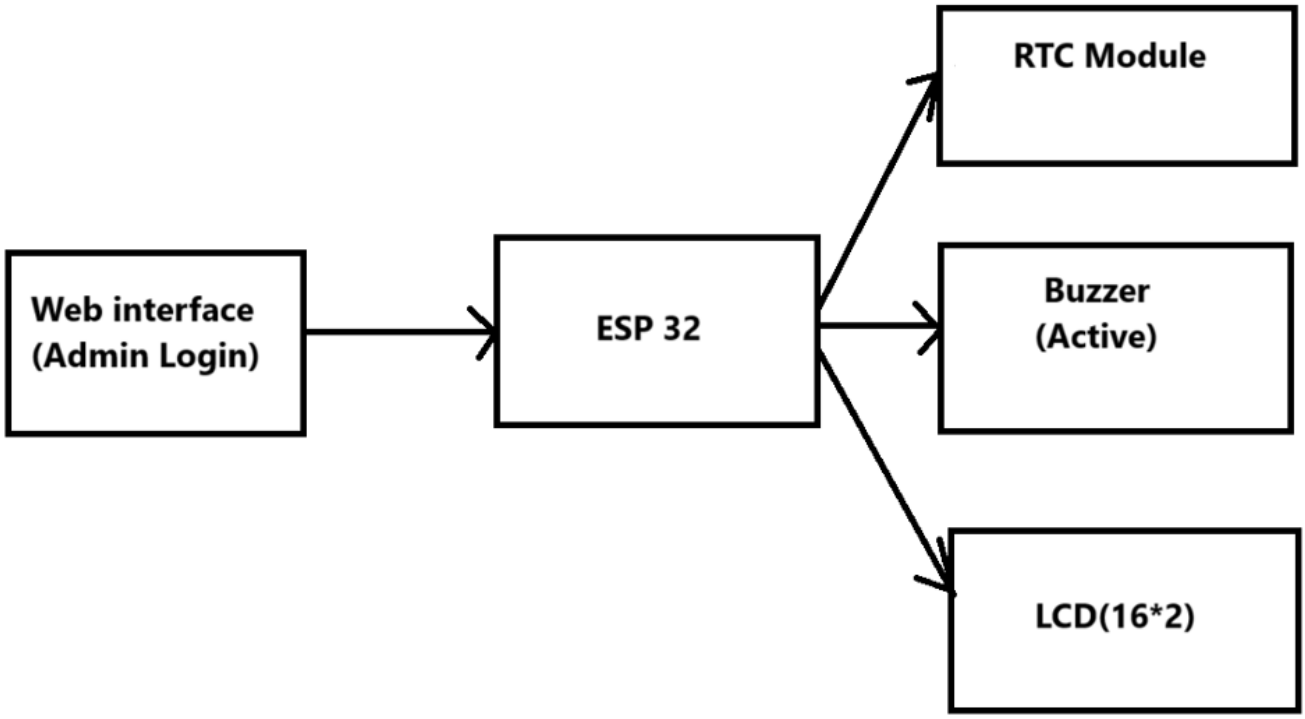

Figure 3.1 Block diagram

Fig 3.1shows the block diagram of the system controlled by an ESP32 microcontroller, which receives input from a web interface (likely for administrative tasks). Based on its programming and the input received, the ESP32 interacts with several output modules: an RTC module for real-time clock functions, an active buzzer for generating sound alerts, and a 16x2 LCD to display textual or numerical information.

Component Description

i)Hardware:

The following hardware components are used for the project:

ESP32

Description: ESP32 is a powerful microcontroller chip with integrated Wi-Fi and Bluetooth, widely used in IoT and embedded systems.
Function:It offers dual-core processing, built-in Wi-Fi/Bluetooth, 34 GPIO pins, ADC/DAC, PWM, and support for SPI, I2C, and UART protocols.
Features:ESP32 enables wireless communication, sensor interfacing, and real-time control in smart devices and automation projects.

Figure 3.2 ESP 32

RTC Module(DS3231)

Description: An RTC (Real-Time Clock) module is a timekeeping device that keeps track of the current time and date even when the main system is powered off.
Function: It includes a built-in battery backup, supports I2C communication, and typically uses chips like DS1307 or DS3231 for high accuracy.
Features:RTC modules provide consistent time data for logging, scheduling, and time-stamping in embedded systems and IoT applications.

Figure 3.3RTC Module

Buzzer:

Description: A buzzer is an audio signaling device that emits sound when activated, used for alerts, alarms, or notifications.

Function :It can be either active (with built-in oscillator) or passive, operates on low voltage (usually 3V–5V), and is easy to interface with microcontrollers.

Features: Buzzers generate sound to indicate events such as errors, completed tasks, or emergency alerts in electronic systems.

Figure 3.4 Buzzer

16x2 LCD:

Description:The 16x2 LCD is a display module, as shown in figure 3.6, that can show 16 characters per line on two rows, commonly used in embedded systems.

Function:It displays alphanumeric characters and symbols, controlled by microcontrollers for various applications.

Features:16 characters by 2 lines, backlight, low power consumption, and parallel interface for easy interfacing with microcontrollers.

Figure 3.5 16X2 LCD Display

table 3.1 Components used

Srno.	Components	Component description	Amount(INR)
1	ESP32	A Wi-Fi and Bluetooth-enabled microcontroller used for wireless communication and control in IoT applications.	1000
2	RTC Module	A timekeeping module that maintains accurate date and time, even during power loss.	400
3	Buzzer	An audio device that produces sound alerts or notifications when powered.	100
4	LCD Display screen	A liquid crystal display used for visual output in electronic devices.	250
	Total		1750

ii) Software:

These softwares were used for development :

- **Arduino IDE:**

  The Arduino Integrated Development Environment (IDE) is an open- source software platform designed for programming and developing applications for Arduino. It provides a code editor, a compiler, and a serial monitor for uploading and debugging code on STM32. With a simple and intuitive interface, it helps enable the creation of interactive and embedded electronics projects.

- **Firebase**

  Firebase is a platform developed by Google that provides a variety of cloud-based services to help developers build and manage mobile and web applications. It offers features like real-time databases, authentication, analytics, cloud storage, and hosting, which streamline the development process. Firebase also supports features like push notifications, crash reporting, and performance monitoring, making it a popular choice for developers looking to create scalable, high-performance apps. It simplifies backend infrastructure management, allowing developers to focus more on creating the app's user experience.

Chapter 4
Implementation

This chapter shows the schematics and their description.

Hardware

Components Required:

- STM 32
- RTC module
- LCD Display
- Buzzer
- power supply
- Connecting wires

Hardware Connections:

1) RTC Module (DS3231) to ESP32:

   Connect the VCC pin of the RTC module to the 5V pin of the ESP32.
   Connect the GND pin of the RTC module to the GND pin of the ESP32.
   Connect the SDA pin of the RTC to GPIO21 (the I2C data line of the ESP32).
   Connect the SCL pin of the RTC to GPIO22 (the I2C clock line of the ESP32).

2) LCD Display (I2C 16x2) to ESP32:

   Connect the VCC pin of the LCD to the 5V pin of the ESP32.
   Connect the GND pin of the LCD to the GND pin of the ESP32.
   Connect the SDA pin of the LCD to GPIO21 (same as the RTC's SDA).
   Connect the SCL pin of the LCD to GPIO22 (same as the RTC's SCL).

3) Buzzer to ESP32:

   Connect the positive terminal of the buzzer to any available GPIO pin (e.g., GPIO18).
   Connect the negative terminal of the buzzer to the GND pin of the ESP32.

Power Connections:

Ensure all components are powered appropriately, using a common ground.

Software (Flowchart/ Algorithms):

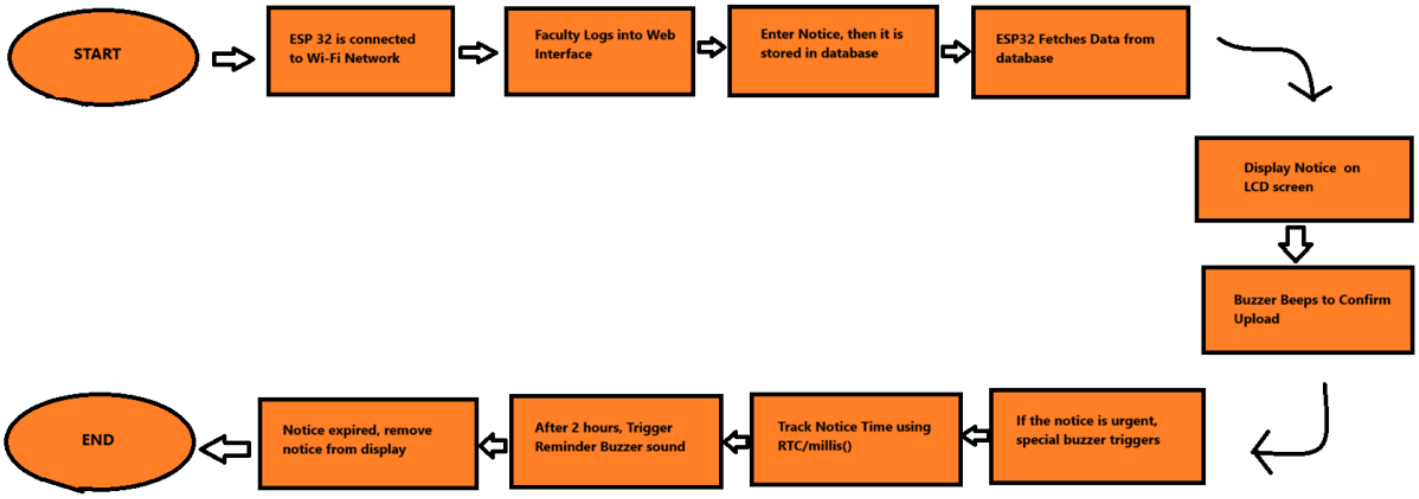

Figure 4.1 flowchart of processes in the Digital Notice Board

In Figure 4.1, the flowchart illustrates a notice display system managed by an ESP32. Starting with the ESP32 connecting to a Wi-Fi network, faculty logs into a web interface to enter a notice, which is then stored in a database. The ESP32 periodically fetches this data and displays the notice on an LCD screen. Upon successful upload to the database, a buzzer beeps for confirmation. The system tracks the notice time using an RTC or milliseconds, and if the notice is marked as urgent, a special buzzer trigger is activated. After two hours, a reminder buzzer sounds, and eventually, the expired notice is removed from the display, concluding the process.

Chapter 5: Results and Conclusion

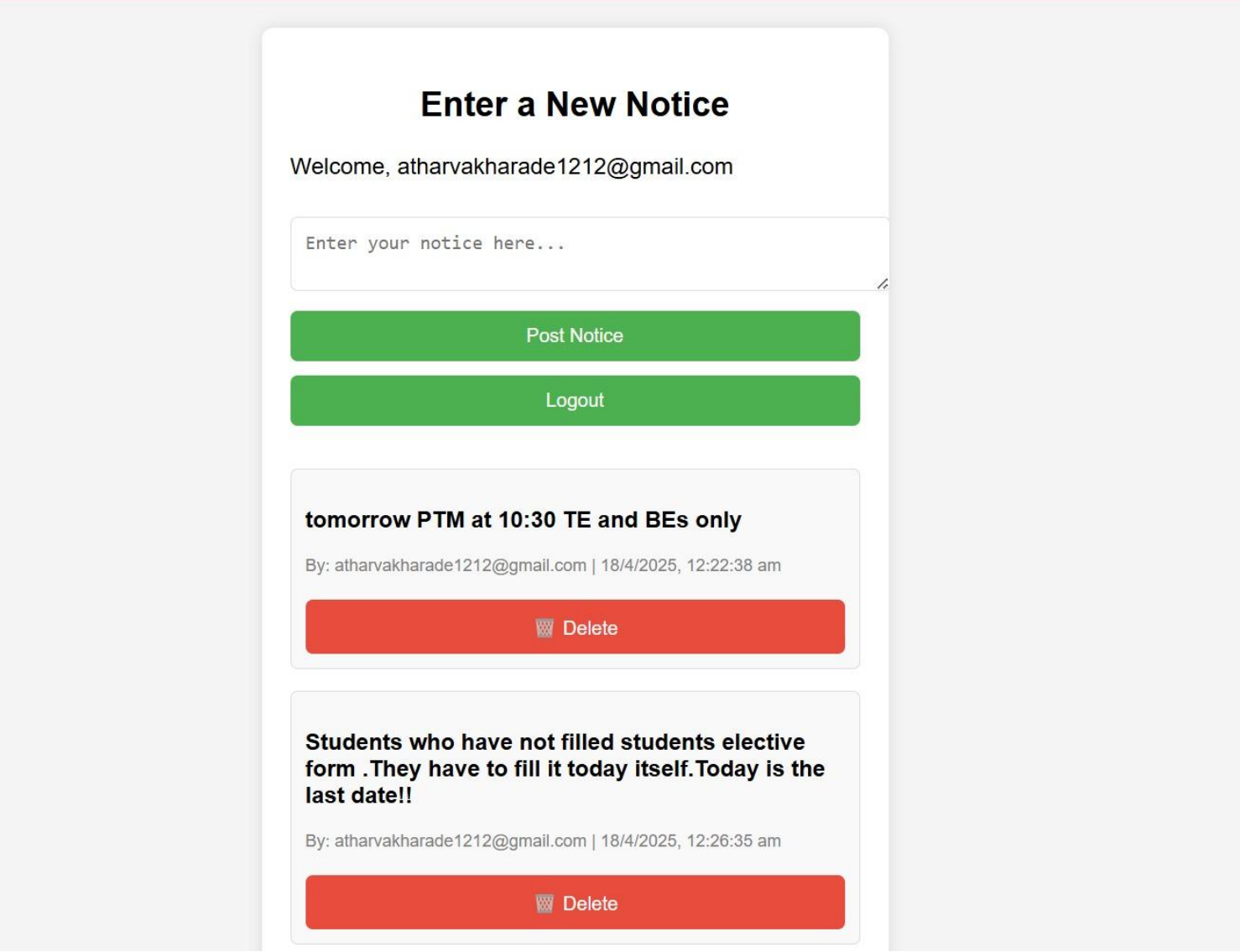

Fig 5.1 web based smart notice board interface

Fig 5.1 shows a **web-based Smart Notice Board interface** used by teachers to manage and publish notices. Upon logging in with their email, teachers can enter new notices through a simple text input field and submit them using the "Post Notice" button. All submitted notices are shown below with a timestamp and the teacher's email for reference. Each notice also includes a "Delete" button to allow easy removal. This system offers an efficient and user-friendly way for teachers to communicate important updates and announcements digitally.

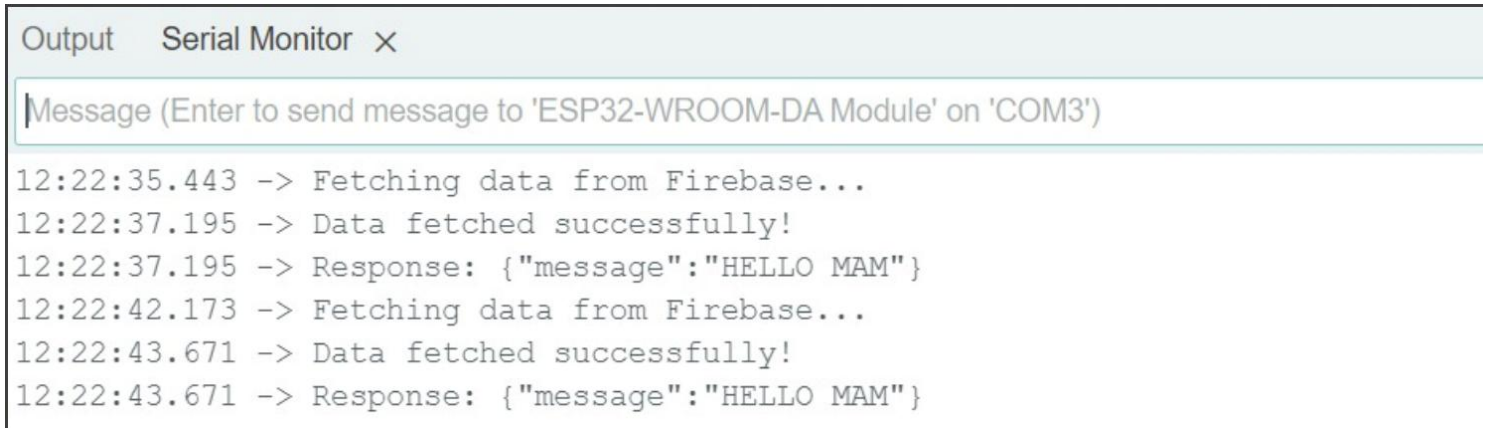

Figure 5.2:Output on serial monitor in Arduino IDE (ESP32)

Fig 5.2 shows a serial monitor output, likely from an ESP32-based system, connected via COM3. The output displays timestamps followed by messages indicating the ESP32 is periodically fetching data from Firebase. Each fetch is reported as successful, and the response received from Firebase is a JSON object containing a "message" key with the value "HELLO MAM". This suggests the ESP32 is successfully retrieving the same message repeatedly from the Firebase database at intervals of approximately five seconds.

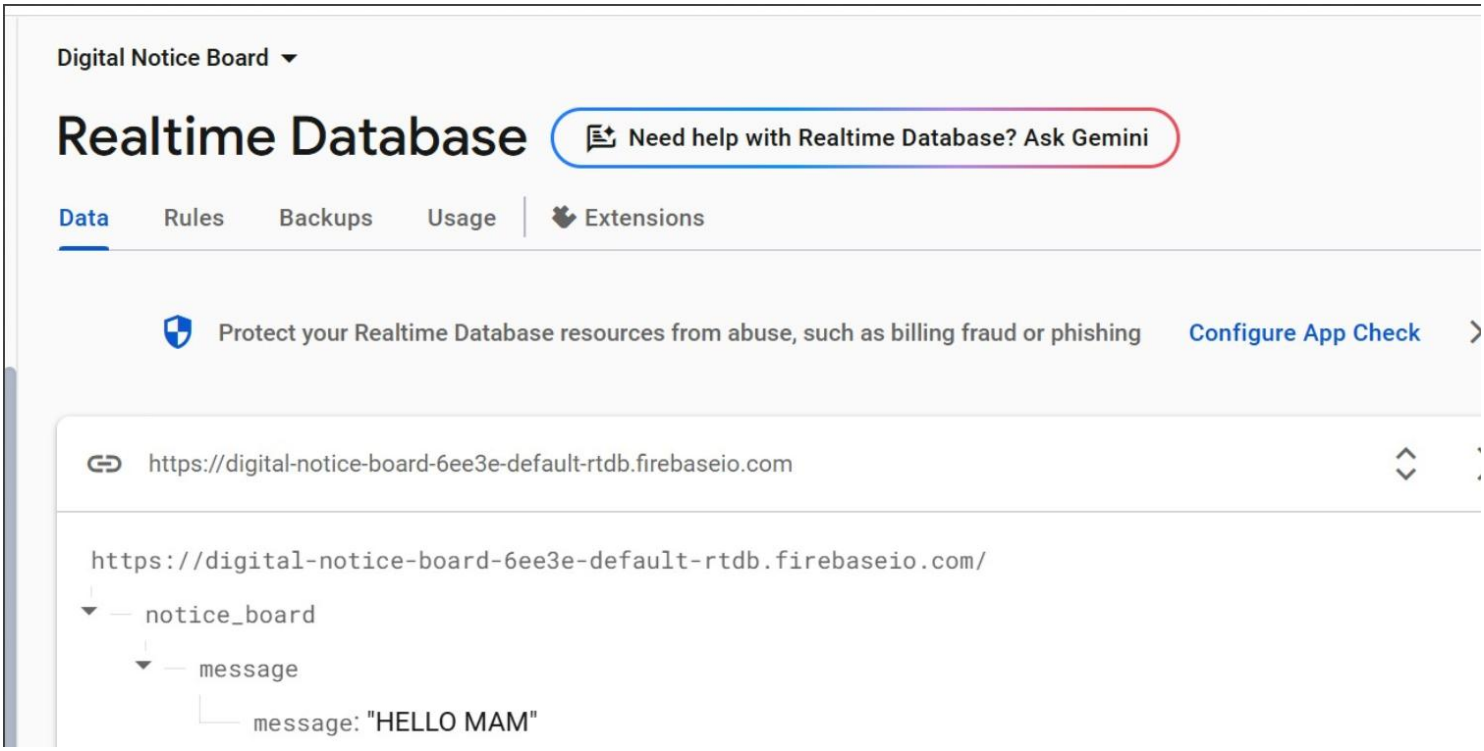

Figure 5.3: Data from ESP32 is saved on firebase

Fig 5.3 shows a Firebase Realtime Database console for a project named "Digital Notice Board". Under the root node, there's a node labeled "notice_board", which contains a child node named "message". The value associated with this "message" node is the string "HELLO MAM". This indicates that the Firebase Realtime Database currently stores a single message, "HELLO MAM", within the specified path in the database.

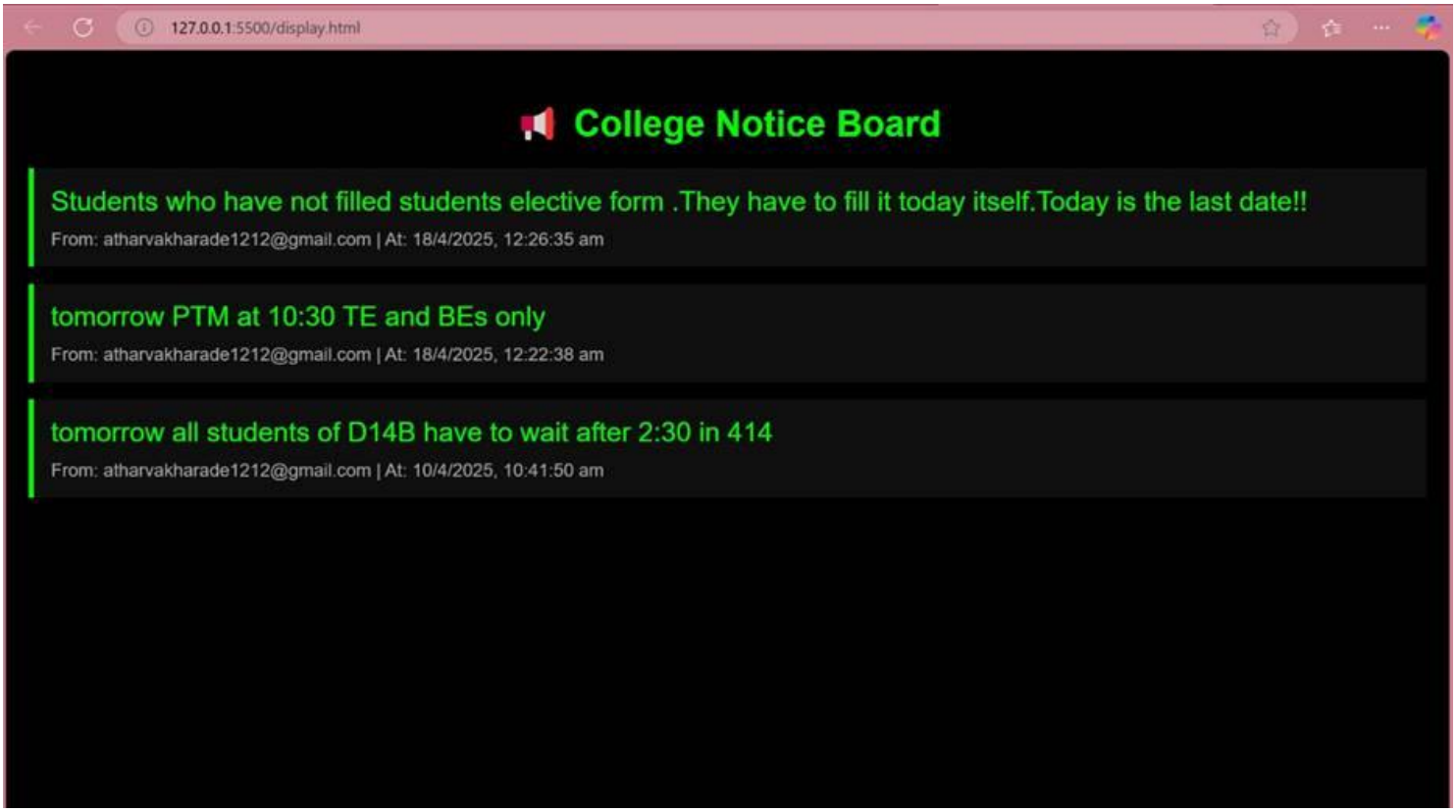

Fig 5.4 interface of smart college notice board

Fig 5.4 shows the **display interface of a Smart College Notice Board**, designed to showcase important announcements for students and faculty. It features a bold header with a megaphone icon labeled "College Notice Board" and lists multiple notices with green text on a black background for high visibility. Each notice includes the content, sender's email, and the date and time it was posted. This display is intended for real-time notice broadcasting, making it easy to keep everyone informed through a digital medium.

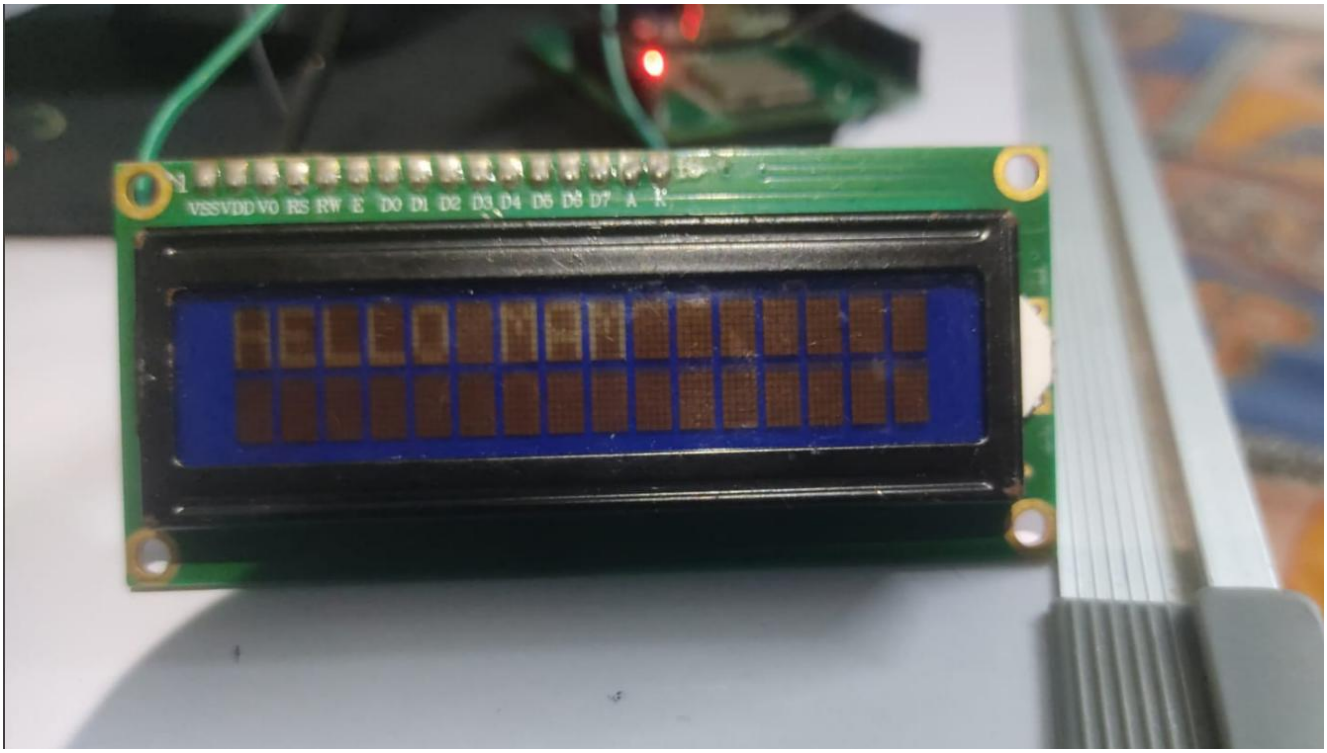

Figure 5.5:Output on LCD

Fig 5.5 shows a 16x2 LCD display with a blue backlight. The top row of the display shows the text "HELLO MAM", while the bottom row displays a series of filled rectangular blocks, indicating that these character positions are active but not displaying specific characters. The LCD module is green and has visible pin headers along the top edge for connecting to a microcontroller or other circuitry.

Conclusion

The **Digital Notice Board** represents a significant step forward from traditional paper-based systems, offering a highly efficient and modern method for sharing real-time information. Unlike physical notice boards that require manual updates and are limited by location, this digital system enables immediate updates from a centralized source. This ensures that users always have access to the latest announcements without delay, improving overall information accuracy and responsiveness. The ability to update content remotely also minimizes the need for physical presence, making the system highly adaptable for various institutional environments. One of the core advantages of the Digital Notice Board is its contribution to **streamlined communication** within schools, colleges, workplaces, and public institutions. By providing a dynamic, eye-catching interface, it captures attention more effectively than static posters or printed memos. It also reduces the workload associated with manual notice distribution and maintenance, saving time and resources. In environments with a high volume of announcements, such as educational campuses or office buildings, the digital system brings order and accessibility, allowing users to stay informed and organized with minimal effort. Looking ahead, the Digital Notice Board has the potential to evolve into a **versatile communication hub**. Features like mobile application integration, real-time push notifications, and support for multimedia (images, videos, animations) could greatly enhance its usability and appeal. Additionally, incorporating scheduling functions, user-specific notifications, or AI-based content prioritization could make the platform even more intelligent and user-friendly. These advancements would not only improve communication but also support a smart, connected infrastructure aligned with modern digital transformation goals, Furthermore, the Digital Notice Board promotes **environmental sustainability** by significantly reducing paper usage and printing waste. By transitioning to a digital format, institutions contribute to eco-friendly practices while also cutting costs associated with stationery and maintenance. This not only supports green initiatives but also aligns with the global movement toward smart and sustainable technologies.

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References

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