

DYNAMIC ANNOUNCEMENT DISSEMINATION IN REAL-TIME VIRTUAL ENVIRONMENTS

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Abstract—

In the world of communication within organizations, the old-fashioned paper notice boards have faced persistent issues like slow and manual updates, limited accessibility, and environmental concerns tied to paper usage. The paper tackles historical issues associated with traditional notice boards by introducing an innovative solution that seamlessly merges web technology with hardware integration. To address these challenges, the work begins with the creation of a dynamic website integrated with Node MCU and an IOT development board. The Node MCU retrieves data from the website and displays it on an LED display, effectively eliminating the limitations of physical notice boards. The integration of Node MCU and LED display creates a seamless bridge between the virtual world of the web and the physical world of visual communication. Real-time updates become the norm, granting users immediate access to the latest information from anywhere, and facilitating interaction and engagement regardless of location. This project rectifies these historical shortcomings and introduces a sustainable, efficient, and user-friendly communication medium for organizations and communities, offering a compelling alternative to traditional notice boards.

Keywords—

Node MCU, Communication, Dynamic Website, LED Display, User-friendly, Virtual World, Physical World, Integration.

I. INTRODUCTION

Notice boards are ubiquitous fixtures found in various settings like schools, transportation hubs, shopping centers, and workplaces, serving as platforms for sharing public information. These boards display a range of content, including advertisements, announcements, and notices aimed at informing or engaging with the community. [2]. The boards serve as essential tools for disseminating information, announcements, and updates to a diverse audience. Unlike digital platforms, notice boards offer a physical presence, capturing the attention of passersby and creating a central point for shared knowledge. These traditional notice boards, whether used in educational institutions, corporate offices, or public spaces, suffer from several limitations. These static boards are constrained by physical space, making it challenging to display a large amount of information. Additionally, updating information on these boards is a manual and time-consuming process, often leading to outdated or irrelevant content

being displayed [3]. The main purpose is approach to electronic notice board systems involves integrating them with users' mobile phones, enabling remote access to display the latest information. This innovative system allows users to easily transmit messages or updates from any location, enhancing convenience and efficiency. By leveraging mobile technology, the notice board becomes more dynamic and responsive to real-time needs [2]

Thus, the transition from traditional notice boards to website-based smart notice boards represents a paradigm shift in communication methods. Leveraging the power of the internet and digital technologies, smart notice boards offer a dynamic and versatile platform for disseminating information. Unlike their physical counterparts, these digital boards enable real-time updates, interactive features, and customization options. Administrators can remotely manage content, ensuring that information is always current and relevant. Users, in turn, benefit from instant access to announcements, news, and personalized content through a web interface. This evolution of effective communication is not just about conveying information; it's also about fostering engagement and eliciting responses. not only streamlines the communication process but also enhances engagement and responsiveness, marking a progressive step toward efficient and technologically advanced information sharing [3].

The Internet of Things (IoT) refers to a vast network comprising physical devices, vehicles, structures, and various objects embedded with electronics, software, sensors, and connectivity features, facilitating the seamless exchange and collection of data among these entities. With the pervasive adoption of mobile phones and related technologies, communication has significantly evolved, enabling effortless and intelligent interactions with individuals worldwide [1]. Consequently, IoT stands out as a pivotal technology, reshaping lifestyles, and poised for further expansion as enterprises increasingly recognize its transformative capabilities [2].

II. LITERATURE SURVEY

The Literature Survey involves reviewing existing research, publications, and projects related to communication system utilizes either Bluetooth or Wi-Fi for serial data transmission in the realm of web-based notice boards, smart technologies, and associated domains. This is facilitated by the transceiver module, which is integrated along the controlling unit at receiving side [1]. The project entails the development of a cutting-edge bulletin board, equipped with sophisticated functionalities. Utilizing a Node MCU, the system facilitates the posting of notices through voice commands by integrating Google Assistant [2]. The development of an economical, mobile, wire-free electronic notification system integrates Atmel's ATmega32 microcontroller with a range of wireless technologies, including Bluetooth and ZigBee. A comprehensive assessment of its efficacy is undertaken, with a particular emphasis on critical metrics such as transmission range and bit error rate (BER). The virtual announcement platform seamlessly the system collects data wirelessly through a receiver module and then displays it visually on an LCD screen. [3]. The advance notice board prototype has been developed, showcasing integration of a micro-controller PIC18F2550. This cutting-edge solution includes interfacing capabilities with a communication GSM module, specifically the SIM 800L device, seamlessly linked to the ports of the micro-controller [4]. In the development of a Web Controlled Notice Board, a local web server is established, which could potentially be expanded to a global scale over the internet. The Flask framework is employed to handle the reception of messages over the network, ensuring seamless communication between the web browser and the display unit [5]. The system utilizes ZigBee wireless technology to enable authorized users to send messages along with the receiver Xbee number. Upon receiving this information, the receiver Xbee and PIC microcontroller process it to display the message on both the LED running display board and LCD display. This setup allows for convenient and efficient communication in various applications [6]. The system supports multiple users and employ GSM (Global System for Mobile Communications) technology for communication. The emphasis on a robust algorithm suggests a focus on enhancing the security of the system, possibly in the context of password protection [7]. Another approach using a straight forward yet effective approach, incorporating a sturdy algorithm and employing a PIC midrange microcontroller, LCD, GSM module, and various off-the-shelf electronic components. This design prioritizes efficiency and reliability while keeping costs low. [8]. The system

incorporates cutting-edge voice recognition technology, enabling users to interact with the platform through spoken commands. This technology, commonly utilized in a variety of applications, enhances the accessibility and convenience of accessing information and announcements on the virtual board. [9]. The work addresses the issue by introducing an electronic display notice board connected to an Android device via Bluetooth. The Android device sends messages to the notice board through Bluetooth, which are then received by an Arduino [10]. In this paper, we propose a system where an electronic display notice board is connected to a digital notice board linked to an Android device through Bluetooth connectivity where the device sends messages to the display board through a Bluetooth connection, which is facilitated by an Arduino microcontroller. [11]. It aims to create an affordable and user-friendly and employs an Android-based wireless notice board system, leveraging an Arduino Uno microcontroller board to receive and exhibit messages at a minimal cost. transmitted via various communication modes. [12]. A novel system leveraging Android-based applications where a system has been devised to enable smooth connections via Bluetooth and Wi-Fi, enhancing the linking between Android personal digital assistant devices and distant wireless display boards [13]. With the use of GSM technology, the system boasts an extended range, making it suitable for wide-area coverage. By eliminating the need for a conversational interface, it enhances efficiency and simplifies the communication process, and the incorporation of the ARM LPC2148, a 32-bit RISC processor, ensures energy efficiency, making the system environmentally friendly [14]. Arduino board is integrated with a display unit, a mobile app, and an SMS agent, all interconnected via the internet. Users can send messages to be announced on the virtual board through the mobile app, which communicates with the Arduino board. [15].

III. MATERIALS AND METHODS

A. Block diagram of the work

A comprehensive approach involves the hardware circuit, which is meticulously designed to integrate various components in accordance with the specified circuit diagram. Concurrently, a website is created to provide a user interface for interacting with the LED display system. The software aspect involves coding the microcontroller to effectively control the LED display, ensuring seamless operation and functionality.

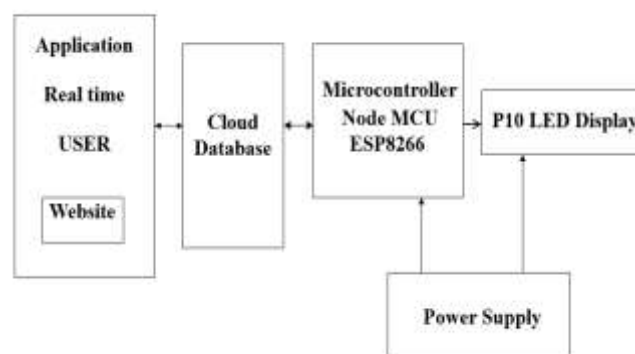


Figure 1 illustrates a schematic representation in block form of a Virtual Announcement Platform. The schematic representation in block form illustrates a comprehensive design that seamlessly connects the online platform with physical P10 LED display boards through the integration of Node-MCU, an IoT (Internet of Things) device, as shown in Fig.1. At the core of the system is a web interface accessible by administrators, allowing to enable real-time posting of notices, updates, and announcements, organizations can utilize the Node-MCU, an affordable IoT platform built on the ESP8266 Wi-Fi module, and it serves as the bridge between the web server and the P10 LED display boards. When new content is posted on the website, the Node-MCU fetches this information through the internet and updates the display boards accordingly.

Microcontroller

Node-MCU (Node Microcontroller), an open-source software and hardware development ecosystem, is centered around the ESP8266, an affordable System-on-a-Chip (SoC) crafted by Espressif Systems. This chip Combining essential computing elements like a central processing unit (CPU), random access memory (RAM), and wireless connectivity, alongside a contemporary operating system and software development kit (SDK), yields a comprehensive computing solution. It serves as a comprehensive WiFi solution, enabling seamless integration of WiFi capabilities into existing microcontroller setups, while also supporting standalone application execution.

P10 LED Display

The P10 LED display comprises an array of 512 high-density LEDs, meticulously arranged in a rectangular configuration on a durable plastic substrate. Each display unit features a matrix of 32 LEDs per row and 16 LEDs per column, all independently controllable to generate a diverse array of vibrant, multi-coloured, and dynamic visual presentations. Notably, each LED offers adjustable brightness, affording precise control over the overall display output. Boasting impressive technical specifications, including a maximum power consumption of 20 watts and a 5-volt DC input, the P10 LED display can deliver an outstanding brightness ranging from 3500 to 4500 nits.

- To accomplish this task, the utilization of a Node MCU (ESP8266) microcontroller is necessary which is acting as an IoT bridge, connecting to the internet and fetching the latest content from the website. This content is then displayed on P10 LED display boards strategically placed in relevant locations. The P10 LED displays, known for their visibility, ensure that the information is easily accessible to the intended audience.
- The Real-time User Website serves as a multifaceted platform with a secure login system, leveraging a database for user authentication. Beyond its primary function of message dissemination, the website offers administrators the ability to exercise control over scrolling speed and direction, enhancing customization. This feature-rich interface not only ensures the privacy and security of the notice board content but also provides an intuitive means to tailor the user experience.

B. Use of IOT (Internet of Things) and Software Tools

The IOT - Internet of Things represents a transformative paradigm, seamlessly interconnecting a myriad of physical devices and systems through networked communication. Enabled by embedded sensors, actuators, and connectivity modules, IoT facilitates real-time data acquisition and exchange. This interconnected ecosystem allows for intelligent decision-making, automation, and enhanced efficiency across diverse sectors, ranging from healthcare and agriculture to smart cities and industrial sectors.

- **Hypertext Markup language:**
HTML, an acronym for Hypertext Markup Language, serves as the foundational language for designing web pages. Markup tags are utilized to facilitate the creation of structured documents, allowing for the organization of content and design elements within web pages. Hypertext, integral to HTML, enables the establishment of links between various web pages, contributing to the interconnected nature of the internet.
- **Cascading Style Sheets:**
Cascading Style Sheets, commonly abbreviated as CSS, serves as a fundamental tool for web developers to craft defining the visual appearance and arrangement of their web pages through style specifications, CSS allows for the precise control of HTML elements' appearance across various devices, screen sizes, and media types, ensuring a seamless and captivating user interaction.
- **Hypertext Preprocessor:**
PHP, known as Hypertext Preprocessor, stands as a widely embraced open-source scripting language tailored for web development purposes. Its integration with HTML allows for the creation of dynamic web content and facilitates interactions with databases, along with the execution of server-side functionalities, thereby empowering developers to craft robust and interactive web application.

- **phpMyAdmin:**

PhpMyAdmin is a popular web-based administration tool designed for managing databases, particularly those powered by MariaDB and MySQL. Its functionalities encompass a broad spectrum of tasks, including database and table management, relationship handling, column and index management, permission settings, and user administration.

- **XAMPP:**

XAMPP stands as a prevalent choice among developers for its capacity to facilitate local web server development and testing across multiple platforms. Crafted by Apache Friends, this comprehensive suite comprises essential components where the setup includes the Apache HTTP Server, MariaDB, along with interpreters supporting various programming languages like PHP and Perl.

C. Software Description

The Arduino IDE, functioning as an Integrated Development Environment (IDE) provides a cohesive software environment tailored for coding development purposes, and crafting applications for Arduino microcontrollers. To commence development within the Arduino IDE for the ESP8266, it is essential to incorporate the requisite board file tailored for the ESP8266 board. The Flow of work encapsulates user authentication, message validation, and seamless integration between the website and the receiver unit. This ensures a secure and efficient communication system where only authorized users can update the notice board, and the information is consistently relayed to the physical display unit as shown in Figure 2.

- The website-based smart notice board project begins with the "Start" point, where users interact with the system. The first decision point involves logging in. If the user is already registered, they proceed to enter their password. The password protection mechanism ensures secure access to the system.
- For users who do not have an account, there is an option to register. Once registered, the flow returns to the login step, allowing the newly registered user to enter their credentials.
- Following successful login, the system checks the validity of the sender's identity. This step ensures that only authorized users can post messages. If the identity of the sender is deemed invalid, the system will persist in displaying previous messages on the notice board.
- Alternatively, if the identity of the sender is deemed valid, the system proceeds to replace the old message with the new message. This ensures that only authenticated users can update the content on the smart notice board. After updating the message, the system continuously displays the latest message.

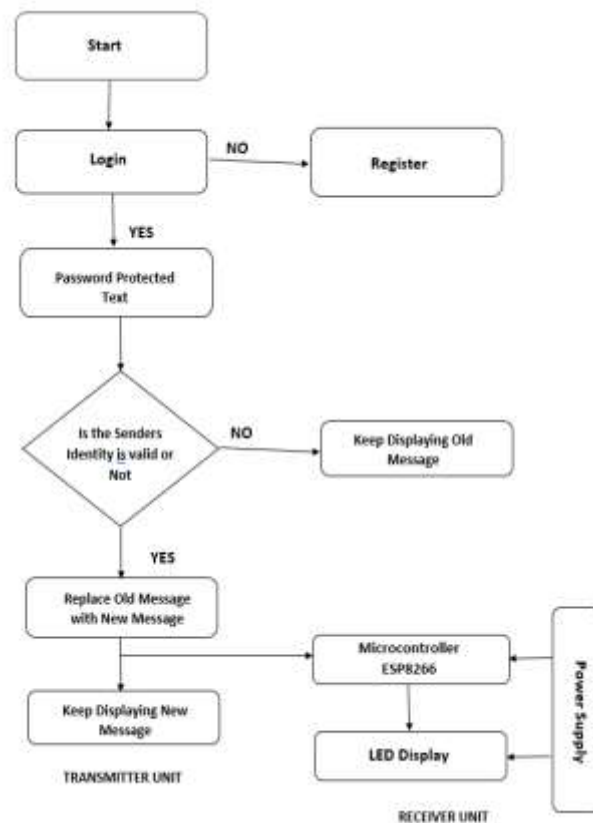


Fig. 2. Illustrates the flowchart delineating the proposed system

- Now, shifting focus to the receiver unit with a microcontroller, this unit constantly monitors the smart notice board. It is designed to keep displaying the current message, whether it is the original message or the updated one.
- The microcontroller holds significant importance in synchronization between the webpage and the physical notice board, ensuring that the displayed information is always up-to-date.

IV. RESULTS AND DISCUSSION

The project demonstrates the successful implementation of a dynamic and efficient communication system. Through the secure login on the website, administrators were able to post messages and announcements in real-time, utilizing features such as customizable scrolling speed and direction. The adoption of digital notice boards has significantly diminished paper consumption and waste, thus fostering environmental sustainability. The initiative commences with the establishment of an interactive website serving as the primary hub for disseminating information. This digital platform empowers authorized individuals to swiftly create, modify, and administer notices in real-time, effectively supplanting the sluggish and labour-intensive procedures characteristic of conventional notice boards.

Step 1- The database is created by using EEPROM, where the registered candidate's data will get stored in the database table, as illustrated in Fig 3.

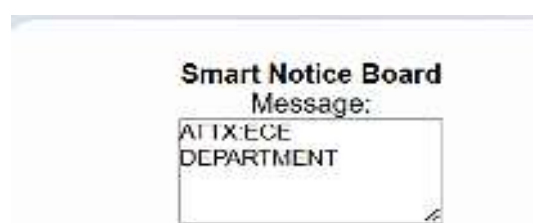


Fig. 3. EEPROM Creation

Step 2- The user First get Login into the website, with the proper credentials, the user can get login into the home page.



Fig. 4. Implementation of Authentication Page

Step 3- Users can conveniently log in to the website at a later time to send their messages, which to be displayed on LED Display, shown in Fig.4.



Fig. 4. Implementation of Home Page

Step 4- Additionally, we implemented advanced features like customizable scrolling speed enhancing the user experience.

The integration of the ESP8266 Node-MCU facilitated seamless communication between the web server and the physical P10 LED display boards.

Utilizing NodeMCU in conjunction with an LED display, this project empowers seamless real-time updates for notifications, guaranteeing users instantaneous access to the most recent information, regardless of their whereabouts. Such functionality significantly improves accessibility, fosters interaction, and encourages engagement among users, thereby fostering efficient communication within both organizational and communal settings.

The interactive capabilities of the intelligent notice board promoted enhanced engagement and collaboration among its users. Whether employed by staff, students, or members of the community, individuals could readily access pertinent information, pose inquiries, or offer feedback via the system, thereby cultivating a more inclusive and interactive communication environment.

Extending beyond corporate environments, the intelligent notice board served as a conduit for community engagement and knowledge dissemination. Municipalities, academic institutions, and local organizations leveraged the platform to distribute critical updates, event notifications, and public announcements, fostering a deeper sense of community participation and interconnectedness.

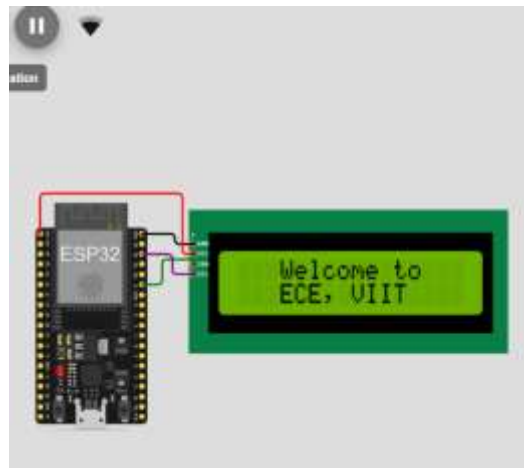


Fig. 5. Displayed message on LED display in Simulation

Thus, the gap between the web environment and the display, the project leverages NodeMCU, an IoT development board. NodeMCU is tasked with fetching data from the website and managing the LED display, facilitating smooth communication between the online platform and the physical notice board.



Fig. 6. Real Time Notice Board

Thus, displayed output on the LED virtual announcement platform, where the content is sent from the dynamic Webpage, as shown in Figure 8.

Through the output, the users experienced a responsive and intuitive web interface, gaining access to the latest information promptly. The synchronization between the website and the display boards ensured that the displayed content remained current.



Fig. 7. Integrating two P10 Panels

The increased efficacy in communication, heightened engagement levels, optimized resource utilization, scalability improvements, financial savings, enriched community involvement, and acquisition of valuable data insights all highlight the profound importance and influence of integrating pioneering communication strategies within both organizational and communal frameworks.

V. CONCLUSION

The website-based smart notice board project successfully amalgamates modern web technologies, IoT integration with ESP8266 Node-MCU, and P10 LED display boards to create an innovative communication platform. The secure login, customizable scrolling features, and real-time synchronization between the website and physical displays enhance user engagement and information dissemination. This project not only demonstrates the seamless convergence of digital and physical communication channels but also presents a scalable and practical solution for organizations seeking

efficient and dynamic notice board systems. The successful implementation underscores the project's potential to redefine traditional communication methods in various contexts.

VI. FUTURE SCOPE

The Future scope includes exploring advanced IoT protocols for enhanced connectivity, integrating AI for intelligent content prioritization, and expanding compatibility with emerging display technologies. Further developments may focus on incorporating user feedback mechanisms and extending the platform's adaptability for diverse organizational and institutional needs.

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