



WIFI BASED DIGITAL LED SCROLLING NOTICE BOARD

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Abstract- The goal of this project is to use wifi technology to design a digital led notice board. It includes the Arduino Nano, which is essential to the project. The term "microcontroller" is frequently used to describe these onboard computers. Depending on the need, the controller's input and output ports interface with various input and output modules. The message and display on the scrolling LED display are automatically read by the microcontroller. It automatically resets and shows the most recent message on the LED display after accessing all of the messages. Put another way, the microcontroller serves as a communication channel between all of the project's modules. This technology can be used in banks, colleges, schools, and other establishments. A comprehensive design and development of a digital wireless electronic notice board is presented in this project report. This project employs Wi-Fi technology to revolutionize traditional notice boards by enabling wireless updates to an LED display. The Arduino Nano serves as the core microcontroller, coordinating communication between input devices and the scrolling LED output. It efficiently retrieves, processes, and updates messages in real time, ensuring the latest information is always displayed. The system's adaptability makes it suitable for diverse applications, including educational institutions, corporate offices, and public spaces. By eliminating manual intervention, this innovative solution enhances efficiency and accessibility in delivering important notices.

1. INTRODUCTION

In previous years, Wi-Fi transceiver systems were primarily utilized by affluent individuals through devices such as mobile phones, personal computers, and laptops. Today, wireless connections are widely preferred due to their ease of use, time efficiency, and ability to facilitate seamless communication. The primary goal of this project is to develop a wireless notice board capable of displaying messages sent by the user. It aims to provide a simple, user-friendly, and easily installable system that efficiently receives and displays notices in a structured manner, enabling users to track updates effortlessly. Wi-Fi, a widely available wireless technology, is compatible with most modern mobile devices and facilitates communication over extensive networks. In this system, Wi-Fi connectivity allows users to transmit information as text messages, which are displayed on an LED notice board. Each notice board is assigned a unique identifier, enabling it to receive and manage messages effectively. This many-to-one information transmission model has gained significant popularity and is now widely adopted across industries, offering a practical and efficient solution for real-time communication. The paper highlights the industrial potential of Wi-Fi technology and its ability to transform communication systems through innovative applications.

The proposed wireless notice board system offers a significant improvement over traditional methods of communication. By eliminating the need for manual updates, it reduces the time and effort required to share important messages. The system utilizes Wi-Fi technology to enable instant updates, making it particularly beneficial for institutions like schools, colleges, and corporate offices, where timely dissemination of information is critical. The user-friendly interface ensures that anyone, regardless of technical expertise, can operate the system with ease. One of the standout features of this design is its real-time message update capability. Users can send messages directly from their devices, such as smartphones or computers, ensuring that information is displayed without delay. The use of scrolling LED displays enhances visibility, allowing the content to be easily noticed even in large spaces. Additionally, the system is scalable, meaning multiple notice boards can be integrated into the network, each identified by its unique code. This allows for customized message delivery to specific boards, enhancing the flexibility of the system. The application of Wi-Fi technology in this project demonstrates its versatility and efficiency in communication systems. Unlike conventional methods, which rely on physical or wired connections, this wireless solution offers greater mobility and convenience. The ability to connect over a wide area network ensures that messages can be sent from virtually any location, provided there is network coverage. This feature is particularly advantageous for industrial and commercial setups, where centralized control of multiple notice boards is essential for effective communication. In conclusion, the wireless notice board system represents a significant technological advancement in the field of information dissemination. It leverages the benefits of Wi-Fi to provide a seamless, efficient, and adaptable solution that can cater to a variety of settings. The system not only streamlines communication but also reduces the operational challenges associated with traditional notice boards. As industries continue to explore innovative uses of Wi-Fi technology, systems like this are poised to become indispensable tools in enhancing organizational efficiency and connectivity.

2. OVERVIEW OF PROPOSED SYSTEM

The proposed digital wireless LED notice board system integrates a modular architecture comprising a **User Interaction Layer**, **Processing Layer**, and **Output Layer**, ensuring seamless real-time communication. Users can input messages through a simple web interface hosted by the ESP8266 Wi-Fi module, which transmits the data to an Arduino Nano microcontroller for validation, formatting, and processing. The processed messages are displayed on an 8x8 LED matrix driven by the MAX7219 IC, with additional modules supporting scalability for longer messages. A piezoelectric buzzer optionally signals new message arrivals, enhancing usability. The system is user-friendly, cost-efficient, and portable, with minimal power consumption, making it ideal for institutions and industries. Despite challenges like network dependency and limited display size, solutions such as local storage and cascading LED modules ensure reliability and scalability. This innovative system showcases the potential of Wi-Fi technology for real-time and efficient communication.

Block diagram:

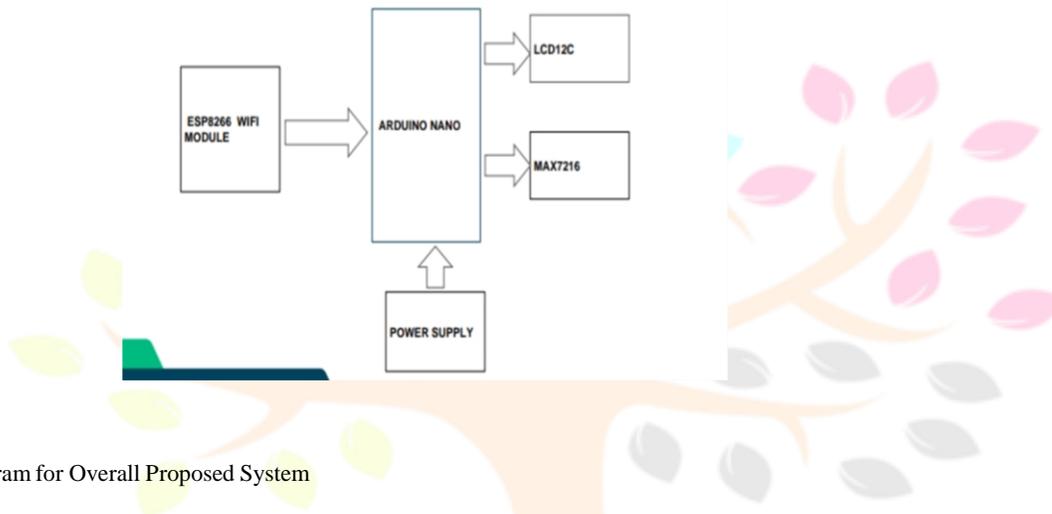


Figure 1: Block Diagram for Overall Proposed System

3. SYSTEM DESIGN

This section outlines the structural and functional aspects of the proposed digital wireless LED notice board. The design integrates hardware and software components to create a user-friendly, efficient, and cost-effective system. It explains the detailed architecture, the individual roles of each hardware component, and the software flow driving the system's functionality.

A. Arduino Nano

The Arduino Nano microcontroller, powered by the ATmega328P, is the backbone of the system, handling core operations like data processing and input-output communication. Its compact size and breadboard-friendly design make it ideal for prototyping and compact applications. The board features 32 KB of flash memory, with 2 KB reserved for the bootloader, along with 2 KB of SRAM and 1 KB of EEPROM for efficient data storage and processing. It interfaces seamlessly with the Wi-Fi module and LED display, ensuring smooth operation. The Arduino Nano supports programming through the versatile Arduino Integrated Development Environment (IDE), which allows both online and offline development. The board's reliable performance and compatibility with a range of sensors and modules make it highly adaptable. Its small form factor is particularly useful in projects where space optimization is crucial. Additionally, its low power consumption enhances its suitability for portable systems. Overall, the Arduino Nano is a powerful and flexible tool for innovative designs.

B. ESP8266 Wi-Fi Module

The ESP8266 module is a powerful wireless communication device that plays a central role in enabling real-time message updates within the system. It functions as a bridge between the microcontroller and the user interface, supporting standard Wi-Fi protocols like 802.11 b/g/n for reliable connectivity. Equipped with a built-in TCP/IP stack, it ensures seamless integration into the system. The module is programmed to host a web page, providing users with a convenient platform to input and send messages. It offers high-speed connectivity and operates with low power consumption, making it energy-efficient. The GPIO pins on the ESP8266 allow easy interfacing with the Arduino, facilitating quick and efficient data transfer. Its compact design and advanced features make it ideal for modern IoT applications. Additionally, its versatility supports integration into a wide range of wireless communication projects.

C. MB102 Power Supply Module

The MB102 breadboard-compatible power supply module is used to deliver a reliable and stable power supply to the system. It efficiently converts external DC input into the required voltage levels of 3.3V for the ESP8266 and 5V for the Arduino Nano, ensuring optimal performance of both components. This module is compact and easy to integrate into breadboard setups, making it ideal for prototyping and small-scale designs. It features an on/off switch, offering users convenient control during operation. The module also includes polarity protection, safeguarding the system against damage caused by incorrect connections. Its ability to provide dual voltage outputs simultaneously enhances its utility in projects involving multiple components. The MB102's simple design and high reliability make it an essential component for maintaining consistent power delivery. Furthermore, its compatibility with standard breadboards allows for seamless integration into various electronic projects. This module ensures both functionality and protection for the connected devices.

D. BUZZER

A piezoelectric buzzer is incorporated into the system as an optional alert feature. It provides auditory feedback to signal the arrival of new messages, ensuring users are notified even in noisy environments. This buzzer enhances the overall user experience by providing an additional layer of interaction, especially in situations where visual cues alone may not be sufficient. The sound emitted by the buzzer is clear and attention-grabbing, making it an effective tool for alerting users. Its integration into the system is simple, and it can be easily enabled or disabled based on user preference. The buzzer works in tandem with the LED display, providing a multi-sensory notification system. It improves accessibility for individuals who may not be able to immediately notice visual messages. Its low power consumption ensures it does not interfere with the system's overall energy efficiency. Additionally, the buzzer adds value to the system by increasing its versatility and reliability in various settings. Overall, it helps ensure important messages are not overlooked.

4. SYSTEM METHODOLOGY

The proposed digital wireless LED notice board system is built with a structured and modular architecture, combining hardware and software components for optimal performance. This design prioritizes scalability, efficiency, and ease of use. The system is divided into three main layers: the User Interaction Layer, Processing Layer, and Output Layer. Each layer has a specific function that contributes to the overall operation of the system. The User Interaction Layer enables users to input messages through a simple interface, while the Processing Layer handles data validation, formatting, and message preparation. The Output Layer manages the display of the processed message on the LED matrix. The interaction between these layers ensures smooth and seamless communication, allowing for real-time message updates and a user-friendly experience. This layered architecture enhances system flexibility and makes it adaptable to future upgrades. Ultimately, the design enables efficient data flow and reliable message delivery.

A. User Interaction Layer

The user interaction layer serves as the interface for remote message input, allowing users to easily send messages to the digital notice board. This layer is powered by the ESP8266 Wi-Fi module, which acts as both a web server and a Wi-Fi transceiver. Users connect to the ESP8266 via their mobile devices, laptops, or any Wi-Fi-enabled gadget, providing flexibility and convenience in sending messages from anywhere within the Wi-Fi range. The key component of this layer is the **Web Interface**, which is hosted directly on the ESP8266 module. This web page is lightweight and responsive, ensuring smooth interaction across various devices. It features a simple input field where users can type their messages and a "Send" button to transmit the message to the system. The interface is designed with non-technical users in mind, offering a straightforward experience without the need for specialized knowledge. The web page is user-friendly, with clear instructions and an intuitive layout that makes it accessible to all.

The **Wi-Fi Network** enables the ESP8266 to connect to an existing Wi-Fi network, allowing the user to access the hosted web page remotely. Once a message is typed and submitted by the user, the data is transmitted to the ESP8266 for further processing. This connection ensures reliable communication between the user and the system, enabling real-time updates to the notice board. The ability to connect to any standard Wi-Fi network ensures that users can interact with the system from virtually anywhere within the network's coverage area, making it highly versatile. The ESP8266 serves as the bridge, efficiently sending data between the user interface and the processing layer of the system.

B. Processing Layer

The processing layer serves as the computational core of the digital wireless LED notice board system, playing a pivotal role in handling and transforming data for display. Managed by the Arduino Nano microcontroller, this layer processes messages received from the user interaction layer and prepares them for visual output. The first stage of the processing layer is **Message Reception**, where the ESP8266 module transmits the user's input message to the Arduino Nano through UART communication. This ensures that the data is transferred in real time, minimizing any delays in message processing. Once the message is received, the **Validation and Error Checking** stage takes place. The Arduino Nano verifies the integrity of the data to ensure that it is complete and not corrupted. If the data is invalid or incomplete, it is discarded, and the system waits for a new input. Error-handling routines are incorporated into the system, allowing it to handle potential issues like weak Wi-Fi signals or network interruptions, ensuring that the system remains operational even under less-than-ideal conditions.

The next step is **Message Formatting**, where the Arduino prepares the message for compatibility with the LED matrix display. This includes adjusting the length of the text to fit within the display's dimensions, managing special characters, and arranging the message to be scrolled smoothly across the LED matrix. This step ensures that the message is readable and formatted correctly for a seamless visual presentation. Lastly, the **Control Logic** is responsible for managing the communication between the Arduino Nano, the LED matrix, and other peripheral components. The Arduino employs specific control algorithms to ensure efficient data flow, preventing bottlenecks, especially when handling larger or multiple display modules. This control logic guarantees that the system operates smoothly and can scale efficiently as needed, allowing for a reliable and responsive user experience.

C. Output Layer

The output layer is responsible for displaying the processed message visually and optionally providing auditory feedback. The primary output device is an 8x8 LED matrix, driven by the MAX7219 IC. This matrix serves as the main display component, and multiple modules can be cascaded together to extend the display area for longer messages. Controlled via a serial communication protocol, the LED matrix efficiently receives and displays data sent from the Arduino Nano. The text appears on the display in a scrolling format, making it easy to read even on smaller screens.

Additionally, the system can include a **Buzzer Feedback** feature, which uses a piezoelectric buzzer to alert users of new messages. This is particularly useful in environments where visual cues alone may not be enough to grab attention. The buzzer sounds when a new message is received, providing an auditory signal for users to notice.

The communication flow between the system layers follows a clear process:

1. **Input from the User:** The user submits a message through the web interface hosted by the ESP8266 module.
2. **Data Transmission:** The message is sent via UART communication from the ESP8266 to the Arduino Nano.
3. **Data Processing:** The Arduino processes the data by validating and formatting it for display.
4. **Output Generation:** Finally, the formatted message is sent to the LED matrix, which displays the text in a scrolling manner. If the buzzer is enabled, it will signal the arrival of a new message. This structured flow ensures that the message is reliably communicated from the user to the display, offering both visual and auditory feedback when needed.

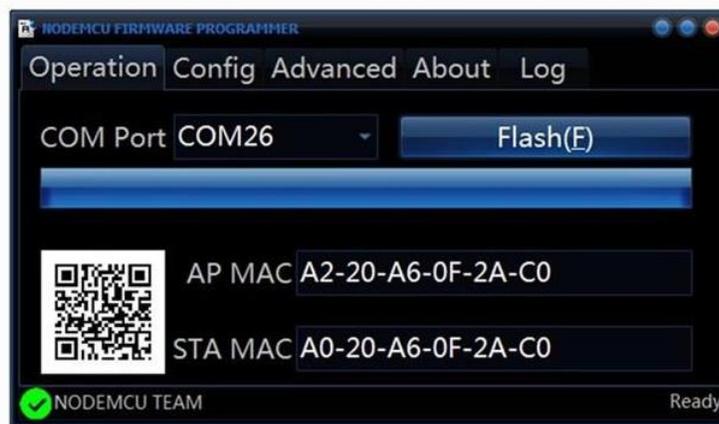


FIGURE 2 :NODEMCU

5. RESULTS AND DISCUSSION

The proposed digital wireless LED notice board system was implemented and tested to evaluate its functionality, reliability, and usability. The results demonstrated that the system successfully fulfills its objectives of real-time message display using Wi-Fi technology, while being user-friendly and cost-effective.

A. SYSTEM PERFORMANCE:

The performance of the system was evaluated under various scenarios to test its capability to handle real-time communication, message accuracy, and hardware reliability.

Real-Time Message Display: Messages sent through the web interface were displayed on the LED matrix with minimal delay. The scrolling mechanism worked smoothly, ensuring the text was legible even on smaller displays. The system consistently

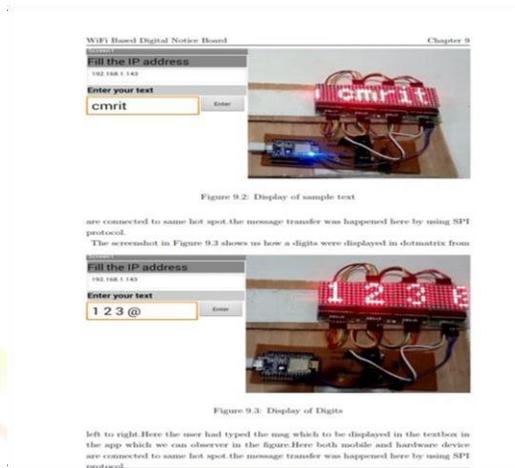


FIGURE 3: OUTPUT

handled sequential messages without requiring manual resets.

Message Integrity: The validation algorithms in the Arduino Nano ensured that corrupted or incomplete messages were not displayed. Error handling was effective in maintaining system stability even during network interruptions.

Hardware Reliability: The Arduino Nano and ESP8266 module performed consistently, with no overheating or crashes during extended operation. Cascading multiple MAX7219 modules demonstrated the scalability of the system, with accurate synchronization between the modules.

B. USABILITY:

The system was tested by non-technical users to evaluate its ease of use. The feedback highlighted the following points:

Web Interface Simplicity:

Users found the web interface intuitive, with straightforward options to input and send messages.

Accessibility:

The system could be accessed from any Wi-Fi-enabled device, eliminating the need for specialized hardware.

C. ADVANTAGES OBSERVED:

The testing phase revealed several advantages of the system

Cost-Efficiency:

The use of low-cost components such as the Arduino Nano, ESP8266, and MAX7219 made the system affordable for large-scale deployments.

Energy Efficiency:

The hardware consumed minimal power, making it suitable for environments with limited energy resources.

Portability:

The compact design and wireless communication eliminated the need for extensive wiring, making the system highly portable.

D. CHALLENGES AND SOLUTIONS:

Despite the overall success, a few challenges were identified during the testing phase:

Network Dependency:

The system's performance relied heavily on the stability of the Wi-Fi network.

Solution: Incorporating a fallback mechanism, such as local storage on the ESP8266, can ensure messages are retained during network outages.

Limited Display Area:

The 8x8 LED matrix constrained the length of messages that could be displayed at a time.

Solution:

Cascading additional modules effectively increased the display area, allowing longer messages to scroll seamlessly.

6. CONCLUSION

The implementation of the digital wireless LED notice board system demonstrates a significant step toward modernizing traditional notification methods. By integrating Wi-Fi technology with the Arduino Nano microcontroller, the system successfully addresses the challenges of manual updates, limited accessibility, and inefficient message dissemination.

The project has proven to be efficient, cost-effective, and user-friendly. Key outcomes include the ability to display real-time messages from remote locations, scalability through cascading additional LED modules, and adaptability for diverse environments such as schools, colleges, banks, and public spaces. The inclusion of a web-based interface ensures that even non-technical users can operate the system with ease.

The system's modular design and low power consumption make it a viable solution for broader applications. Despite minor challenges such as network dependency and limited display area, the proposed solutions and future enhancements—such as cloud integration and advanced display features—can further enhance its functionality.

This project not only serves as a practical application of embedded systems and wireless communication but also provides a foundation for future advancements in digital signage and IoT-based notification systems. The results affirm the potential of this approach to revolutionize how messages are communicated in various public and private domains.

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