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DESIGN AND DEVELOPMENT OF INTEGRATED WIRELESS LED NOTICE BOARD ARDUNIO UNO

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Abstract

The present work focuses on a novel and intriguing way to use wireless technology to display messages on an electronic display board. One essential component of every organization or public space, such as a park, hospital, airport, bus stop, train station, or retail center, is a notice board. Writing out the various notices by hand every now and then is a laborious and time-consuming task. In this work, a wireless digital display board concept has been put out to address the issue. The main goal of this project is to create a notice board that uses GSM technology to accept and show messages from an authorized user anywhere in the world. Messages from authorized users with mobile phones are received by the SIM card installed in the GSM module that is equipped with the wireless display board. The process is made simple and quick by having the received message shown on the wireless notice board. As a result, genuine users can use GSM technology to transmit messages to the notice board from anywhere in the world.

Key words: Arduino UNO; Switch Mode Power Supply (SMPS); SMPS boar, Bluetooth module, GSM module, Notice Board

I. Introduction

Effective and efficient communication is essential in today's fast-paced world and is required in a variety of settings, including companies, public spaces, schools, and hospitals. Traditional notice boards have several drawbacks, including the requirement for manual updates and the absence of dynamic content presentation, despite being in use today. In order to overcome these constraints, we suggest designing and creating an Arduino UNO-based integrated wireless LED notice board. The main goal of this project is to update the traditional notice board method by using LED displays and wireless technology. With this method, information updates should be easier to complete, manual adjustments should take less time and effort, and notifications and notices should be presented in a more interesting manner. Users may remotely update the notice board from their laptops or smart phones thanks to wireless connectivity, which makes it incredibly effective and handy. One essential element of every organization or public space, such as a hospital, airport, bus stop, train station, retail center, or park, is a notice board. Writing out the various notices by hand every now and then is a laborious and time-consuming task. The concept of a wireless digital display board has been put out as a solution to the issue. Using SMS (Short Message Service) technology, GSM technology attempts to simplify message transmission.

An overview of prior work, current technologies, and development techniques pertinent to the design and development of an integrated wireless LED notice board using Arduino UNO is given by the literature review. This survey aims to ascertain the present status of technology, comprehend the obstacles, and investigate possible resolutions. This study explores the effectiveness of electronic notice boards in public places, highlighting their advantages over traditional boards. Important information has been shown on traditional notice boards for a long time in a variety of contexts. Usually, these notice boards are updated manually, with printed or handwritten notices being placed or pinned. These boards work well, but updating them takes time and physical labor, which causes delays and inefficiencies (1). By using digital displays to present information, electronic notice boards are an improvement over traditional boards. These systems frequently make use of e-paper, LED, or LCD displays. The capacity to present dynamic information and change content fast are two important advantages. Studies show that electronic notice boards greatly increase the effectiveness of information sharing in businesses and educational settings. This proposed work focuses on

implementing a digital bulletin board system using an LED matrix, discussing design considerations and user interface(2). A comprehensive overview of Bluetooth technology, its applications, and benefits in wireless communication systems. Wireless communication has become a cornerstone in modern electronics, enabling remote control and updates. Technologies such as Wi-Fi, Bluetooth, and Zigbee are commonly used (3). This article reviews various applications of Bluetooth for short-range wireless systems, including home automation and notice boards. Bluetooth, in particular, is noted for its simplicity, low cost, and ease of integration with microcontrollers like Arduino. Studies have shown that Bluetooth-based systems are effective for short-range communication in various applications, including home automation and wireless notice boards (4). A detailed guide on various projects using Arduino, including wireless communication and LED control. Arduino is an open-source electronics platform based on simple hardware and software. It has become popular for prototyping and educational purposes due to its ease of use and extensive community support. Numerous projects involving Arduino have demonstrated its capability in controlling LED displays and handling wireless communication modules like HC-05 Bluetooth . (5). This paper examines the use of LED displays in various information systems, emphasizing their advantages such as brightness and power efficiency(6). The official documentation for the FastLED library, which is widely used for controlling LED strips and matrices with Arduino (7). This project involves using GSM technology to update a notice board via SMS, showcasing a different approach to wireless communication. LED displays are widely used due to their high brightness, low power consumption, and long lifespan. LED matrices and LED strips are two common types used in display projects. Research has highlighted the versatility of LED matrices for text and simple graphics display, making them suitable for notice boards. Libraries like Fast LED and Adafruit_ NeoPixel provide robust support for controlling these displays with Arduino . (8).This project demonstrates the use of an Arduino and an HC-05 Bluetooth module to control an LED matrix, providing practical implementation(9). This research explores the use of Wi-Fi technology for remote updates to a notice board, comparing it with Bluetooth-based systems(10).

The review of the literature shows that there has been a lot of advancement in the creation of wireless and electronic notice boards. Arduino's integration with Bluetooth and LED displays provides an economical, effective, and user-friendly solution. The proposed project attempts to overcome the shortcomings of traditional notice boards and build on prior work by utilizing current technology and approaches. The survey's findings will inform the integrated wireless LED notice board's design and development, guaranteeing that it satisfies contemporary communication standards.

The following are the project's primary goals:

- Wireless Communication: Using a computer or smart phone, enable remote updates to the notice board via Bluetooth.
- Dynamic Display: To show text messages with both static and scrolling text, use an LED matrix or LED strip.
- User-Friendly Interface: Provide a straightforward and easy-to-use interface so that people may post messages to the notice board. By using inexpensive parts, the system is accessible and affordable for a range of uses.

II. Materials and Methods

The proposed system represents an innovative solution for efficient information dissemination in various settings, such as educational institutions, public places, and organizations. This system leverages cutting edge technologies to overcome the limitations of traditional paper-based and wired notice boards. The following key components and features outline the design and development of this smart wireless electronic notice board shown in Figure 1.

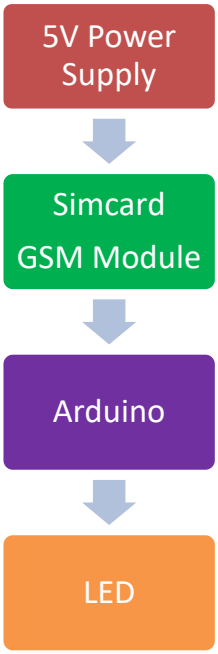

Figure 1 : Proposed block diagram of Wireless LED Notice Board

Smart Wireless Communication: The proposed system embraces wireless communication technologies to facilitate seamless and instant information sharing. By eliminating the need for physical connections, the smart wireless electronic notice board offers greater flexibility in terms of installation and accessibility. Internet of Things (IoT) technology plays a pivotal role in the proposed system. This integration allows for the connection and communication of the electronic notice board with other devices, enhancing its functionality and enabling remote control and monitoring. The inclusion of a GSM (Global System for Mobile Communications) module enhances the system's accessibility. Users can remotely send notices or updates to the electronic notice board via SMS (Short Message Service), ensuring real-time information dissemination. Bluetooth technology facilitates local communication with the electronic notice board. Users in proximity can connect their devices to the notice board, enabling quick and convenient updates without the need for internet connectivity. The system is powered by an Arduino microcontroller, serving as the central processing unit.

Arduino's versatility allows for seamless integration with various modules and sensors, making it a suitable choice for controlling and managing the electronic notice board. The proposed system features a user-friendly interface that allows authorized users to easily post notices in different formats, such as text, images(JPG), and documents(PDF).This interface can be accessed through mobile applications, web platforms, or other designated means. Notices and updates sent to the electronic notice board are displayed in real-time on an LCD (Liquid Crystal Display) screen. The use of an LCD ensures clear and visible information for users, contributing to effective communication. The design prioritizes energy efficiency by incorporating low-power components and modules. Additionally, the system is cost-effective, as it reduces the need for constant paper-based updates and minimizes the maintenance associated with traditional notice boards. To ensure the security and integrity of the information displayed, the system may include authentication measures. This prevents unauthorized access and helps maintain the reliability of the notices posted on the electronic notice board. The proposed system is designed with scalability and adaptability in mind. It can be easily scaled to accommodate varying information loads of different environments, making it suitable for deployment in diverse settings. In conclusion, the design and development of this smart wireless electronic notice board represent a significant advancement in information dissemination systems. By embracing wireless technologies, integrating IoT, and prioritizing user-friendly interfaces, the proposed system addresses the limitations of traditional notice boards, offering a more efficient, dynamic, and sustainable solution for communication in modern contexts.

There cognition of these limitations in the existing system has paved the way for the development of a smart wireless electronic notice board. The new system aims to address these challenges by leveraging modern technologies such as wireless communication, microcontrollers, and digital displays. The shift towards a smart notice board offers several advantages, including:
Real-time Updates: With the use of wireless technology, the smart notice board allowsforreal-timeupdates.Informationcanberemotelysenttothenoticeboard without the need for manual intervention.
Cost-effectiveness: By eliminating the need for paper, ink, and manual labor, the smart notice board system can be more cost-effective in the long run.
Interactivity: Depending on the design, smart notice boards can offer interactive features, allowing users to engage with the displayed content.
Efficiency: Automation and wireless connectivity contribute to a more efficient system, reducing the time and effort required for notice board management.
Scalability: Smart notice boards can accommodate a larger volume of information and are often scalable to adapt to the changing needs of an organization or institution.

III. Methodology

A few crucial steps are involved in the process of creating an integrated wireless LED notice board with an Arduino UNO: system design, hardware assembly, software development, integration, testing, and validation. A thorough, step-by-step method for achieving the intended result is provided below.

GSM Module:

A particular kind of modem that takes a SIM card is called a GSM modem. Similar to a mobile phone, it runs on a subscription to a mobile operator. A GSM modem appears just like a mobile phone to a mobile operator. Applications like Now SMS can send and receive messages via the modem interface, which is exposed by a GSM modem. Make sure you install the correct Windows modem driver from the device maker when installing your GSM modem or when connecting your GSM mobile phone to the PC. If your computer hardware has available communications port capabilities, the Now SMS & MMS gateway can support several modems at once.

Figure.2: GSM Module

P10 LED DISPLAY

The P10 LED display is a versatile and commonly used LED panel with a 10mm pixel pitch, ideal for both indoor and outdoor applications shown in Figure 3.Its modular design allows for easy assembly and scalability, enabling users to create displays of various sizes. With vibrant colors, high brightness, and wide viewing angles, the P10 display ensures clear visibility in diverse environments. Its compatibility with standard control protocols facilitates seamless integration with control devices

like the W3 WiFi controller, enabling remote management and content updates. The P10 LED display is widely employed in projects such as advertising boards, information displays.

Figure 3: P10 LED Display

Arduino UNO

The Arduino UNO is one of the most popular microcontroller boards in the Arduino family. It is based on the ATmega328P microcontroller and is designed for ease of use, making it an ideal choice for beginners and professionals alike. The Arduino UNO board offers a versatile and user-friendly foundation for creating a multitude of applications, ranging from straightforward sensor-based systems to intricate LED blinking projects. The Arduino Uno, a microcontroller board based on the ATmega328, is depicted in Figure 4. Six analog inputs, fourteen digital input/output pins (six of which can be used as PWM outputs), a reset button, an ICSP header, a power jack, a USB port, and a 16 MHz crystal oscillator are among its features. Everything needed to support the microcontroller is included; all you have to do to get it started is power it using a battery, an AC-to-DC adapter, or a USB cable to connect it to a computer. The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards.

Figure 4. Arduino uno

SMPS

The Switched Mode Power Supply (SMPS) employed in the project is a crucial component responsible for converting AC power from the mains to the appropriate DC voltage required to operate the LED display and associated electronics shown in Figure 4. With its high efficiency and compact design, the SMPS ensures reliable power delivery while minimizing energy wastage. It features protection mechanisms such as overvoltage, overcurrent, and short circuit protection, safeguarding the connected components from damage. The SMPS provides stable and regulated output voltages, essential for the optimal performance of sensitive
electronics like LED displays and controllers. Its light weight and cost-effective design make it suitable for integration into various electronic devices and projects, including the wireless LED notice board with smart phone integration.

Figure.4: SMPS

Implementation System

There are several uses for GSM-based electronic notice boards, such as in the banking industry, stock markets, public advertising, education, and traffic management.

- Educational Institutions and Organizations: Currently, the public is informed about events through the posting of papers on notice boards. Wireless notice boards provide for real-time information presentation, so this method can be abandoned.
- Crime Prevention: Information about runaway offenders, public safety advice, and display boards on roadways will all be included. When and when vehicle thefts happen, the board will assist in flashing alerts about them.
- Handling Traffic: We regularly encounter traffic bottlenecks in large cities. Notifying them ahead of time to use alternate routes would be one method to prevent this. An electronic bulletin board functions

IV.Results and Discussion

The development and implementation of the Integrated Wireless LED Notice Board using Arduino UNO yielded several key results. These results are categorized into hardware performance, software functionality, and user interaction.

The process of incorporating Bluetooth communication into a notice board that uses Bluetooth connectivity to function wirelessly entails sending messages wirelessly. Choose an appropriate microcontroller or development board with Bluetooth functionality first. Examples of such boards are the Raspberry Pi and Arduino, both of which have built-in Bluetooth modules. To render the messages, connect the selected display unit—such as an e-paper display or an LED matrix—to the microcontroller. Depending on the requirements of the project, integrate a Bluetooth module (such as the HC-05 or HC-06) into the system and set it up for slave or master mode connection. Create a protocol for encoding messages for Bluetooth transmission, selecting a format appropriate for the displayed data.

To connect to the notice board, use Bluetooth communication protocols within the application. Create a microcontroller application that actively listens for incoming Bluetooth messages, decodes them, and shows the appropriate data on the display device that is connected. It is optional to incorporate security protocols and user authentication to control access. Optimize power management techniques to save energy, especially when using them for extended periods of time.

Test the system thoroughly under a variety of conditions, resolving any problems that may occur, and record the guidelines and requirements for future use. To improve user experience, think about adding new features or improving the user interface, including scheduling messages or integrating multimedia. If you want to guarantee a safe and dependable wireless notice board system, always consider Bluetooth range and implement security precautions, especially in shared spaces.

Figure 5. Real time implementation of wireless notice boar

The Integrated Wireless LED Notice Board may get the following improvements in the future:

Wi-Fi Connectivity: Using modules such as ESP8266 or ESP32, one can add Wi-Fi capabilities to enable remote updates via the internet.

Advanced Display Features: Adding animations, images, and various typefaces to improve the aesthetic appeal.

Integration with Other Systems: Enabling automated updates for the notice board by connecting it to other systems (weather stations, event calendars, etc.).

Energy Efficiency: When the notice board is not in use, power-saving modes can be implemented to use less energy.

Conclusion

The goals of the Arduino UNO-powered Integrated Wireless LED Notice Board were effectively met, and a cutting-edge, effective, and user-friendly solution for dynamic information display was offered. The experiment proved that combining LED displays and wireless communication with microcontroller platforms was both practical and efficient. According to the findings, these kinds of technologies can greatly improve communication in a variety of contexts and provide an adaptable and practical means of information dissemination. The system can be further improved in the future with new features, making it an even more useful tool for a variety of applications.

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