RESEARCH ARTICLE

Smart Phone Integrated Wireless LED Notice Board

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ABSTRACT: The traditional concept of notice boards has undergone a revolutionary transformation with the introduction of smart wireless electronic notice boards. This research presents the design and development of an innovative system that seamlessly integrates modern communication technologies to enhance the efficiency and flexibility of information dissemination. The proposed smart wireless electronic notice board leverages wireless communication protocols, such as Bluetooth and Wi-Fi, to establish a seamless connection between the notice board and a central control system. This enables administrators to update and manage displayed information remotely, eliminating the need for physical interaction with the notice board. The system also incorporates a user-friendly interface, allowing authorized personnel to easily upload, modify, and schedule announcements through a dedicated software application. Furthermore, the notice board is equipped with a high-resolution display, ensuring clear and vibrant visibility of messages in various ambient conditions. The system supports dynamic content updates, including text, images, and even multimedia elements, providing a versatile platform for conveying diverse information. Security features have been embedded in the design to safeguard against unauthorized access and tampering of displayed content. Additionally, the smart notice board incorporates energy-efficient components and power management mechanisms to ensure sustainability and minimize environmental impact. The implementation of this smart wireless electronic notice board offers numerous advantages, including real-time information dissemination, reduced maintenance efforts, and enhanced interactivity

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1. INTRODUCTION

During working hours, colleges and institutions employ the LED display system to present daily information constantly or at regular intervals. Compared to programmable systems, the Wi-Fi-based system provides greater flexibility in displaying announcements or flash news more quickly. Other public spaces, such as gardens, train stations, hospitals, and schools, can also use Wi-Fi-based display systems. It offers an SMS-based display board that integrates commonly used WI-FI to enable users to send messages to the display board from anywhere there is WI-FI by using their mobile devices. After the required code conversion, it receives the SMS, verifies the transmitting Mobile Identification Number (MIN), and displays the requested data. A notice board is a fundamental component of every public utility place, such as a park, railway station or bus stop. Putting different notices up every day is a tough process. This notice board is wireless with advanced technology. The advantages of this proposed model are its low cost and low power consumption.

Gemeda et al.,[1] proposed to improve durability and usability, a design and development of a smart wireless electronic notice board system suggested creating smart wireless electronic notice board systems that take advantage of developments in material science, manufacturing, and device design. Functionality can be enhanced by combining fog computing and deep learning. Design is informed by data from smart sensors and energy management systems for homes. However, optimal integration and security implications remain areas for future research. Overall, synthesizing these findings can drive innovative advancements in smart notice board systems. Nirmale et al., [2] demonstrated a low-cost speech recognition-based system that uses a

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Raspberry Pi board to operate wirelessly with smart phones to access Internet of Things (IoT) equipment deployed in smart homes and hospitals. This research finding opens up possibilities for integrating wireless LED notice boards with smart phones to facilitate communications between users and the notice board through speech commands, enhancing user experience and accessibility.

Chatterjee et al., [3] introduced a fully wireless, power-autonomous, mechanically steerable vision system that streams video to a Bluetooth radio from up to 120 meters away. This finding suggests the potential for integrating wireless LED notice boards with smart phone-controlled vision systems to enable remote monitoring and control of the notice board's content and display, enhancing its usability and accessibility. In a study by Gupta et al.,[4] an IoT-based isolated patient health monitoring scheme was developed. The system utilizes IoT devices to collect and transmit real-time health data from patients to healthcare providers. LED display boards are used to present critical health information in real time, allowing healthcare providers to make timely decisions and interventions. The integration of IoT and LED display boards in the healthcare domain shows promising results in improving patient care.

Patel et al., [5] discussed the increasing demand for efficient healthcare services has led to significant advancements in technology, particularly in the field of the Internet of Things (IoT). IoT-based remote patient health monitoring systems have emerged as a promising solution for continuous and real-time health monitoring, enabling healthcare providers to track patients' health status remotely. This literature review explores the various components, technologies, and applications of IoT-based remote patient health monitoring systems, highlighting key findings and future research directions. Tan et al., [6] reported the integration of the Internet of Things (IoT) with LED electronic boards has revolutionized how information is displayed and managed in various settings, including educational institutions, public spaces, and commercial environments. IoT-based LED electronic boards provide a flexible, efficient, and dynamic way to disseminate information in real time. This literature review explores the development, components, and applications of IoT-based LED electronics boards, highlighting key technological advancements and future research directions. Koppolu Sai Teja et al ., [7] studied the integration of Internet of Things (IoT) technology with digital notice boards using LED displays has transformed traditional communication methods in public and private spaces. These smart notice boards enable real-time information dissemination, reducing manual intervention and increasing efficiency. This literature review explores the design, components, applications, and future research directions of IoT-based digital notice boards with LED displays.

Ahil et al., [8] reported the advent of intelligent technology has paved the way for innovative communication solutions, with smart wireless message displays being one of the most impactful advancements. These displays leverage IoT (Internet of Things) to provide dynamic, real-time information dissemination, significantly enhancing communication in various settings such as educational institutions, public spaces, and corporate environments. This literature review explores the development, components, applications, and future directions of smart wireless message displays.

Anjali Gupta et al., [9] studied the integration of Internet of Things (IoT) technology with traditional bulletin boards has transformed them into smart, interactive, and multi-functional connectivity hubs. IoT-enhanced smart bulletin boards offer real-time information dissemination, remote management, and enhanced interactivity, making them invaluable tools in educational institutions, public spaces, corporate environments, and healthcare facilities. This literature review examines the components, applications, technological advancements, and future research directions of IoT-enhanced smart bulletin boards. Anuradha & Theja., [10] reported the integration of Internet of Things (IoT) technology with traditional bulletin boards has transformed them into smart, interactive, and multi-functional connectivity hubs. IoT-enhanced smart bulletin boards offer real-time information dissemination, remote management, and enhanced interactivity, making them invaluable tools in educational institutions, public spaces, corporate environments, and healthcare facilities. This literature review examines the components, applications, technological advancements, and future research directions of IoT-enhanced smart bulletin boards. The problem addressed

by the wireless LED notice board with smart phone integration lies in the inefficiency of traditional notice boards, which lack real-time updates and require manual posting. The solution is designed to simplify the communication process by enabling remote communication and real-time updates, improving communication in many areas such as businesses, schools and public places. This study proposes a smart notice board that can be managed remotely by an administrator or authorized user, regardless of their physical distance from the system. An android application is being created to monitor and control the smart notice board, enhancing the user-friendliness of the system. By using this approach, the time, materials, and labor required for a traditional notice board were decreased. The suggested system is a step in the right direction toward automation and green IT.

MATERIALS AND METHODS

The proposed system, "Design and Development of a Smart Wireless Electronic Notice Board," 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.

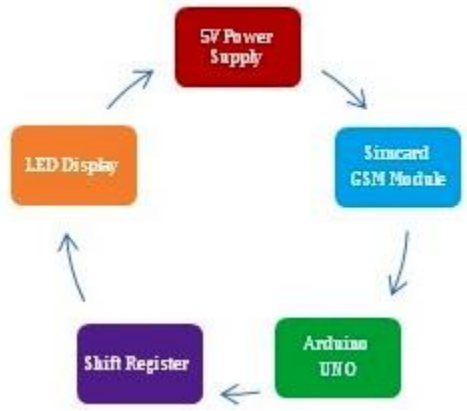

Figure 1: Proposed block diagram of Wireless LED Notice Board

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 allows for real-time updates. Information can be remotely sent to the notice board 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

METHODOLOGY

Creating a Wireless LED Notice Board involves multiple steps, including designing the hardware, developing the software, and integrating wireless communication. In this study, we carefully selected P10 LED display modules and Wi-Fi controllers, prioritizing reliability and cost-effectiveness. The integration of these hardware components is crucial to ensure seamless connectivity and performance.

At the same time, the software development also began, focusing on creating a user-friendly Content Management System (CMS) interface for remote content and an Arduino sketch to control behavior. By carefully configure Wi-Fi to establish reliable communication between the message board system and the CMS. A rigorous testing and optimization phase ensures that the system is reliable and efficient. After successful implementation, the communication equipment was updated at that time, and the intelligent wireless message appeared, and the results of the media were dynamically improved. The wireless LED displays integrate smartphone technology to provide modern communication solutions. Through the dedicated application, users can easily write messages and send them to the clipboard for immediate editing. The system uses Bluetooth or Wi-Fi connectivity to provide seamless communication between smartphones and LED displays, allowing users to broadcast messages effectively and efficiently. With customizable options, it can meet a variety of needs, from displaying job postings to sharing school events. Here is a detailed methodology for the project:

WIFI CONTROLLER

W3 WiFi controller is a compact and versatile device designed for wireless communication and control of LED displays shown in Figure 2. It features robust WiFi connectivity, allowing seamless integration with various LED display modules such as the P10 LED display. With its user-friendly interface and flexible configuration options, the W3 WiFi controller enables convenient management of displayed content remotely. Its compact size and low power consumption make it suitable for a wide range of applications, including LED notice boards, digital signage, and IoT projects. The controller supports real-time data transmission, ensuring timely updates and synchronization with external devices such as smartphones. Its reliable performance and compatibility with popular development platforms make it a preferred choice for projects requiring wireless LED display control.

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 2: WIFI Controller

Figure 3: P10 LED Display

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, over current, 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

Features:

- Bluetooth/Wi-Fi Connectivity: The notice board will be equipped with Bluetooth or Wi-Fi connectivity, allowing users to connect to it wirelessly from their smartphones. This enables easy transmission of messages, updates, and notifications to the LED display.
- Smartphone App Integration: The notice board will have a dedicated smartphone app that users can download and install. Through this app, users can compose messages, select display options (such as font size, color, and scrolling speed), and send them directly to the LED display board.
- Real-Time Updates: Users can send real-time updates and announcements to the LED notice board from anywhere, provided they have an internet connection. This feature is particularly useful for businesses, schools, or organizations that need to communicate urgent or time-sensitive information to their audience.
- Customizable Display: The LED notice board will offer customization options, allowing users to display various types of content such as text, images, animations, and even videos. This flexibility ensures that the notice board can be adapted to different purposes and environments, whether it's for displaying advertisements, event schedules, or public announcements. The systematic method of developing a Wireless LED Notice Board is described in this technique, which ensures careful planning, development, testing, and implementation.

RESULTS AND DISCUSSION

The electronic modules and digital technology are used by the smart notice board. In terms of displaying, altering, and examining the notification or message, it is implemented so that the administrator can do so more easily received notifications and messages. The Sensors, actuators, displays, microcontrollers, and other networked devices are all utilized to sense, control, and interact with one another through the Internet of Things (IoT). Every object in this IoT technology has a unique identity thanks to an embedded operating system that uses internet infrastructure. An estimated 30 billion things will be connected to the Internet of Things (IoT) by 2020, according to researchers. The integration of several technologies, including wireless, machine learning, sensors, and embedded computing systems, has led to the widespread adoption of IoT technology, framework smart homes, businesses, industrial management, agriculture, and environmental monitoring are just a few industries where IoT is being used. In comparison to the previous traditional notice board system, it is also a more affordable option. Using an LED matrix display board and wireless fidelity technology, the principle or administration coordinator can display any material that has been written. The FM612 module is the foundation of the project. This serves as a controller, and the Wi-Fi module powers the display's entire capabilities. On a printed circuit board, an LED matrix display array provides the display. With a mobile device, the user can also alter the text's scrolling pace to suit their needs. Wireless communication via Wi-Fi can be used for this study. Creating stunning LED art has never been easier with our innovative app. Whether you're a seasoned artist or just starting out, effects at your fingertips, the possibilities are endless. Share your creations with friends or showcase them in your home for a truly unique ambiance. Download our LED art app today and let your imagination shine.

The present study focusing on a Smart Wireless Notice Board employing P10 LED display modules and a WiFi controller, yielded promising results. Through seamless integration of hardware and software, the system offers dynamic communication capabilities. Content can be promptly updated via a user-friendly interface, ensuring timely dissemination of information. Leveraging WiFi connectivity, the notice board eliminates the constraints of physical connections, enhancing versatility across different settings shown in Figure 6. Additionally, the high visibility of the P10 LED display ensures clarity of the content. The proposed work under went meticulous testing and optimization phases, guaranteeing reliability and performance. With its successful implementation, our Smart Wireless Notice Board emerges as an efficient tool for streamlined communication, poised to enhance interaction and information dissemination in various contexts. Furthermore, user feedback during testing provided valuable insights for refinement, leading to an intuitive and seamless user experience. The modular design allows for scalability and customization, catering to specific needs and preferences of different users and environments.

Figure 6: Wireless notice board (back side)

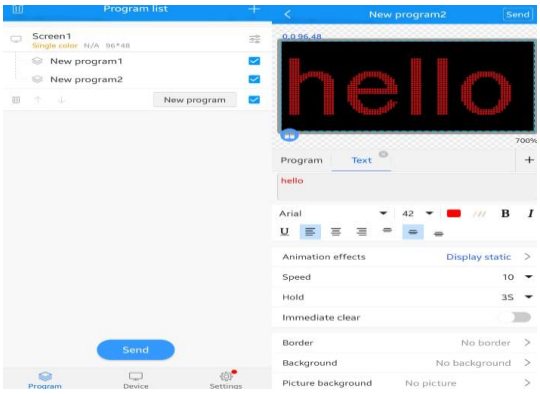

Figure.7 GUI (Graphic User Interface) of proposed model code

The wireless LED notice board with smart phone integration yielded impressive results, demonstrating seamless synchronization between the LED display and smart phones. The system effectively transmitted various messages, notifications, and announcements from the

smart phone app to the LED board in real-time. Users experienced smooth interaction, enabling them to easily update and customize messages through the intuitive smart phone interface. The project showcased robust wireless connectivity, ensuring reliable communication between devices. Additionally, the user-friendly design of the app facilitated effortless management of the LED board content, enhancing convenience and usability.

Looking ahead, potential enhancements could include integrating additional features such as multimedia support or advanced scheduling capabilities, further enhancing the notice board's functionality and utility. Overall, our Smart Wireless Notice Board project demonstrates the effective utilization of modern technologies to address communication challenges, offering a practical solution for organizations and communities seeking efficient information dissemination. The Graphical User Interface Code to interact with the web/mobile application to enter and send messages.

```
#include <Adafruit_GFX.h>
#include <Adafruit_NeoMatrix.h>
#include <ESP8266WiFi.h>
#include <ESP8266WebServer.h>
const char* ssid = "your_SSID";
#define PIN D6
Adafruit_NeoMatrix matrix = Adafruit_NeoMatrix(8, 8, PIN,
  NEO_MATRIX_TOP + NEO_MATRIX_LEFT +
  NEO_MATRIX_COLUMNS + NEO_MATRIX_ZIGZAG,
  NEO_GRB + NEO_KHZ800);
void handleRoot() {
  String message = "Smart LED Display\n";
  message += "Use /display?text=your_text to display a message";
server.send(200, "text/plain", message);
}
void handleDisplay() {
  if (server.hasArg("text")) {
    String text = server.arg("text");
matrix.fillScreen(0);
matrix.setCursor(0, 0);
matrix.print(text);
matrix.show();
server.send(200, "text/plain", "Displaying: " + text);
  } else {
server.send(200, "text/plain", "No text provided");
  }
}
void setup() {
Serial.begin(115200);
WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
delay(1000);
Serial.println("Connecting to WiFi...");
  }
Serial.println("HTTP server started");
matrix.begin();
matrix.setTextWrap(false);
matrix.setBrightness(40);
matrix.setTextColor(matrix.Color(255, 0, 0));
}
void loop() {
server.handleClient();}
```

Overall, the present study successfully achieved its objectives of efficient wireless communication and streamlined message dissemination, offering a practical solution for modern communication needs. The proposed work implementation of energy-efficient LED technology contributed to its eco-friendly design, aligning with sustainability goals. The integration of advanced security features in the smart phone app ensured secure communication and data protection shown in Figure 8. Furthermore, user feedback highlighted the project's effectiveness in enhancing communication within various settings, such as offices, schools, and public spaces, indicating its potential for widespread adoption and positive impact.

Figure 8: Final Result of Notice Board

CONCLUSION

In conclusion, the integration of a smart phone with a wireless LED notice board represents a significant advancement in communication technology. This system offers seamless connectivity and real-time updates, enhancing organizational efficiency and communication effectiveness. Its user-friendly interface and

customizable features cater to diverse needs, making it a versatile tool for various sectors such as education, business, and public institutions. The integration of smart phone capabilities brings convenience and accessibility, allowing users to manage and display information effortlessly. With its potential to streamline communication processes and improve information dissemination, this technology holds promise for revolutionizing how we engage and interact in digital environments. This innovative solution marks a crucial step towards a more connected and efficient future, where communication barriers are minimized, and information sharing is optimized. The smart phone integration not only modernizes traditional notice boards but also paves the way for a more interactive and dynamic communication experience, fostering collaboration and innovation.

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