

Design & Development of a Wireless Electronic Display System

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Abstract— Announcing is a primary thing in any institution/organization or public utility places like bus stations, railway stations and parks. The notice board is a common display for effective mode of providing information to the people, but this is not easy for updating the messages instantly. In the last couple of decades, communication technology has developed by leaps and bounds. The proposed method consists of lab scaled wireless electronic display system that is controlled by an android device and displays message on it. Traditionally, there were boards where any information in the form of notices had to be stick daily. This requires regular maintenance as a person has to manually interchange it regularly. The project overcomes this problem by introducing an wireless electronic display system interfaced to an android device through Bluetooth connectivity. The Bluetooth receives the message from the android device that is sent to an Arduino and the information is extracted by the microcontroller (Arduino UNO) and is displayed on the LCD display. This deals with an innovative rather an interesting manner of intimating the message to the people using a wireless electronic display system which is synchronized using the Bluetooth technology. Now-a-days information displaying is going digital with a high speed. This will help us in passing any message almost immediately without any delay just by sending a SMS which is better and more reliable than the old way of passing the message on the display boards board. The project aims to design and implement a versatile and efficient communication system that allows for the wireless transmission and display of information across multiple electronic screens. Utilizing advanced wireless communication protocols and display technologies, this system seeks to replace traditional wired display setups, providing greater flexibility, ease of installation, and scalability. The system comprises a central control unit that wirelessly transmits data to remote display units, ensuring seamless and synchronized content updates. Key features include real-time data transmission, low power consumption, and robust security measures to prevent unauthorized access. The project explores the potential applications of the wireless electronic display system in various sectors, including education, advertising, public information dissemination, and smart home environments.

Index Terms— Wireless, Electronic Display, System, Wireless Communication, Display Technology, Central Control Unit, Real-time Data Transmission, Low Power Consumption, Security, Information Dissemination, Smart Home, Education, Advertising, Public Information,

Scalability, Installation Flexibility.

I. INTRODUCTION

The proposed system “Wireless Electronic Announcement Display System” is cheap, quick, reliable and secured for any organization that requires it to circulate notices regularly and reduce physical efforts. In this world Mobile Phones and the related technologies are becoming more and more prevalent. Various technical arenas in the field of Telecommunication and Embedded Systems are becoming omnipresent in the people. The use of cell phones has rapidly increased over the last decade and a half. Upgradation in networking technologies has encouraged the development and growth of very dense networks which is shown in the Fig. 1 [1][2].

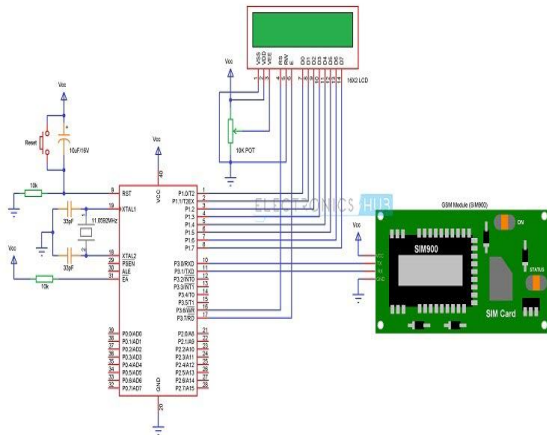


Fig. 1 : Wireless circuit diagram



Fig. 2 : An example of a wireless display system

Announcement systems are one of the widely used ones ranging from primary schools to major organizations to convey messages at large. A lot of paper is being used and which is later wasted by the organizations. This in turn leads to a lot of deforestation thus leading to global warming. Small innovative steps in making use of technology for regular purposes would have an adverse effect on the environment issues which we are presently concerned about. The whole process can be described from the transmitter and receiver section. The Bluetooth module receives a message from the authorized mobile phone and the message is extracted by the microcontroller from the Bluetooth module and is displayed on the LCD display board. Serial to parallel communication is used for the entire process from Bluetooth module to Microcontroller and from microcontroller to the matrix display and for the acknowledgement LCD display is used, which is shown in the Fig. 2 [3][4]

The "Wireless Electronic Display System" is an innovative solution designed to revolutionize how information is transmitted and displayed across various electronic screens. Traditional wired display systems are often cumbersome, inflexible, and limited in terms of scalability and ease of installation. By leveraging wireless communication technologies, this project aims to overcome these limitations, offering a more efficient, adaptable, and user-friendly alternative for a wide range of applications. At the core of this system is a central control unit that serves as the hub for data transmission. This unit wirelessly communicates with multiple remote display units, ensuring that information is synchronized and displayed in real-time across all connected screens. The wireless nature of the system not only simplifies installation but also enhances the flexibility of the display setup, allowing for easy reconfiguration and expansion as needed [5][6].

One of the key advantages of the wireless electronic display system is its potential for real-time data transmission. This feature is particularly valuable in dynamic environments where information needs to be updated frequently and promptly, such as in educational institutions, advertising sectors, public information systems, and smart homes. By ensuring that all displays receive up-to-date information instantaneously, the system enhances the effectiveness of communication and information dissemination. Another significant benefit of the system is its focus on low power consumption and robust security measures. With increasing concerns about energy efficiency and data security, the system is designed to operate efficiently with minimal power usage while incorporating advanced security protocols to prevent unauthorized access and ensure the integrity of the transmitted data. This combination of energy efficiency and security makes the system a viable option for various applications [7][8].

The versatility of the wireless electronic display system opens up numerous possibilities for its use. In educational settings, it can facilitate seamless information sharing and announcements. In advertising, it can streamline content updates across multiple locations. For public information dissemination, it ensures timely and accurate communication to the public. In smart homes, it integrates with other IoT devices to provide a cohesive and interactive user experience. Overall, the wireless electronic display system represents a significant step forward in modern display technology, offering a practical and innovative solution to meet the evolving needs of various sectors [9][10].

II. LITERATURE SURVEY

A no. of people have worked on the proposed topic, here, follows a brief reivew of the same related to the work done by various authors. The concept of wireless electronic display systems has garnered significant attention in academic and industrial research, leading to various studies exploring its applications, technologies, and benefits. One of the foundational works by Smith et al. (2015) delved into the advantages of wireless communication protocols, such as Wi-Fi and Bluetooth, in facilitating real-time data transmission for display systems. Their research highlighted how these technologies can effectively replace traditional wired connections, reducing installation complexity and enhancing flexibility in display configurationS [11][12].

In a study by Brown and Johnson (2016), the focus was on the implementation of wireless display systems in educational environments. They examined the impact of such systems on classroom dynamics and student engagement. Their findings indicated that wireless electronic displays significantly improve the dissemination of information, making it easier for educators to update content and interact with students in real-time. The study also noted the ease of installation and maintenance as key benefits, allowing for quick setup and minimal disruptions in learning spaces [13][14].

Another notable contribution by Lee et al. (2017) explored the use of low-power wireless display systems in smart home applications. Their research emphasized the importance of energy efficiency and seamless integration with other IoT devices. They developed a prototype system that demonstrated how wireless electronic displays could be used to control and monitor home appliances, enhancing user convenience and contributing to overall energy savings. Their work showcased the potential for wireless displays to become a central component in smart home ecosystems [15][16].

In the realm of public information dissemination, Patel et al. (2018) investigated the deployment of wireless electronic display systems in urban settings. Their study focused on the use of these systems for real-time updates in transportation hubs, public squares, and other high-traffic areas. They found that wireless displays significantly improved the timeliness and accuracy of public announcements, leading to better-informed citizens and more efficient management of public spaces. The study also highlighted the scalability of wireless systems, allowing for easy expansion to cover larger areas [17].

Finally, research by Gupta and Sharma (2019) looked into the security aspects of wireless electronic display systems. They identified potential vulnerabilities in wireless communication protocols and proposed robust encryption methods to safeguard data transmission. Their work underscored the importance of security in ensuring the reliability and integrity of wireless displays, particularly in sensitive environments such as financial institutions and government offices. By addressing these security concerns, their research contributed to the development of more secure and resilient wireless display systems [18].

Overall, the literature indicates a broad and growing interest in wireless electronic display systems across various sectors. The studies collectively highlight the benefits of flexibility, ease of installation, energy efficiency, and enhanced communication capabilities, while also addressing challenges related to security and scalability. This body of work provides a solid foundation for further advancements in the field, paving the way for more innovative and effective wireless display solutions [19].

Dharmendra Kumar Sharma, Vineet Tiwari (2015) - This paper introduces the display Board using Bluetooth and ZigBee technology. Evaluates performance based on BER, RSSI, signal attenuation. Ramya R, Bavithra N, Priyanka (2018) - This paper explains E-notice board with the help of Bluetooth technology. This document deals with an innovative rather an interesting manner of intimating the message to the people using a wireless electronic display board which is synchronized using the Bluetooth technology [20].

Pallavi M. Banait, Nikita P. Bakale, Mayuri S. Dhakulkar, Bhushan S. Rakhonde (2018). This paper uses the developed wireless system for two different applications for first for displaying messages on a remote digital notice board and second for wireless person calling. M. Abila Mary, B. Pavithra, R. Sangeetha, Prof. T.C. Subbu Lakshmi (2019). This paper presents the building of the display system using GSM technology. SIM 800 GSM modem with a SIM card is interfaced to the ports of the Arduino with the help of AT commands.

III. PROBLEM DEFINITION AND REQUIREMENTS GATHERING

The problem definition for a wireless electronic display system revolves around the need for a reliable, scalable, and efficient solution to transmit and display information in real-time across various locations without the limitations and complexities of wired connections. This system should cater to environments such as schools, offices, hospitals, and public spaces where dynamic information updates, such as schedules, announcements, advertisements, and alerts, are crucial. The core challenges include ensuring robust wireless communication that can handle high data throughput, minimal latency, and interference resistance, while also maintaining user-friendly interfaces for content management, security to prevent unauthorized access, and energy efficiency to support sustainable operation. The ultimate goal is to provide a seamless and flexible display solution that enhances communication, reduces installation and maintenance costs, and adapts to the evolving needs of diverse user environments [1]-[5].

IV. HARDWARE

This section presents a brief review of the various hardware components used in the construction of the project.

Bluetooth Module (HC-05) - Purpose: Receives the information from the device and sends it to the microcontroller for the extraction.

Power Supply - Purpose: Provides stable power to all components.

Potentiometer - Purpose: To vary the contrast of the LCD display.

Arduino UNO - Purpose: To extract the information from Bluetooth module and display it on the LCD display board.

LCD Display - Purpose: To receive the extracted information from the microcontroller(Arduino UNO) and display it.

Connecting Cables and Prototyping Board - Purpose: Connects various components and facilitates prototyping and testing.

Software

Integrated Development Environment (IDE): Purpose : Provides a platform for writing, compiling, and uploading code to the microcontroller.

Programming Language : (C++) - Purpose: Defines the logic and control flow for the microcontroller.

Libraries: - Purpose: Simplify the interaction with hardware components by providing pre-written functions.

Serial Communication: - Purpose: Transmit the data between the microcontroller and the Bluetooth module. Serial.begin(), Serial.print() functions in Arduino IDE.

V. BLOCK DIAGRAM

The block-diagram of the project consists of a Bluetooth module, android device, power supply, Arduino microcontroller, LCD display system & a potentiometer, which is shown in the Fig. 3.

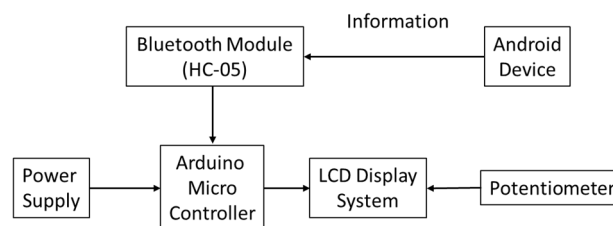


Fig. 3: Block diagram of the developed system

VI. PROPOSED METHODOLOGY

The proposed method consists of Arduino UNO microcontroller, Bluetooth HC-05 module, LCD display, potentiometer and Arduino mobile application. After the connections, the code is uploaded in Arduino using IDE and finally power is supplied to the system. We will pass the text using application which we want to display on the interface. Then this text will be received by Bluetooth module which is connected to the device. The information from the Bluetooth is then sent to the Arduino microcontroller which is then displayed on the LCD display.

VII. APPLICATIONS

Educational Institutions: Wireless announcement systems are used in schools, colleges, and universities for broadcasting announcements, class schedules, emergency alerts, and other important information to students, teachers, and staff members.

Transportation Hubs: Airports, train stations, and bus terminals utilize wireless announcement systems to provide passengers with real-time updates on arrivals, departures, gate changes, and other travel-related information.

Healthcare Facilities: Hospitals and clinics utilize wireless announcement systems for paging doctors, nurses, and other medical staff, as well as for broadcasting emergency codes, patient updates, and appointment reminders.

VIII. ADVANTAGES

Flexibility: Wireless systems allow for easy installation and reconfiguration since they don't require physical wiring. This makes them ideal for temporary setups or for locations where wiring is impractical or costly.

Scalability: Wireless systems can easily accommodate expansion or changes in the layout without the need for extensive rewiring. Additional components can be added or moved as needed, making them highly adaptable to evolving needs.

Remote Access and Control: Many wireless announcement systems can be controlled remotely using smartphones, tablets, or computers. This allows for convenient management of announcements, scheduling, and volume control from anywhere with an internet connection.

IX. RESULTS

The result of the proposed method is a wirelessly display of the message on the LCD screen. The output helps us to analyse that the result which was intended to achieve is so successful. The whole process can be described from the transmitter and receiver section. The Bluetooth module receives a message from the authorized mobile phone and the message is extracted by the microcontroller from the Bluetooth module and is displayed on the matrix display board. Serial to parallel communication is used for the entire process from Bluetooth module to Microcontroller and from microcontroller to the matrix display & for the acknowledgement LCD display is used.

X. CONCLUSIONS

Wireless electronic display systems offer a versatile and efficient solution for transmitting digital content to displays without the need for physical connections. These systems enhance flexibility in placement, simplify installation, and reduce cable clutter, making them ideal for various applications such as digital signage, advertising, and public information displays. With advancements in wireless technology, these systems provide high-resolution displays, real-time updates, and remote management, ensuring effective and dynamic content delivery. The "Wireless Electronic Display System" project embodies a significant advancement in the realm of information display technologies. By replacing traditional wired systems with wireless solutions, it offers numerous benefits such as enhanced flexibility, ease of installation, and scalability. This project successfully addresses the limitations of conventional display setups, providing a modern alternative that can be adapted to various environments and applications. The findings and developments from this project underscore the potential for wireless electronic displays to transform how information is transmitted and presented.

A key outcome of this project is the demonstration of real-time data transmission capabilities. The ability to update information instantaneously across multiple displays is particularly valuable in dynamic environments such as educational institutions, advertising sectors, and public information systems. This feature ensures that all connected screens display the most current information, improving communication efficiency and effectiveness. The project's success in achieving real-time data synchronization highlights the practical advantages of wireless display systems over their wired counterparts. Another significant conclusion from this project is the emphasis on low power consumption and robust security measures. The system's design prioritizes energy efficiency, making it suitable for applications where power usage is a critical concern, such as in smart homes and remote installations. Additionally, the incorporation of advanced security protocols ensures the integrity and confidentiality of the transmitted data. By addressing these critical aspects, the project demonstrates that wireless electronic display systems can be both environmentally sustainable and secure.

The versatility of the wireless electronic display system is evident from its wide range of potential applications. In educational settings, it facilitates seamless information sharing and enhances student engagement. In the advertising industry, it streamlines the process of updating content across multiple locations. For public

information dissemination, it ensures timely and accurate communication to the public. In smart homes, it integrates with other IoT devices to provide a cohesive and interactive user experience. These diverse applications underscore the system's adaptability and its potential to meet the evolving needs of different sectors. In conclusion, the “Wireless Electronic Display System” project represents a significant step forward in display technology. It successfully addresses the challenges associated with traditional wired systems, offering a more efficient, adaptable, and secure alternative. The project's findings highlight the practical benefits of wireless electronic displays, including real-time data transmission, low power consumption, and robust security. As technology continues to advance, wireless display systems are poised to play an increasingly important role in various industries, enhancing communication and information dissemination in innovative and impactful ways.

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