

LED Screen That Can Display Scrolling Text Controlled Via a Smartphone

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Abstract

With the rapid advancement of smart technologies, the integration of smartphone-controlled devices has become an essential aspect of modern digital communication. This paper presents the development and implementation of a smartphone-controlled LED display capable of displaying scrolling text. The system utilizes a microcontroller-based architecture, such as ESP32 or Arduino, in conjunction with an LED matrix to showcase dynamic text messages. panel Communication between the smartphone and the display is achieved through wireless protocols like Bluetooth or Wi-Fi, enabling real-time message updates. The proposed system offers a cost-effective and user-friendly solution for applications such as digital signage, advertising, and real-time information broadcasting. The paper also discusses the hardware design, software implementation, and potential improvements for future advancements.

Key words: Smart technologies, Smartphone-controlled devices, Digital communication.

1. Introduction

In the era of the Internet of Things (IoT), wireless control and digital displays have significantly improved communication methods across various industries. LED scrolling displays are widely used in advertising, public information systems, and smart home applications. Traditional LED displays require complex programming interfaces, making them difficult for non-technical users to operate. This research aims to develop a smartphonecontrolled LED display that allows users to input and modify scrolling text messages in real time via a mobile application. By leveraging microcontrollers like ESP32 and wireless communication protocols such as Wi-Fi and Bluetooth, the proposed system offers a highly interactive and customizable platform.

2. Methodology

The implementation of this project follows a structured approach, beginning with discussions on its objectives based on daily requirements. Practical applications are explored through YouTube videos and research papers to understand real-world relevance. Existing scheduling patterns are analyzed and modified to enhance efficiency. Feasibility studies are conducted through consultations with guides, reference materials, and market surveys for resource availability. Suitable electronic components are identified, followed by the design of a prototype block diagram. The interfacing of essential modules, including a buzzer, sensors, and a voice synthesis module, with an Arduino controller is planned. Energy-efficient components are selected to optimize performance. The software platform is developed using programming languages to handle real-time data. Finally, all components are assembled, wired, and tested to ensure the prototype functions as intended.

3. System Design and Implementation

3.1 Hardware Components

• **Microcontroller:** Arduino UNO R3 for handling communication and text display.

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Fig 1 : Arduino UNO R3

• LED Matrix Display: P10 panel for visualizing scrolling text.



Fig 2: P10 LED

• **Communication Module:** Built-in Wi-Fi/Bluetooth in R3 or an external HC-05 Bluetooth module for Arduino.



Fig 3 : Bluetooth Module

• **Power Supply:** 5V/12V adapter depending on the LED panel specifications.

3.2 Software Development

- **Mobile Application:** Google assistant for sending text commands.
- Microcontroller Firmware: Programmed using Arduino IDE with relevant libraries (DMD.h, TimerOne.h, SPI.h, etc.).
- **Communication Protocol:** Serial data transmission over Bluetooth to receive user input.

3.3 Working Principle

The user enters text into the mobile application, which transmits the message to the microcontroller over a

wireless network. The microcontroller processes the input and displays the text on the LED matrix panel while executing a scrolling function. The display continuously updates as new messages are received.



Fig 4: Block Diagram of LED screen that can display scrolling text controlled via a smartphone



Schematic Diagram

4. Applications and Benefits

- Advertising and Marketing: Businesses can update promotional messages remotely without manual reconfiguration.
- **Public Information Systems:** Displaying real-time announcements at transportation hubs, schools, and hospitals.
- Smart Home Integration: Personalized messages for notifications, reminders, or decorative lighting.
- **Event Management:** Live message updates for conferences, concerts, and exhibitions.

5. Future Enhancements

- **Cloud Integration:** Storing and fetching messages from an IoT cloud platform.
- Voice and Gesture Control: Implementing AIdriven interfaces for user input.
- **Multilingual Support:** Automatic language translation for global communication.



• **Energy Optimization:** Implementing adaptive brightness control for power efficiency.

6. Conclusion

The proposed smartphone-controlled LED scrolling display system provides an innovative and flexible approach to dynamic text visualization. With the ability to update messages in real-time via a smartphone, it eliminates the need for complex programming and manual adjustments. The system's scalability and ease of use make it suitable for commercial, educational, and personal applications. Future research will focus on integrating AI-based voice commands and cloud connectivity to enhance the functionality of the display. This technology contributes to the evolution of digital signage, fostering smarter and more interactive communication solutions.

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