WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Arduino Based Message Moving Display using Bluetooth Technology

[1]P.C Amalu and [2]O. Olabisi

[1]Department of Physics, Ajayi Crowther University, Oyo, Nigeria.
[2]Department of Science Laboratory Technology, Lautech Ogbomoso, Oyo State, Nigeria.
Email: ***oolabisi@lautech.edu.ng***

ABSTRACT

This article explores the development of an Arduino-based message moving display using Bluetooth technology. The integration of Arduino, an open-source electronics platform, with Bluetooth enables wireless communication and data exchange for remote control and content updates. The system comprises an Arduino microcontroller, a Bluetooth module, LED matrix or LED strips, and a power supply. By programming the Arduino to interpret incoming messages and control the LED display, users can send customized content in real-time via a mobile application or software. The Arduino-based display finds applications in various settings such as retail stores, transportation hubs, educational institutions, and public spaces. The benefits include flexibility in content updates, cost-effectiveness compared to proprietary systems, and enhanced user engagement through the moving message effect. This Arduino-based moving message display using Bluetooth technology provides an efficient and interactive solution for effective information dissemination in dynamic environments.

Keywords*: LED display, Arduino-based, Matrix, Bluetooth Technology, Wireless Communication.*

1.0 INTRODUCTION

Communication plays a vital role in our lives, and it is crucial to maintain continuous contact with one another. It involves intentionally exchanging information through various available or preferred technical or conventional methods, requiring a sender, a message, and a recipient [1]. In the context of educational institutions, the LED display system is designed to present real-time or periodic information throughout the working hours, specifically targeting colleges and universities [2]. In today's digital era, advertisements and information are commonly displayed on moving or scrolling digital screens. However, many institutions still rely on traditional wooden boards to communicate information to their students. This approach often leads to overcrowding, damage, obstructions, chaos, and compliance issues[3]. This project aim to address these problems by developing a digital board using LED technology and readily available materials, enabling departments and faculties across various institutions to easily disseminate information. The objective of this project is to develop an LED-based scrolling display that utilizes Bluetooth technology. This display will enable wireless communication and control, allowing for seamless and convenient dissemination of information. By incorporating Bluetooth technology into the LED display, users will be able to remotely update the content displayed on the screen. This wireless functionality eliminates the need for physical connections or manual interventions, making it a flexible and user-friendly solution. The scrolling display will have the capability to receive data and messages from compatible devices such as smartphones, tablets, or computers[4,5]. Through a dedicated mobile application or software, users will be able to send customized content, announcements, or notifications to the LED display in real-time. This technology offers numerous advantages, including improved efficiency, reduced maintenance efforts, and increased versatility. The LED-based scrolling display using Bluetooth technology can be employed in various settings such as educational institutions, transportation hubs, retail stores, or public spaces where the dissemination of timely information is crucial[6,7,8].

2.0 SYSTEM FUNCTIONALITY AND DESCRIPTION

Bluetooth Technology:

Bluetooth technology is a wireless communication protocol that enables devices to connect and exchange data over short distances. It operates on the 2.4 GHz frequency band and supports secure and efficient data transmission. By incorporating Bluetooth technology into LED-based scrolling displays, a new level of flexibility and control is achieved.

Wireless Communication and Control:

The integration of Bluetooth technology enables wireless communication and control of LED-based scrolling displays. Instead of relying on physical connections or manual interventions, users can remotely update the content displayed on the screen. This feature significantly reduces maintenance efforts and allows for seamless content management.

Customized Content and Real-time Updates:

Through a dedicated mobile application or software, users can send customized content, announcements, or notifications to the LED display in real-time. The Bluetooth connection establishes a direct link between the user's device and the display, facilitating quick and effortless content updates. This capability proves invaluable in dynamic environments where information needs to be updated frequently.

Ease of Installation and Flexibility:

LED-based scrolling displays utilizing Bluetooth technology offer ease of installation and flexibility. Since there are no physical connections required, the installation process becomes simpler and more efficient. The displays can be mounted in various locations without the constraints of wired connections, providing flexibility in placement and design.

Enhanced User Experience:

The integration of Bluetooth technology enhances the user experience of LED-based scrolling displays. Users can interact with the display through their smartphones or tablets, allowing for a more personalized and engaging experience. It opens up possibilities for interactive features such as touch-based interactions, gesture controls, or proximity-based triggering of content [9].

Applications and Benefits:

The LED-based scrolling displays using Bluetooth technology find applications in a wide range of settings. In educational institutions, these displays can be used to convey important announcements, event schedules, or emergency alerts. In retail stores, they can serve as advertising platforms or provide real-time information on promotions and discounts. Transportation hubs can utilize them for displaying arrival and departure schedules, platform information, or public service announcements. The benefits include improved efficiency, reduced maintenance costs, enhanced communication, and a more engaging experience for users [10,11].

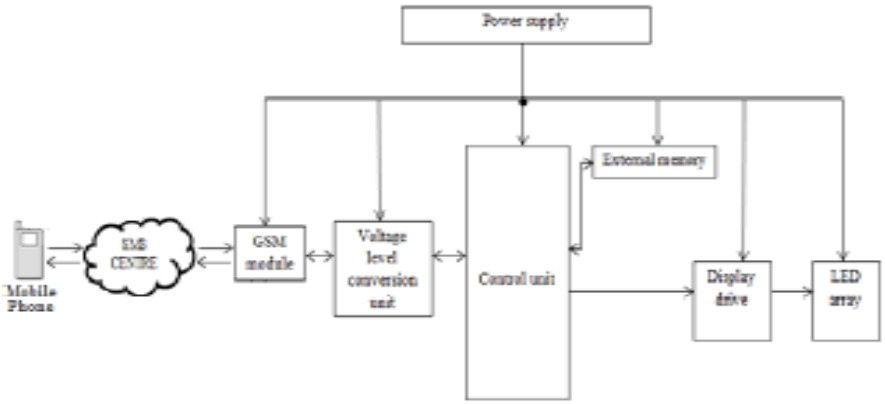

Figure 1: Block diagram of message moving display board [12]

3.0 METHODOLOGY

Hardware

Arduino board

Bluetooth module (HC-05)

LED matrix display

Jumper wires

Breadboard and PCB (Printed Circuit Board)

Power supply

Resistors

The Bluetooth module was connected to the Arduino board using jumper wires. The TX (transmit) pin of the Bluetooth module is connected to the RX (receive) pin of the Arduino, and vice versa.

The LED was connected to the Arduino board through the appropriate pins (data, clock, and latch pins) from the display to the Arduino. Then adriuuno was properly installed Install the Arduino IDE (Integrated Development Environment)

Arduino code:

- Begin by including the necessary libraries for the LED matrix and the Bluetooth module.

- Set up the variables and pins required for the display and Bluetooth module.

- Initialize the Bluetooth module and set the baud rate.

- A function was created to receive and process messages from the Bluetooth module.

- This function read incoming characters and store them in a buffer until a complete message is received.

- Implement a function to update the LED matrix based on the received message.

- This function interpret the received message and control the display accordingly. In the main loop of the Arduino code, call the function to receive and process messages from the Bluetooth module continuously.

- Inside the loop, call the function to update the LED matrix as needed.

- Upload the code to the Arduino board:

- Arduino board was connected to computer using a USB cable.

- "Upload" button was clicked in the Arduino IDE to compile and upload the code to the Arduino board.

- The correct board and port were selected.

Testing the system:

-Power on the Arduino board and that the Bluetooth module is properly connected.

- Mobile device was paired with the Bluetooth module on the Arduino.

- A Bluetooth terminal app on mobile device was used to send messages to the Arduino.

-The Arduino receive the messages and update the LED matrix or LED strip accordingly.

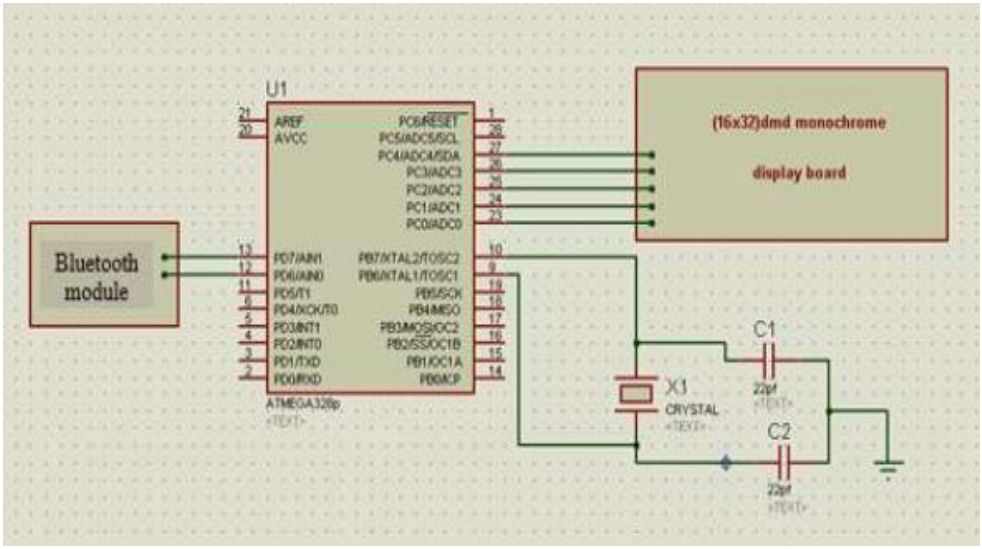

Figure 2: Circuit diagram of the message moving display board [13]

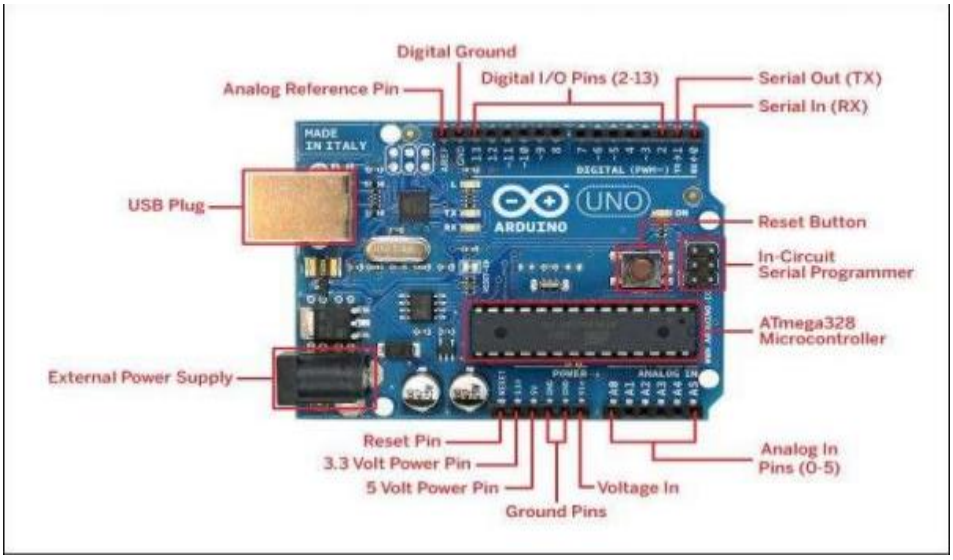

Figure 3: Bluetooth module connected [14]

Figure 4: Front view of Arduino Based moving message display board

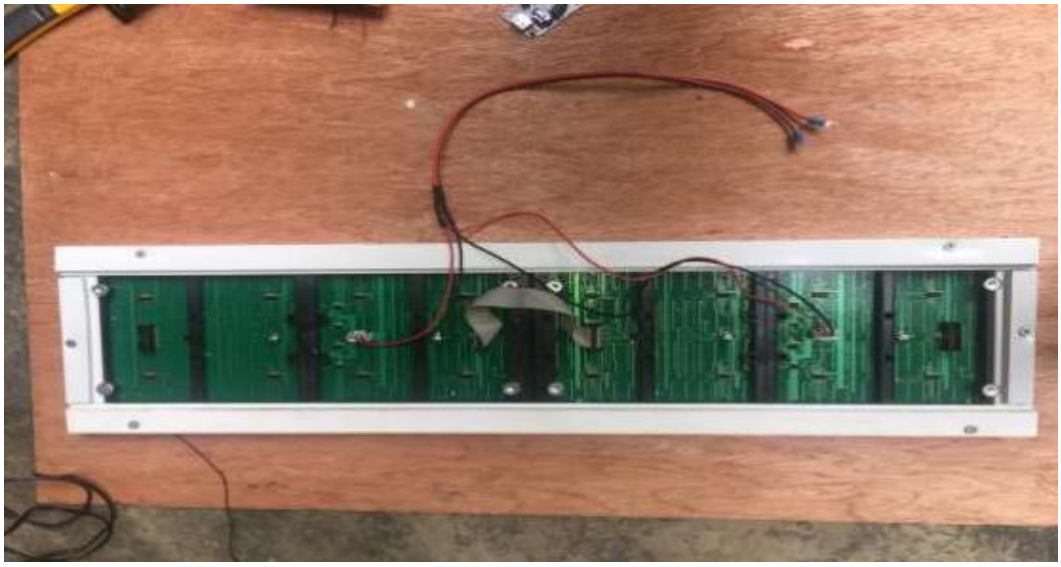

Figure 5: Back View of the Bluetooth Messge Moving Display.

4.0 RESULTS AND DISCUSSION

Once the project was completed, it was activated, and a transmission was initiated through the Android smartphone equiped with a Bluetooth software application resembling a scrolling display board. The transmitted message was cross-referenced with the message sent via the Bluetooth application on the phone, resulting in message moving display board visibly presenting the transmitted message

Bluetooth Communication: The Bluetooth module on the Arduino board enables wireless communication between the Arduino and a Bluetooth-enabled device, such as a smartphone or tablet. The system should be able to establish a reliable connection with the Bluetooth module and receive messages sent from the connected device.

Message Reception: The Arduino code should be able to receive messages sent over Bluetooth from the connected device. The received messages may include text, commands, or any other data required to control the moving message display.

Message Processing: The Arduino code should interpret the received messages and extract the necessary information. It should process the messages to determine the content and desired display behavior. This could involve parsing the text, converting it to the appropriate format for the LED matrix or LED strip, and extracting commands for effects like scrolling, color changes, or animations.

Display Control: Based on the received and processed messages, the Arduino code should control the LED matrix or LED strip display accordingly. It should update the display to show the desired text, apply any specified effects or animations, and ensure smooth scrolling or transitions between messages.

User Interaction: The Bluetooth terminal app or software on the connected device should allow users to input and send messages to the Arduino. Users can type messages on their device and send them wirelessly to the Arduino, which will update the display accordingly. This provides a user-friendly interface for controlling the moving message display.

Reliability and Stability: The system should operate reliably and consistently, maintaining a stable Bluetooth connection and accurately displaying the received messages. It should handle various input scenarios, such as messages of different lengths, special characters, or commands, without encountering errors or unexpected behavior.

Customizability: The Arduino-based moving message display using Bluetooth technology allows for customization. Users can modify the Arduino code to implement additional features or functionalities based on their specific requirements. For example, they can add support for different LED matrix or LED strip types, incorporate additional sensors or input methods, or expand the display capabilities.

5.0 CONCLUSION

The research work presented a meticulously designed and implemented GSM-based notice board circuit, which demonstrated efficiency and cost-effectiveness. Through the utilization of a GSM network, text messages sent from an authorized mobile phone were received by a GSM modem and promptly displayed on the LED display board. The wireless network implementation eliminated the need for cumbersome wired connections and manual reprogramming of the microcontroller for each new message display. The design leveraged microcontrollers to reduce the system's size, resulting in a compact and portable form factor. The use of two AT89C52 microcontrollers significantly enhanced the processing speed and message display capabilities. Moreover, the design proved to be economically viable by employing affordable components such as LEDs, Vero board, microcontrollers, and power supply. This research model offers an efficient solution for instant information transfer in various settings, including cinemas, restaurants, schools, public transport, railways, airports, banks, with minimal errors and maintenance requirements.

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