WIRLESS MESSAGE DISPLAY SYSTEM

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Content

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Abstract

The Wireless Message Display System is a project aimed at creating a wireless communication system that receives messages and displays them on an LCD screen. The system utilizes an Arduino microcontroller and a wireless module to enable wireless communication between a central unit and remote devices. The received messages are displayed on a 16x2 Liquid Crystal display, providing a convenient and efficient way to relay information wirelessly in various environments.

The objectives of the project are to develop a wireless communication system, display messages on an LCD screen, enable real-time message updates, incorporate visual and audible notifications, implement message scrolling functionality, create a user-friendly interface, ensure system reliability and stability, and allow for future enhancements.

The hardware components used in the project include an Arduino Uno, a 16x2 LCD display, a Bluetooth module HC-05, a buzzer, an LED, connecting wires, a breadboard, resistors, and a capacitor.

The project utilizes software libraries such as Liquid Crystal for controlling the LCD display and Software Serial for serial communication with the wireless module.

The project offers a reliable and efficient solution for wireless message communication, providing real-time information display and room for future enhancements and expansions.

Introduction

The Wireless Message Display System is a project aimed at creating a wireless communication system that receives messages and displays them on an LCD screen. The system is built using an Arduino microcontroller, which communicates with a wireless module to receive messages wirelessly. The received messages are then displayed on a 16x2 Liquid Crystal display. The project provides an efficient and convenient way to relay messages wirelessly in various environments.

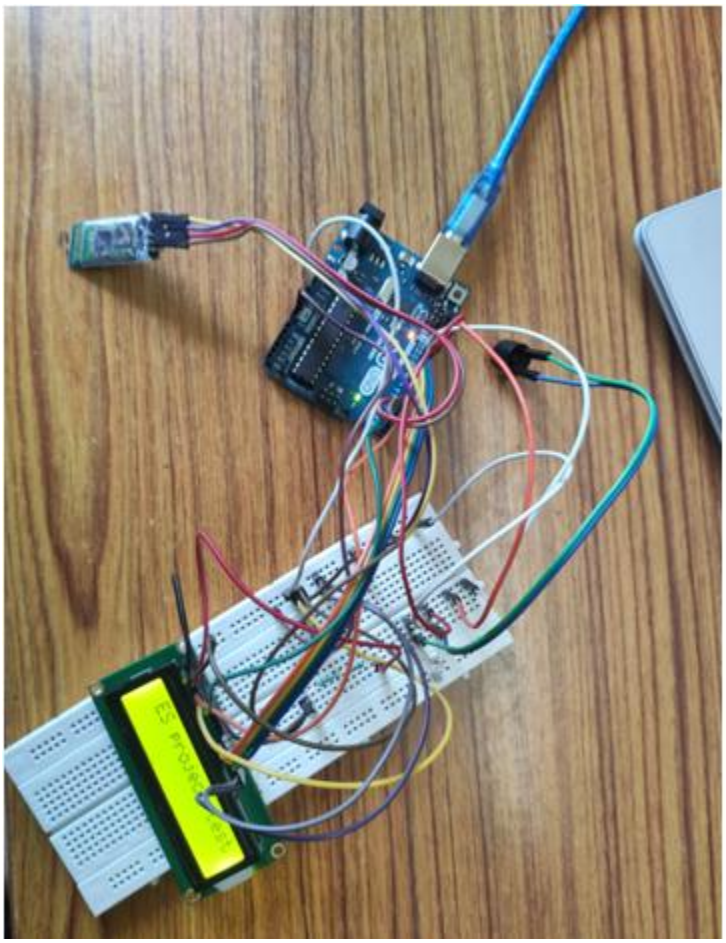

Figure i: A picture of Wireless Message Displaying System

Objective

The objectives of the Wireless Message Display System project are:

- Develop a wireless communication system: The primary objective is to design a system that enables wireless communication between a central unit (Arduino) and a remote device (e.g., computer, smartphone, another Arduino). The system should establish a reliable and efficient means of transmitting messages wirelessly.

- Display messages on an LCD screen: Implement a mechanism to display received messages on an LCD screen. The objective is to provide a clear and legible display that can effectively convey information to users.

- Real-time message updates: Enable real-time updates of messages on the LCD screen. Messages should be dynamically refreshed as new data is received, allowing for timely information display.

- Visual and audible notifications: Incorporate visual and audible notifications to draw attention to new messages. The system should utilize an LED and a buzzer to provide clear indications of message arrival, ensuring that users are alerted to new information.

- Message scrolling functionality: Implement a scrolling mechanism for messages that exceed the display's character limit. This objective allows for the continuous display of longer messages, ensuring that users can read complete messages regardless of their length.

- User-friendly interface: Develop a user-friendly interface that simplifies message display and management. The objective is to make it easy for users to interact with the system, such as initializing the display, clearing old messages, or navigating through different messages.

- System reliability and stability: Ensure that the Wireless Message Display System operates reliably and consistently. The objective is to create a robust system that can handle wireless communication without significant disruptions or data loss.

- Scope for future enhancements: Design the system with the potential for future enhancements and expansions. The objective is to develop a flexible

architecture that allows for additional features, such as network connectivity, message formatting, or scheduling, to be integrated into the system in the future.

- By setting these objectives, the project aims to create a functional and versatile Wireless Message Display System that can effectively transmit, display, and manage wireless messages in real-time, while also providing room for future growth and improvements.

Hardware Components

The project requires the following hardware components:

- Arduino Uno
- 16x2 LCD display
- Bluetooth module HC-05
- Buzzer
- LED
- Connecting wires
- Breadboard
- Resistors

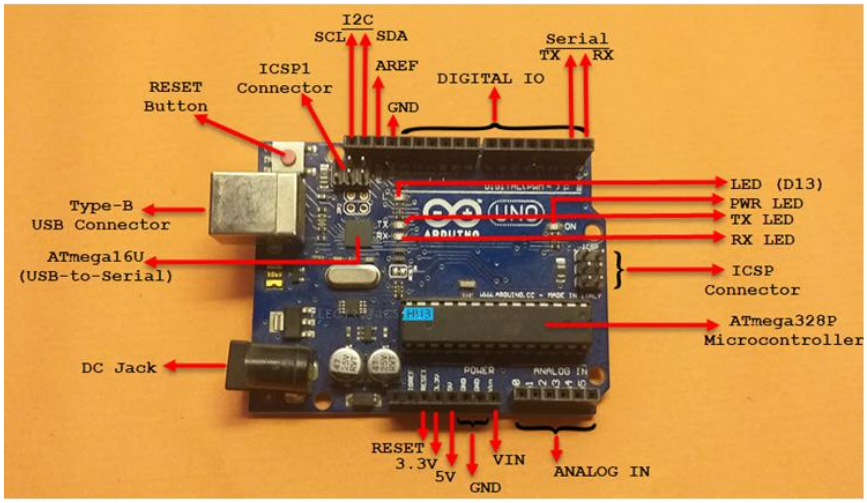

Fig. ii(a) : picture of an Arduino Uno

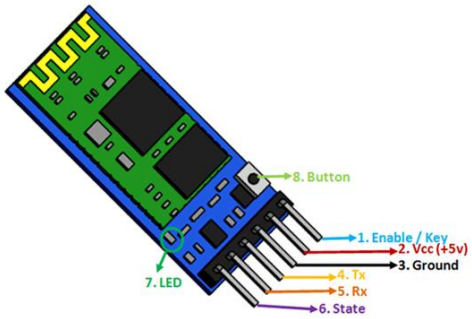

Fig. ii(b) : diagram of a Bluetooth module

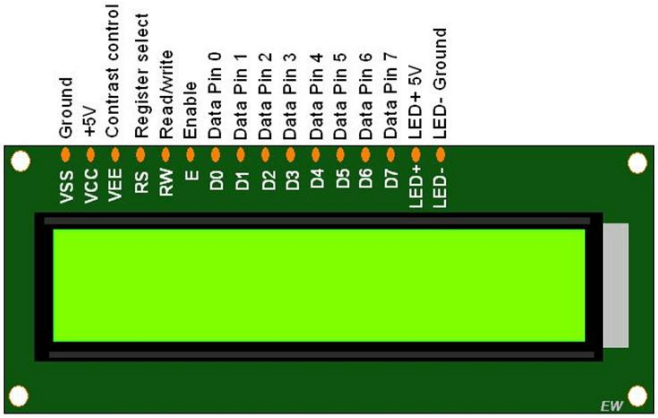

Fig. ii(c): diagram of a 16 x 2 LCD

Fig. ii(d): picture of a Buzzer

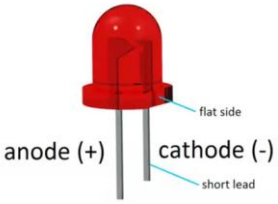

Fig. ii(e): picture of a LCD

Hardware Description

The hardware description of the Wireless Message Display System project includes the components used in the system. Here are the key hardware components involved:

- Arduino Board:
  - The central control unit of the system, responsible for processing and managing the incoming wireless messages and controlling the connected hardware.
  - I Arduino Uno has been used

- LCD Display:
  - A two-line alphanumeric LCD display used to visually present the received messages.
  - The LCD display module typically consists of a 16x2 character display, capable of displaying 16 characters per line and 2 lines of text.

- Wireless Module (Bluetooth Module):
  - A wireless communication module that enables the transmission of messages from a remote device to the Arduino board.
  - HC-05 has been used

- LED (Light-Emitting Diode):
  - An indicator LED that provides visual feedback to indicate the arrival of new messages.
  - It is connected to a digital pin of the Arduino board and is controlled to turn on or off based on the arrival of new messages.

- Buzzer:
  - An audible buzzer that produces a short beep to alert the user about new messages.
  - It is connected to a digital pin of the Arduino board and It is controlled to emit sound signals based on certain events or conditions.

- Connection Wires:
  - Various jumper wires or cables are used to establish connections between the Arduino board and other components.
  - The wires ensure the proper flow of data and power between the components, following the circuit diagram.

- Power Supply:
    - The Arduino board and other components require a power supply to operate.
    - The power supply is provided by a USB connection to a computer or a dedicated power source, such as a battery pack or an external power adapter.
- Breadboard:
    - A breadboard is a device used in electronics prototyping to create temporary electrical connections without soldering. It consists of a grid of holes where components and wires can be inserted and interconnected.
- Resistor:
    - A resistor is an electronic component that restricts or limits the flow of electric current in a circuit. It is commonly used to control the amount of current or voltage in a circuit and is characterized by its resistance value, measured in ohms.

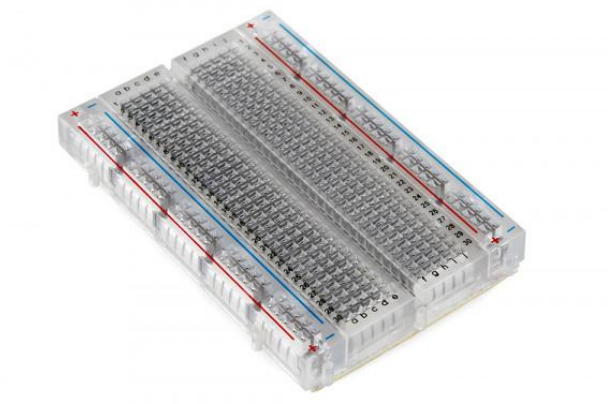

Fig. ii(f): picture of a breadboard

Fig. ii(g): picture of connecting wires

Circuit Diagram

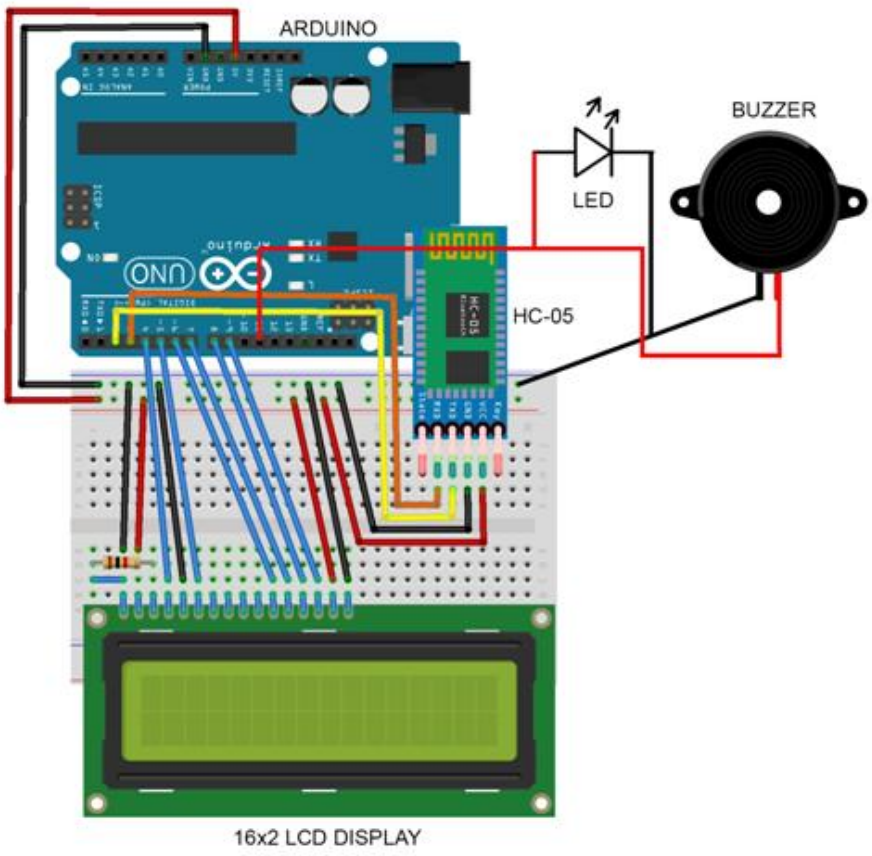

Fig. iii : Circuit diagram of the *Wireless Message Display* system

Design Consideration

During the design phase of the Wireless Message Display System project, several considerations were taken into account to ensure the successful implementation of the system. Here are some design considerations that were addressed:

- Wireless Communication Protocol:
  The selection of a suitable wireless communication protocol was a crucial consideration. Factors such as range, data rate, power consumption, and availability of compatible modules were taken into account. The decision to use Software Serial and a specific baud rate (9600) was made based on the project's requirements and the capabilities of the hardware components.

- Hardware Components:
  Careful selection of hardware components was essential for the project's success. Considerations included compatibility with the Arduino board, availability, cost, and functionality. The use of an Arduino board, *Liquid-Crystal* library for the LCD display, Software *Seriallibrary* for serial communication, and appropriate pins for connections were chosen to ensure seamless integration and reliable performance.

- User Interface:
  Designing a user-friendly interface was important to facilitate ease of use. The LCD display was chosen for its simplicity and readability. Considerations included the size and type of the display, ensuring it had sufficient characters and lines to accommodate messages effectively. The clear and legible font style was selected to enhance readability.

- Visual and Audible Feedback:
  To provide clear notifications, visual and audible feedback mechanisms were incorporated. The LED and buzzer were chosen for their simplicity and effectiveness in drawing attention. The LED was programmed to blink, while the buzzer emitted a short beep to indicate the arrival of new messages.

- Message Scrolling:
  The ability to handle messages longer than the display's character limit was an important consideration. The scrolling mechanism was implemented to ensure complete message visibility by continuously shifting the displayed text. The scrolling speed and delay between steps were adjusted to provide an optimal reading experience.

- Power Management:
  Efficient power management was taken into account to ensure the system's reliability and longevity. The use of appropriate pins and configuration for power-consuming components, such as the LED and buzzer, was implemented. Techniques like setting pins to LOW or using sleep modes were considered to minimize power consumption during idle periods.

- System Integration and Expansion:
  The system was designed with modularity and expandability in mind. This included using well-documented libraries, modular coding practices, and standard hardware interfaces. Such an approach allows for easy integration of additional features or future enhancements, such as network connectivity, message formatting, or scheduling capabilities.

- Robustness and Error Handling:
  To enhance system reliability, error handling mechanisms were implemented. These included validating received messages, handling communication errors or interruptions, and providing appropriate feedback or error messages to the user. Error handling routines were designed to ensure the system gracefully recovers from unexpected situations.

  By considering these design aspects, the Wireless Message Display System was designed to effectively handle wireless communication, provide a user-friendly interface, deliver clear notifications, manage long messages, optimize power usage, allow for system expansion, and ensure reliable operation.

Software Libraries

The project utilizes the following libraries:

- ***LiquidCrystal*:** This library provides functions to control and manipulate the LCD display.

- ***SoftwareSerial*:** This library enables software-based serial communication on specific digital pins of the Arduino, allowing communication with the wireless module.

Source Code

```
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>

LiquidCrystal lcd(4, 5, 6, 7, 8, 9);
SoftwareSerial mySerial(2, 3);   //(RX, TX);

String val = "No Data";
String oldval;
String newval = "No Data";
int i = 0;

const int ledBuzzerPin = 11;     // LED connected to pin 11

void setup() {
  lcd.begin(16,2);
  mySerial.begin(9600);
  Serial.begin(9600);
  lcd.setCursor(0, 0);
  lcd.print("WIRELESS MESSAGE");
  lcd.setCursor(0, 1);
  lcd.print(" DISPLAY ");
  delay(3000);
  lcd.clear();
  lcd.print("BY: CSM21050");
  lcd.setCursor(0, 1);

  lcd.print("CSM21007,CSM21044");
  delay(3000);

  pinMode(ledBuzzerPin, OUTPUT);
}

void loop() {
  if (mySerial.available()) {
    val = mySerial.readString();
    val.trim();
    Serial.println(val);

    if (val != oldval) {
      newval = val;
```

```
      digitalWrite(ledBuzzerPin, HIGH);
      delay(800);  // Adjust the duration of the blink as needed
      digitalWrite(ledBuzzerPin, LOW);
    }
  }

  lcd.clear();
  lcd.setCursor(i, 0);
  lcd.print(newval);
  i++;
  if (i >= newval.length() + 16) {
    i = 0;
  }

  delay(500);  // Adjust the delay between scrolling steps as needed

  oldval = val;
}
```

Functionality and Workflow

The Wireless Message Display System follows the following workflow:

Initialization:

- The *LiquidCrystal* library is used to initialize the LCD display with the necessary pin configurations.
- The *SoftwareSerial* library is used to initialize the software serial communication with the wireless module by specifying the RX (receive) and TX (transmit) pins.
- Serial communication is established with the computer for debugging purposes.

Display Initialization:

- The LCD display shows a welcome message to introduce the purpose of the system.
- After a few seconds, the display shows the names of the project contributors as a credit acknowledgment.

Main Loop:

- The Arduino continuously checks for incoming data from the wireless module using the *mySerial.available()* function.
- If data is available, it is read using *mySerial.readString()* and stored in the variable "*val*".
- Leading and trailing white spaces are removed from the received message using the *val.trim()* function.
- The received message is printed to the serial monitor using *Serial.println(val)* for debugging purposes.

Message Comparison and Alert:

- The received message is compared with the previous message stored in the variable "*oldval*" to determine if a new message has arrived.
- If the new message is different from the old message, it is considered a new message, and the following actions are performed:
- The new message is assigned to the variable "*newval*".
- The *buzzerPin* and *ledPin* are set to HIGH to activate the buzzer and LED as an alert.
- A delay of 800 milliseconds is provided to control the duration of the alert.
- The buzzer and LED are turned off by setting the pins to LOW.

Display Update:

- The LCD display is cleared using *lcd.clear()* to prepare for the new message.

- The cursor position is set to the current value of "*i*" using *lcd.setCursor(i, 0).*
- The new message is printed on the LCD display using *lcd.print(newval).*
- The " *i* " variable is incremented to scroll the message horizontally on the display.
- If the entire message has been displayed, the " *i* " value is reset to 0 to restart the scrolling.

Delay and Message Storage:

- A delay of 500 milliseconds is added to control the speed of scrolling and provide a pause between iterations.
- The *oldval* is updated with the current value of *val* to keep track of the previous message.

Project Image

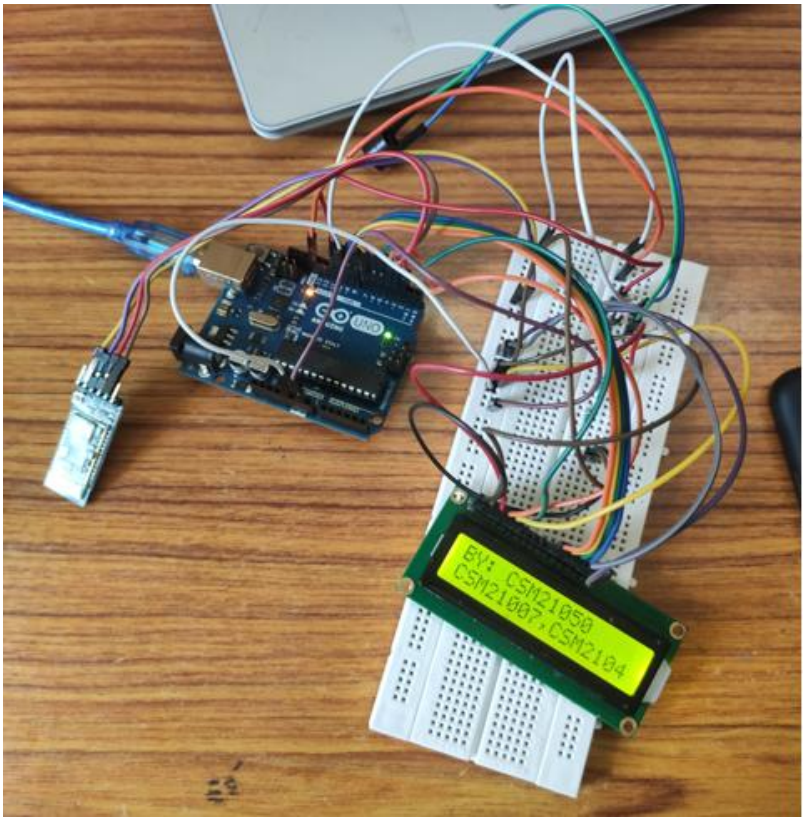

Fig. iv(a): Picture of *Wireless Message Display* project

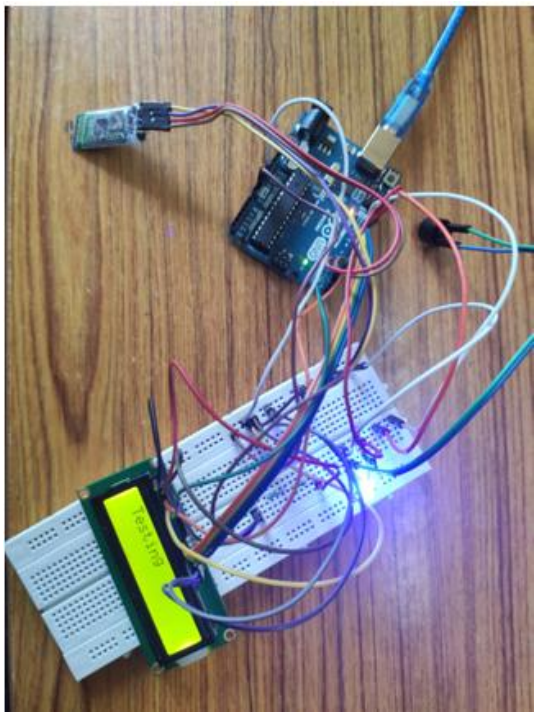

Fig. iv(b): picture of *Wireless Message Display* project

Application Areas

The Wireless Message Display System can be utilized in various applications where wireless communication and message display are required. Here are some examples:

Public Transportation Information System:
The system can be implemented in bus stations, train stations, or airports to display real-time information about arrivals, departures, delays, or any other relevant updates. Messages can be wirelessly transmitted to the display system, ensuring that passengers receive timely and accurate information.

Industrial Monitoring and Control:
In an industrial setting, the system can be used to display important messages related to machine status, production targets, maintenance schedules, or safety notifications. Messages can be sent wirelessly from control rooms or monitoring stations to provide real-time updates to operators or supervisors.

Advertising and Promotional Displays:
The system can be employed for advertising purposes in shopping malls, retail stores, or exhibition booths. Advertisers or store owners can wirelessly send promotional messages or offers to the display system, attracting the attention of potential customers and increasing sales.

Emergency Alert Systems:
The Wireless Message Display System can be integrated into emergency alert systems in public spaces, such as schools, hospitals, or government buildings. During emergency situations, messages can be wirelessly transmitted to the display system to provide instructions, evacuation routes, or safety precautions, ensuring effective communication and response.

Smart Home Notifications:
The system can be incorporated into a smart home setup, where messages related to security alerts, home automation events, or reminders can be wirelessly sent and displayed. This allows homeowners to receive important information at a glance, enhancing convenience and home management.

Event Information and Updates:
During conferences, exhibitions, or large-scale events, the system can serve as a central display for conveying event schedules, session updates, or important

announcements. Event organizers can wirelessly send messages to the display system, ensuring participants are well-informed and engaged.

Hospitality and Customer Service:
In hotels, restaurants, or customer service centres, the system can be utilized to display personalized messages for guests or customers. Messages such as welcome notes, reservation confirmations, or special offers can be wirelessly transmitted, enhancing the overall customer experience.

Campus or Building Navigation:
In educational institutions, corporate campuses, or large buildings, the system can assist in displaying navigational information. Messages can be wirelessly sent to guide students, employees, or visitors, providing directions, room numbers, or event locations.

These are just a few examples of how the Wireless Message Display System can be applied in different contexts. The versatility of the system allows for customization and adaptation to meet specific communication needs in various industries and environments

Future Extensions and Enhancements

The Wireless Message Display System project can be enhanced in several areas to improve its functionality and capabilities. Here are some potential improvement areas for future development:

Wireless Communication Range:
Consider utilizing wireless modules with extended communication ranges or exploring alternative wireless protocols to improve the range of communication between the wireless module and the Arduino. This would allow for the system to operate effectively over larger distances or in environments with potential signal interference.

Enhanced Message Formatting:
Expand the system's capability to handle various message formatting options, such as font styles, colors, or graphical elements. This would allow for more visually appealing and informative message displays, making the system suitable for applications where visual aesthetics are crucial, such as advertising or digital signage.

Multiple Display Support:
Implement the ability to connect and control multiple LCD displays simultaneously. This enhancement would enable the system to distribute messages across multiple locations or display different messages on different screens, expanding its usability in larger spaces or multi-room environments.

Interactive User Interface:
Integrate a user interface, such as buttons or a touchscreen, to allow users to interact with the system. This would enable functionalities like message selection, scrolling control, or message deletion, providing users with more control and flexibility in managing displayed messages.

Network Connectivity:
Incorporate network connectivity capabilities, such as Ethernet or Wi-Fi, to enable remote message management and updates. This would allow for centralized control of the display system, facilitating message scheduling, real-time updates, and remote monitoring, especially in applications that require frequent message changes or dynamic content.

Message Scheduling and Prioritization:
Implement a scheduling feature that enables the system to display messages at specific times or dates. This would be beneficial in applications where time-sensitive information needs to be displayed automatically, such as event schedules, time-bound promotions, or daily announcements. Additionally, incorporating message prioritization based on urgency or importance would ensure critical messages are displayed promptly.

Data Logging and Analytics:
Introduce a data logging capability to record incoming messages, timestamps, and other relevant information. This would allow for data analysis, usage monitoring, and performance evaluation of the system. It can provide insights into message frequency, peak periods, and user interactions, aiding in decision-making and system optimization.

Power Efficiency:
Implement power-saving techniques, such as sleep modes or power management algorithms, to optimize energy consumption. This would extend the system's battery life or reduce power usage when idle, making it more suitable for portable or battery-operated applications.

These improvement areas aim to enhance the functionality, versatility, and user experience of the Wireless Message Display System, making it more adaptable to a wider range of applications and providing additional features for customization and control.

Conclusion:

The Wireless Message Display System offers a practical solution for wirelessly receiving and displaying messages using an Arduino microcontroller and a wireless module. The system's ability to communicate wirelessly provides flexibility in various applications, such as remote control systems and also value detection systems in a particular Device or Embedded System Device.

Through the use of software libraries like *LiquidCrystal* and *SoftwareSerial*, the project has leveraged existing tools to simplify the development process and enhance functionality. The source code provided showcases the implementation of key functionalities, such as receiving and processing messages, displaying them on the LCD screen, and providing visual and audible feedback.

The Wireless Message Display System offers a reliable and efficient solution for wireless message communication, with real-time information display and potential for future expansions.

References

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