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IOT Based Digital Led Notice Board Using Arduino UNO

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ABSTRACT
This paper presents the implementation of a simple IoT-based wireless notice board. The proposed system utilizes Wi-Fi to communicate with a cloud database. The concept of a digital notice board begins with sending a message to the cloud using an Android mobile device. At the receiving end, an Arduino Uno equipped with an active internet connection is deployed and configured to receive incoming messages. Upon receiving a new message, the system alerts the connected LCD display, which then shows the message in real-time.

Keywords: IoT, Arduino Uno, Notice Board

1. INTRODUCTION

Smartphones have become an integral part of daily life, offering convenience, reliability, and user-friendly interfaces to perform various tasks. With the advancement of embedded systems and wireless technologies, communication with peripheral devices has become more efficient and widespread. Among these technologies, Wi-Fi-based wireless communication has found numerous applications, including the development of digital notice boards.

This paper presents the design and implementation of a simple, low-cost, IoT-based wireless notice board system. The system leverages Wi-Fi to transmit messages from a remote user to a digital notice board via cloud connectivity. The user sends alphanumeric messages using a smartphone application or any Personal Digital Assistant (PDA) capable of cloud-based or Wi-Fi communication.

At the receiving end, an Arduino Uno microcontroller, connected to the internet, is programmed to receive messages using Wi-Fi. Upon reception, it displays the messages on an LCD screen. The system supports both cloud-based and local Wi-Fi-based serial communication methods, with the Arduino Uno acting as a client device. It is programmed in C to handle data reception and control the LCD output.

By eliminating the need for manual updates, printing, and physical resources such as paper and ink, this wireless notice board system reduces operational costs and human effort. It enables the remote and instantaneous delivery of important information to intended recipients, making it ideal for institutions, offices, and public display systems.

2. PROPOSED SYSTEM

The proposed system utilizes serial communication to interface a cloud module with the Arduino Uno board. This setup is controlled through an Android application, which ensures that only authorized devices can send commands to the system. Once a stable connection is established between the IoT-based digital notice board and the cloud, users are able to send alphanumeric text messages remotely.

These messages are displayed on the notice board and can be updated at any time by simply sending a new message, which overwrites the previous one. This allows for real-time updates and flexible message management without the need for physical interaction with the hardware.

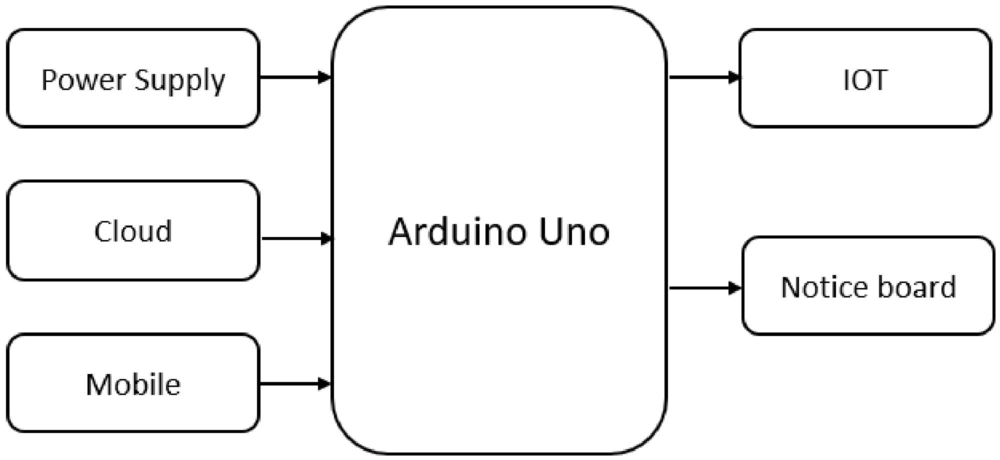

Figure 1. Proposed block diagram

This system operates over Wi-Fi, allowing users to send data to the notice board from anywhere in the world, as long as they have a valid internet connection on their device. Once a message is pushed via the cloud, it is received by the Arduino Uno, which processes the incoming data and displays the corresponding message on the connected LCD screen.

3. HARDWARE DESCRIPTION

3.1 Internet of Things (IoT)

The Internet of Things (IoT) is a technological paradigm in which physical objects—referred to as "smart objects"—are embedded with identification, sensing, networking, and data processing capabilities. These features enable them to connect with one another and exchange information over the internet.

A key enabler of IoT is cloud computing, which allows these smart devices to transmit data to the cloud. This ensures that data captured from various environments can be stored, accessed, and retrieved remotely, creating a smart, ubiquitous, and always-connected ecosystem.

Each IoT device typically has a unique identifier and an IP address, allowing it to have a virtual presence on the internet. Devices such as sensors and actuators not only collect environmental data but also provide real-time feedback and status updates. This real-time communication enhances system responsiveness and allows for remote monitoring and control.

The proliferation of large-scale embedded sensors and actuators has further enhanced the IoT ecosystem. These devices are capable of automatically gathering environmental data with minimal or no human intervention. As a result, IoT has become a critical tool for addressing complex technological challenges, enabling automation, and providing seamless access to information across multiple platforms.

3.2 Arduino

Arduino is an open-source electronics platform based on simple, flexible hardware and software integration. It is widely used for building digital devices and interactive systems. Arduino boards are designed to read inputs—such as sensor data—and convert them into outputs, such as triggering an alert or activating a device. Due to its ease of use, low cost, and extensive community support, Arduino is an ideal choice for rapid prototyping and educational purposes. In this project, the Arduino Uno is used to receive data from the cloud and control the LCD display accordingly.

Fig 2. Arduino board.

3.3 Liquid Crystal Display (LCD)

An LCD, or Liquid Crystal Display, is a flat-panel display technology that works by blocking light. It consists of two layers of polarized glass with a liquid crystal solution sandwiched between them. A backlight shines through the first layer, and the liquid crystals align to allow or block light in specific patterns, thereby forming visible characters or images. In this system, the LCD is used to display the alphanumeric messages received by the Arduino Uno, providing a real-time digital notice board interface.

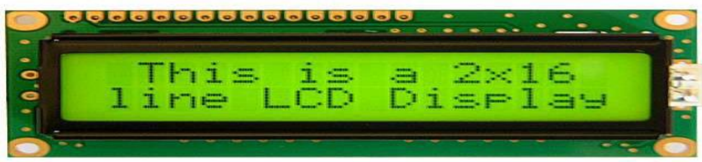

Figure 3. LCD display.

4 LEDART App:

How to install and synchronize the LED art app with the Wi-Fi-enabled controller. The LED art app enables users to control what is displayed on an LED screen. The Summary walks through the installation of the app from the Play Store, the connection of the mobile device to the controller, and the steps needed to configure the display properties, including width and height settings relevant to the LED screen.

The primary focus is to ensure that the app can successfully send information to the controller so that it appears on the display. Throughout the demonstration, the presenter emphasizes the importance of proper synchronization between the controller and the screen to ensure that programmed messages, like are displayed accurately. The video also explains that a countdown configuration does not work directly within this app alone, hinting at the necessity of additional software for such functions. In conclusion, the module provides a comprehensive insight into the use of the LED art app, troubleshooting common issues with synchronization, and highlights the upcoming modules where additional functionalities, like connecting the climate clock with a laptop for countdown features, will be discussed.

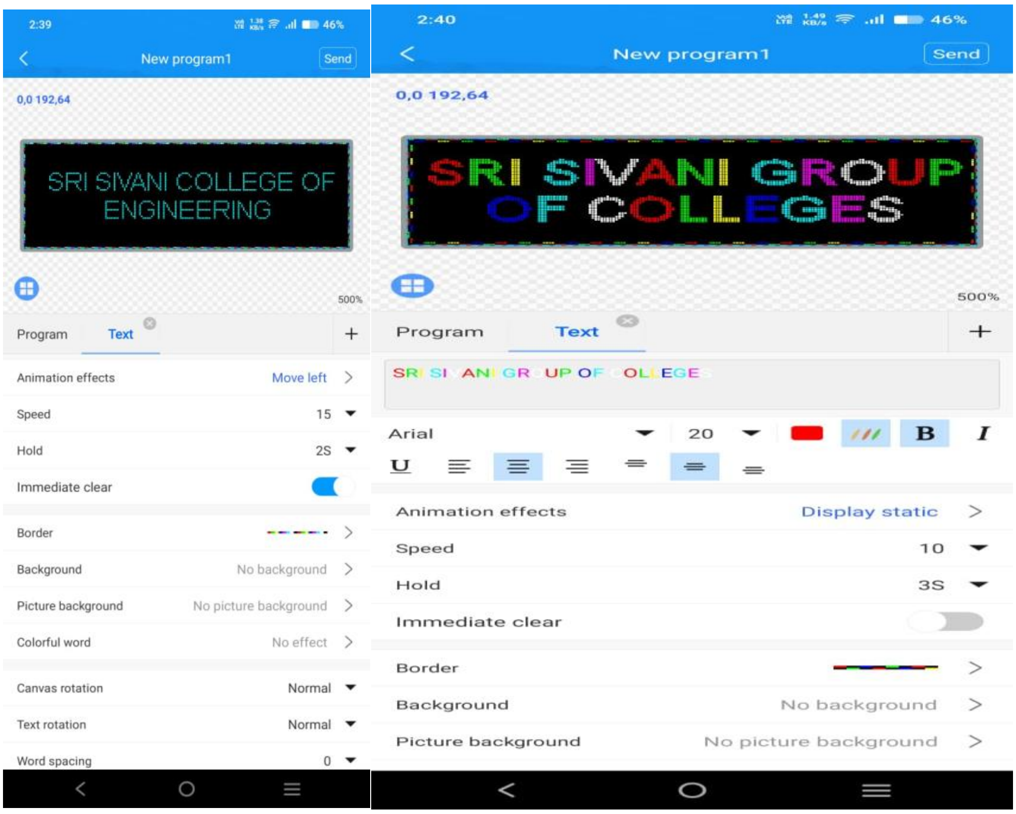

Fig4 Implementation in Software

Highlights

Installation Process: Install the LED art app from the Play Store efficiently.

Controller Connection: Connect the mobile device to the Wi-Fi-enabled controller.

Display Configuration: Details on entering specific dimensions (height and width of the LED) are elaborated on for proper configuration.

🔄 Synchronization Steps: The importance of synchronizing the controller with the display to ensure accurate information display is emphasized.

⏱ Message Programming: learn to program messages for display, demonstrating how to enter custom text like "Welcome to Ece ."

⚙ Troubleshooting: troubleshooting synchronization issues that may arise during the setup.

Key Insights

User-Friendly Setup: The LED art app is designed to be user-friendly, simplifying the installation process for individuals who may not be technically savvy. This reduces barriers to access technology, allowing for broader participation in tech-related projects.

Connectivity Importance: The requirement to connect the mobile device to the Wi-Fi controller emphasizes the evolving nature of smart displays and IoT (Internet of Things) integrations. This serves to illustrate how conventional technology can be enhanced through connectivity. 🛠 Configuring Displays: The dimensions entered into the app (96 width x 16 height) signify the need for personalized configuration for each setup. This tailored approach ensures that displays function as intended and meet specific project goals. 🔧 Critical Synchronization: The method of identifying when synchronization occurs (around combinations 35-40 in the video) reflects the often complex nature of tech integrations. Understanding this critical process is essential for developers and hobbyists alike. Dynamic Messaging: The ability to change messages displayed on the LED opens up numerous possibilities for real-time updates and dynamic information sharing, thereby enhancing the utility of such displays in various environments (e.g., events, public announcements). ❗ Need for Additional Software: The hint towards requiring additional software for countdown functionalities indicates a limitation of the current system. Understanding these limitations will inform users of the essential elements needed for complete setups in future projects. Broader Implications: The skills learned in this module are not just applicable to one project (the LED climate clock) but can be adapted for various scenarios, promoting renewable energy themes and climate awareness. In conclusion, this module serves as a foundational step for enthusiasts aiming to use LED technology creatively while also providing a practical skill set for real-world applications. It prepares users for future endeavors in LED display management and programming, emphasizing both the potential and the challenges inherent in such technology.

4.2 HD2020 LED Control System: Operation Manual

Introduction

The HD2020 LED Control System is designed to manage and control large-scale LED displays with advanced features for efficient operation. This system supports various content formats, flexible display options, and multiple communication methods, making it ideal for a wide range of LED signage applications.

System Requirements

Before starting the installation, ensure your system meets the following requirements:

- Operating System: Windows XP SP3, Win7, Win8, Win10.
- Memory: Minimum 4GB RAM.
- Disk Space: Minimum 1GB free disk space.
- Ports: RS232/RS485 (for serial connection), Ethernet (for network control), USB (for content transfer).

Installation

Download Software

1. Visit the official Huidu Technology website or your distributor's portal.

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2. Download the HD2020 Software compatible with your operating system.

Install the Software

1. Locate the downloaded installation file (e.g., HD2020_V1.3.2.1.exe).
2. Double-click to run the installation wizard.
3. Follow on-screen instructions and click Next to complete the installation.
4. Once installed, launch the software from the desktop shortcut or Start men

Follow the on screen prompts (Next) to complete the installation to complete the installation

Hardware Setup

Connecting the Controller

1. Connect the HD2020 controller to the LED display using an RS232, RS485, or Ethernet cable.
2. Ensure the controller is powered on and properly connected to the LED screen.

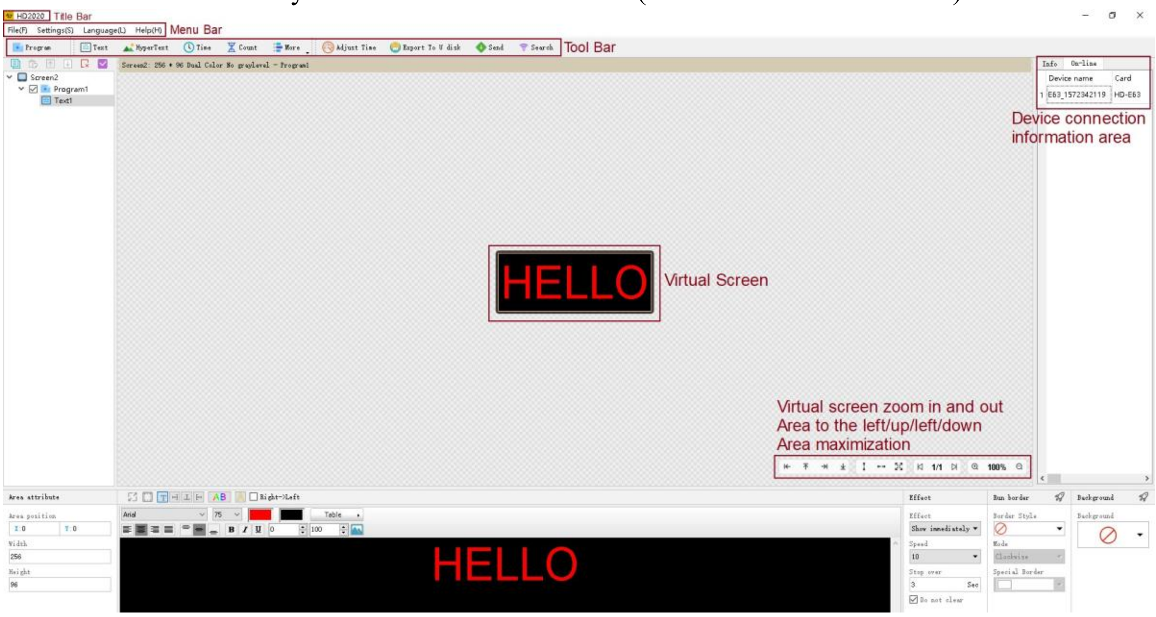
Communication Settings

1. Open the HD2020 software and navigate to the Communication Settings.
2. Select the correct communication port (RS232, RS485, or Network) that matches the connection type you're using.
3. Set the appropriate baud rate, IP address (for network connection), and other settings to match your LED hardware.

Software Configuration

Create a New Project

1. Open the HD2020 software.
2. Click on New Project to start a new LED display configuration.
3. Enter the dimensions of your display (number of pixels in height and width).
4. Choose your communication method (RS232/RS485 or Ethernet).



Upload Content

1. Navigate to the Media Library.
2. Upload your content (images, text, animations, etc.) using the Add Media button.
3. Arrange and configure content to fit your display layout.

Create and Schedule Programs

1. Go to the Program Management section.
2. Create a new program by selecting the content you want to display.
3. Schedule content to show at specific times (e.g., hourly, daily).
4. Set up automatic transitions and effects between different content pieces.

Display Settings

Adjust Brightness and Contrast

1. From the Display Settings menu, adjust the brightness and contrast to optimize visibility based on ambient light conditions.
2. Test different settings for optimal performance.

Control Content Layout

1. Use the Content Layout tab to adjust how content appears on your LED display.
2. Set up text scrolling, image display timing, and animation effects.

Advanced Features

Integrate Dynamic Data

1. Configure dynamic content such as time, temperature, and weather by connecting external data sources (e.g., internet API for weather updates).
2. Set up real-time data feeds to display information automatically.

Multi-Screen Control

1. The HD2020 supports controlling multiple LED displays at once.
2. Connect additional displays using the same communication method and configure them within the same software interface.

Fig. Final Results

Troubleshooting

Display Not Showing Content

- Check the physical connections between the controller and the display.
- Ensure the correct communication port is selected in the software settings.
- Restart the software and the controller to reset connections.

Connectivity Issues

- Verify that your serial or network connection is properly configured.
- If using Ethernet, ensure the correct IP address is set and the network cable is functioning.

- For Wi-Fi, ensure the router and controller are connected to the same network.

Conclusion

The IoT-based Digital LED Notice Board using Wi-Fi and Arduino Uno successfully achieves its objective of creating a modern, efficient, and remotely controllable messaging system. By integrating the Arduino Uno, ESP8266 Wi-Fi module, and an LED matrix display, the system allows users to upload, display, and update messages in real time through a web interface or mobile application.

Key outcomes of the project include:

- **RemoteCommunication:**
  The system facilitates effective remote communication, allowing users to update messages over the internet. This ensures timely dissemination of important information to large audiences without requiring physical access to the board.
- **User-FriendlyInterface:**
  Designed with simplicity in mind, the interface enables users with minimal technical skills to manage the system easily. This makes it practical for use in schools, offices, and public spaces where staff or students can update content independently.
- **Scalability and Customization:**
  While the current prototype supports a single LED matrix, the system architecture allows for future scalability. Additional matrices or enhanced features can be incorporated, making it adaptable for both small-scale and large-scale deployments.
- **Reliability and Performance:**
  The system demonstrated consistent and responsive performance, with minimal delay between message submission and display. Although occasional network connectivity issues were observed, they were effectively mitigated through software and configuration adjustments.

Overall, the project successfully showcases the integration of IoT and microcontroller technologies to modernize traditional notice boards. The result is a flexible, interactive, and cost-effective solution that enhances communication in various environments.

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