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Smart Digital Notice and Time Table Display System

J.SRAVANTHI[1], SAMINENI NAGESWARI[2] , SHAGALA AKSHARA[3] , KOTHAPALLY RAMAKRISHNA[4], YESHALA YASHWAN[5]

[1]Assistant Professor, Dept of ECE, TKR College of Engineering and Technology

[2,3,4,5] Student, Dept of ECE, TKR College of Engineering and Technology

Abstract - In educational institutions, traditional notice boards and manual timetable displays are often time-consuming, less interactive, and prone to delays in communication. To overcome these limitations, this project proposes a Smart Digital Notice and Time Table Display System that provides a modern, automated, and user-friendly solution. The system uses a digital display unit controlled by a microcontroller or Raspberry Pi/Arduino integrated with wireless communication (Wi-Fi/Bluetooth/IoT platform) for real-time updates.Authorized staff can upload notices, announcements, and timetable schedules through a web or mobile application, which are instantly reflected on the digital display screens. This ensures quick dissemination of information without manual intervention, reducing paper usage and improving efficiency. The system can also support multimedia content such as images, alerts, and emergency notifications, making communication more effective.By combining automation, IoT, and digital display technologies, the Smart Digital Notice and Time Table Display System provides a reliable, eco-friendly, and scalable solution for educational institutions to streamline information sharing and enhance campus communication.

I .INTRODUCTION

In today’s educational institutions, offices, and public environments, effective and fast communication is essential for smooth functioning, timely announcements, and emergency alerts. Traditional notice boards that rely on paper have been used for many years; however, they come with several limitations. Updating notices manually is time-consuming, visibility is limited, and there is always a chance of delays or errors, especially during urgent situations. In addition, the continuous use of paper contributes to environmental issues. With the rapid growth of digital technology, there is an increasing demand for communication systems that are faster, more efficient, and eco-friendly. Digital notice boards provide a modern solution by allowing real-time updates, reducing manual effort, and improving accessibility. They eliminate the need for printed notices and ensure that information can be displayed instantly. This project proposes a Bluetooth-based Digital Notice Board using an Arduino Uno microcontroller and three horizontally connected P10 LED display panels. The system uses an HC-05 Bluetooth module to enable wireless communication between a smartphone and the display unit. Users can send messages through a mobile application either by typing or by using speech-to-text conversion, making the system more user-friendly and accessible. The hardware setup includes an Arduino Uno as the central controller, which processes incoming data and controls the display. The three P10 LED panels are connected side-by-side to form a larger display area of 96×16 pixels. This expanded display improves readability and allows longer messages to be shown with minimal scrolling. The bright LED panels ensure that the displayed information is clearly visible even from a distance. When a user sends a message via Bluetooth, the HC-05 module receives it and forwards it to the Arduino. The Arduino processes the message and displays it on the LED panels in either scrolling or static format. This process happens in real time, allowing instant updates without any delay. The system is suitable for various applications such as schools, colleges, offices, hospitals, transport stations, and shopping malls. It can be used to display announcements, schedules, alerts, and emergency messages efficiently. The use of voice input also allows ` Smart Digital Notice and Timetable Display System users to update messages quickly without needing to type, making the system more interactive and convenient. Additionally, this project promotes paperless communication and supports modern concepts such as smart campuses and smart cities. Compared to Wi-Fi or GSM-based systems, Bluetooth offers a simpler, low-cost, and reliable solution for short-range communication. The system is easy to install, portable, and scalable, as more display panels or advanced technologies can be added in the future. In conclusion, the Digital Notice Board using Arduino, Bluetooth, and P10 LED panels provides an efficient, cost-effective, and eco-friendly solution for modern communication needs. It enhances the speed, reliability, and convenience of information sharing.

A . Existing System

Traditional notice boards are widely used in schools, colleges, offices, government buildings, transportation terminals, hospitals, and public areas. These boards typically consist of printed paper notices pinned to a wooden or glass display board. Although simple, these systems suffer from multiple drawbacks such as time wastage, manual effort, paper consumption, and delayed information updates.

In existing manual systems:

- Notices are printed or handwritten.
- Staff must physically paste or replace notices.
- Updates during emergencies or sudden announcements are delayed.
- Paper waste increases environmental impact.
- Multiple locations require duplication of effort.
- No remote or wireless control is available.

To automate this, some institutions use electronic notice boards with LCD or LED TVs connected to computers or USB drives. However, such systems also have limitations like:

- Need for a computer to update content.
- No wireless real-time communication.
- Limited visibility in bright light if using LCDs.
- Requires power and complex setup.

Modern systems introduced GSM-based notice boards, where messages are sent via SMS to a SIM-enabled microcontroller board. Although this supports long-distance messaging, it has drawbacks like SMS delays, network dependency, recurring costs, and message-length restrictions. Wi-Fi-based systems using Node MCU or ESP32 allow users to send messages through mobile apps or web servers. These are more advanced but require internet connectivity, router configuration, and cloud platforms, making them less ideal in places with poor network access. Most existing digital boards use a single P10 LED panel, limiting the display area to 32×16 pixels. This restricts long sentences and reduces readability for large audiences. Also, many systems rely only on text input, lacking voice-to-text functionality which can make it more user-friendly. Smart Digital Notice and Timetable Display System

Therefore, the existing systems either:

- Rely heavily on manual work,
- Need internet or GSM infrastructure,
- Support only limited display area,
- Or do not support voice-based wireless updates.

B.Proposed System

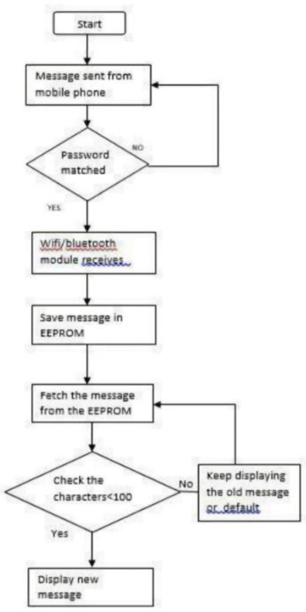
The proposed system is a Bluetooth-based Digital Notice Board that uses an Arduino Uno and three P10 LED panels connected side by side. It allows users to send messages wirelessly from a mobile phone, either by typing or using voice input. The system removes the need for manual notice updates, provides instant message display, and improves visibility with a wider LED screen.

Key Components:

- Arduino Uno – Acts as the main controller and manages message processing and display
- HC-05 Bluetooth Module – Receives text or voice-converted messages from the smartphone Smart Digital Notice and Timetable Display System
- P10 LED Panels (96×16 pixels) – Connected horizontally to create a larger display area
- Mobile Application – Used to send messages through text or voice-to-text input
- Power Supply (5V / 12V) – Provides required power to the Arduino and display panels
- Connecting Wires and Drivers – Used to connect and control the LED panels properly

WORKING PRINCIPLE:

- When the system is powered on, the Arduino initializes the P10 LED panels and the Bluetooth module.
- The user opens a Bluetooth Terminal or Voice-to-Text app on their smartphone.
- The smartphone is paired with the HC-05 Bluetooth module using the default password (1234 or 0000).
- The user sends a message either by typing or by speaking, which is converted into text.
- The Bluetooth module receives this message and forwards it to the Arduino through serial communication (TX–RX).
- The Arduino processes the received data and sends it to the connected P10 LED display panels.
- The message is displayed on the 96×16 screen, either as scrolling text or as a fixed message, depending on the program.
- When a new message is received, the previous message is cleared and replaced with the new one.



Flow Chart

C. Objective of the Project

The primary goal of this project is to design and implement a Bluetooth-based Smart Digital Notice and Timetable Display System that enables fast, wireless, and paperless communication. The objectives are as follows:

To develop a robust end-to-end communication system, the project begins by accepting user input from a smartphone application, either in the form of typed text or voice converted into text. This input is transmitted wirelessly using a Bluetooth module, ensuring simple and reliable short-range communication without the need for internet connectivity.

The received data is processed using an Arduino-based embedded system, which acts as the central controller. The Arduino interprets the incoming message and manages its display on LED panels. Efficient data handling and serial communication techniques are used to ensure smooth and real-time performance.

To enhance visibility and readability, the system utilizes multiple P10 LED display panels arranged horizontally to form a larger display area. These panels are capable of showing both static and scrolling text, allowing longer messages to be presented clearly even from a distance.

The system is designed to support real-time updates, where newly received messages automatically replace the previous ones without delay. This ensures that important announcements, schedules, and alerts can be communicated instantly and efficiently.

To improve usability and accessibility, a voice-to-text feature is integrated, allowing users to speak messages instead of typing them. This makes the system more convenient, especially for quick updates or for users who prefer hands-free interaction.

Additionally, the project emphasizes cost-effectiveness and eco-friendliness by eliminating the need for paper-based notices and reducing operational expenses. The system operates independently of internet or GSM networks, making it suitable for areas with limited connectivity.

Techniques such as modular design, scalable hardware configuration, and efficient power management are employed to enhance system reliability and flexibility. The accomplishment of these objectives results in a practical and user-friendly digital notice system that improves communication, supports smart environments, and contributes to modern digital infrastructure.

II. METHODOLOGY

A. System Approach

The proposed system follows a hardware-based embedded approach for implementing a Smart Digital Notice and Timetable Display System. The methodology begins with capturing user input from a smartphone through a Bluetooth-enabled mobile application. The input can be either typed text or voice, which is converted into text using a voice-to-text feature.

This text data is transmitted wirelessly via the HC-05 Bluetooth module using serial communication. The Arduino Uno microcontroller receives this data through UART (TX–RX pins) and processes it to control the display output. The processed message is then sent to multiple P10 LED display panels connected in a cascaded manner to form a larger display area.

The system ensures real-time updates, where newly received messages automatically replace previous content. Depending on message length, the system displays text either in static or scrolling format. The overall methodology focuses on simplicity, low cost, and efficient communication without relying on internet connectivity.

B. Data Processing and Communication

The input message received from the smartphone is handled through serial communication. The HC-05 Bluetooth module acts as a bridge between the mobile device and the Arduino.

Once the message is received, the Arduino processes it by:

- Reading serial input continuously
- Storing the message temporarily
- Formatting the text for display

Character handling techniques are used to ensure compatibility with the LED display. Long messages are segmented and displayed using scrolling techniques, while short messages are shown statically. This ensures optimal use of the available display area (96×16 pixels).

C. System Architecture

The system is divided into three main modules:

1. Input Module – Smartphone application and Bluetooth module used to send messages wirelessly.
2. Processing Module – Arduino Uno, which processes incoming data and controls system operations.
3. Output Module – P10 LED display panels used to visually present the message.

The modules are interconnected using serial communication and digital control signals. Libraries such as DMD or PxMatrix are used for efficient LED matrix handling and text rendering.

III. IMPLEMENTATION

Block Diagram Description

The implemented system follows a simple and effective workflow. Initially, the system is powered on, and the Arduino initializes the Bluetooth module and LED display panels. The user connects their smartphone to the HC-05 module via Bluetooth pairing.

Once connected, the user sends a message through a Bluetooth terminal or voice-to-text application. The HC-05 module receives the message and forwards it to the Arduino. The Arduino processes the incoming data and sends corresponding signals to the P10 LED display panels.

The display shows the message in real time. If a new message is received, the previous message is cleared and replaced automatically. The system continuously runs in a loop, checking for new incoming data.

HARDWARE IMPLEMENTATION

The hardware setup includes an Arduino Uno as the central controller, an HC-05 Bluetooth module for wireless communication, and three P10 LED panels connected horizontally to create a 96×16 display.

The Bluetooth module is connected to the Arduino using TX and RX pins for serial communication. The LED panels are interfaced using digital I/O pins along with display driver connections. A regulated power supply provides stable voltage to all components.

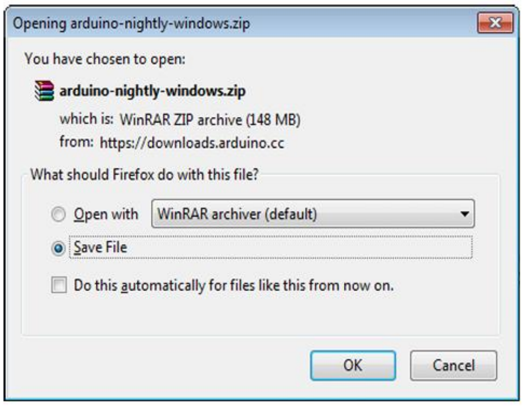
SOFTWARE IMPLEMENTATION

CREATING PROJECT IN ARDUINO ARDUINO IDE INSTALLATION:

In these we will get know of the process of installation of Arduino IDE and connecting Arduino uno to Arduino IDE.

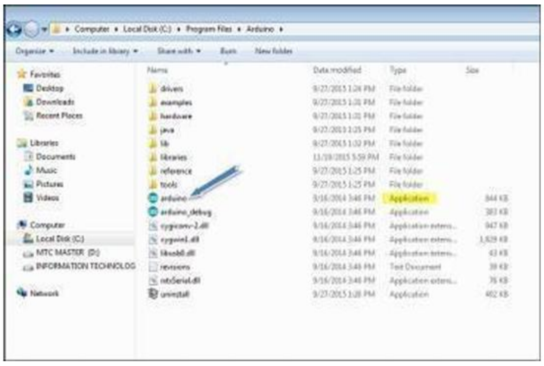
Step 1 The HC-05 component enables bidirectional (full-duplex) wireless communication, allowing microcontrollers to exchange data with phones or computers. In case we use Adriana UNO, Arduino Duemilanove, Nano, Arduino Mega 2560, or Diecimila, we will need a standard USB cable (A plug to B plug), In case we use Arduino Nano, we will need an A to Mini-B cable.

Step 2 – Download Arduino IDE Software. We can get different versions of Arduino IDE from the Download page on the Arduino Official website. We must select WER software, which is compatible with WER operating system (Windows, IOS, or Linux). After wear file download is complete, unzip the file.



Step 3 – Start by powering up the Arduino board. Boards like the Uno, Mega, Duemilanove, and Nano can automatically receive power either from the USB connection to your computer or from an external power source. However, if you are using the Diecimila, you need to ensure it is set to draw power from the USB. This is done using a small jumper located between the USB port and the power jack—make sure it is placed on the two pins closest to the USB side. Next, connect the Arduino board to your computer using a USB cable. Once connected, the green power LED labeled "PWR" should light up, indicating that the board is receiving power.

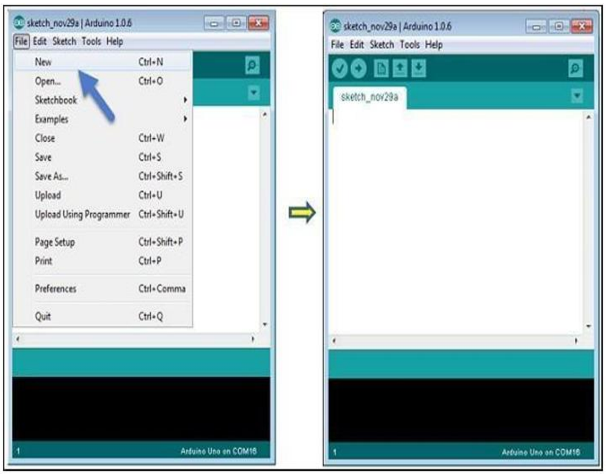
Step 4 – Launch Arduino IDE.



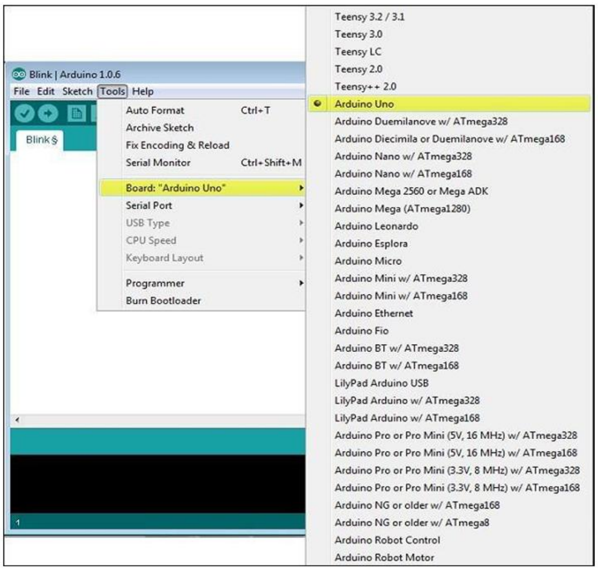
Once the Arduino IDE has been downloaded, the next step is to extract (unzip) the folder. After opening the extracted folder, you will see an application file with an infinity symbol icon (application.exe). Simply double-click this icon to launch and start using the IDE.

Step 5 – Let's start with our first project. After opening the software, you'll notice two main options: you can either create a new project or open an existing example project.

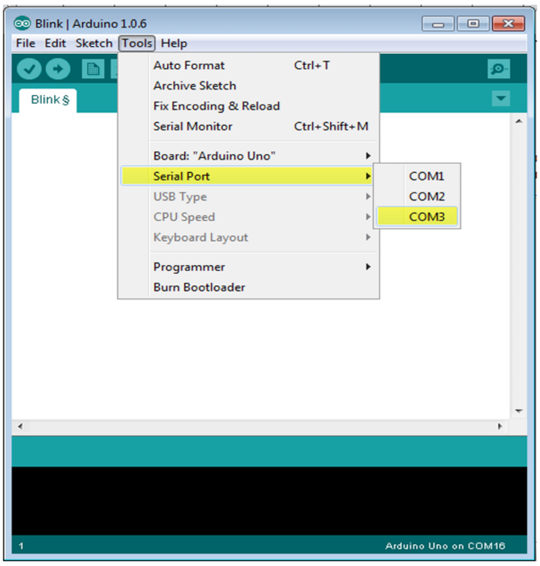
If you want to create a new project, go to File → New. To try an example project, go to File → Examples → Basics → Blink. Here, we're choosing the "Blink" example, which is one of the simplest programs. This example makes an LED turn on and off repeatedly with a small delay. You're free to explore and select any other example from the list as well.



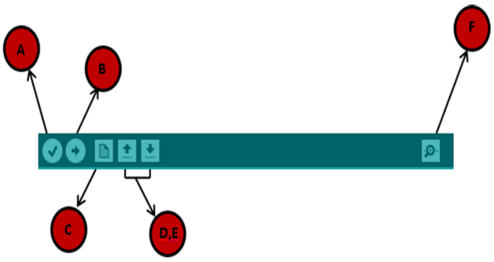
Step 6 – Select our Arduino board. To prevent upload failures, ensure the board selection in the Tools menu matches the exact model connected to your machine. Go to Tools → Board and select wear board. Here, we have selected Arduino Uno board according to our tutorial, but we must select the name matching the board that we are using.



Step 7 – Select WER serial port. Select the serial device of the Arduino board. Go to Tools → Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, we can disconnect WER Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.



Step 8 – Upload the program to WER board. Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.



- A – Checks your code for any compilation errors.
- B – Uploads the program to the Arduino board.
- C – Creates a new sketch quickly.
- D – Opens an example sketch directly.
- E – Saves your current sketch.
- F – Opens the Serial Monitor, which allows you to send and receive data between your computer and the board.

To upload your program, simply click the Upload button. After a few seconds, you'll notice the RX and TX LEDs on the board blinking, which indicates data transfer. Once the process is complete, a "Done uploading" message will appear in the status bar

IV RESULTS AND DISCUSSION

Today, the world is rapidly shifting toward digitalization. To improve or upgrade existing systems, we need to adopt modern techniques. Wireless technology plays a key role in this, as it enables quick and efficient data transmission over long distances. It saves time, cost of cables and size of the system. User name and password type authentication system is provided for adding securities. Previously the notice board using black board was used. To evaluate system efficiency, multiple tests were conducted considering parameters such as response time, accuracy of message display, visibility, Bluetooth communication range, and panel synchronization. Message Transmission Speed: The time taken from sending a message on the phone to displaying it on the P10 board was between 0.8 to 1.5 seconds, depending on message length. This proves the system provides real-time updates with minimum delay. Display Accuracy: All characters including alphabets, numbers, and symbols were displayed correctly on the three P10 panels. Scrolling messages were smooth with no flickering or distortion. Visibility Test: The display was clearly visible up to 15–20 meters indoors and 8–10 meters outdoors, due to high brightness of P10 LED modules. Bluetooth Range Test: With the HC-05 module, wireless communication worked up to 10 meters indoors and 20 meters in open space without packet loss. Beyond that, signal strength dropped. Voice to Text Reliability: When a voice-to-text mobile app was used, approximately 90–95% accuracy was achieved in converting speech into displayable text. Power Consumption & Hardware Stability: The system ran efficiently on a 5V power supply for Arduino and 5V/12V for P10 panels, consuming around 1.5–2 Amps depending on brightness level. The system successfully met its objectives—providing a cost-effective, real-time, wireless notice board solution with high performance and reliability.

V. CONCLUSION

This Bluetooth-enabled signage system built around the Arduino Uno and P10 panels offers a creative, low-cost, and high-performance alternative to outdated physical bulletin boards. It enables wireless, real-time communication using a smartphone, making information display faster and more accessible. Through the integration of three horizontally connected P10 panels, this system supports longer and more visible messages compared to single-panel systems. It promotes automation, paperless communication, and energy efficiency, making it a practical choice for educational institutions, offices, transportation systems, hospitals, and public places. The system was tested successfully for message update speed, readability, Bluetooth range, and display performance, proving its reliability. It does not require internet or SIM cards, which reduces cost and dependency on external services. It is highly scalable and can be upgraded to support IoT, cloud services, GSM, or Android applications in the future. In conclusion, the proposed system is a step toward building smart communication platforms in smart cities and campuses. It combines simplicity, efficiency, and practicality—making it suitable for modern digital infrastructure.

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