AUTOMATIC TIMETABLE DISPLAY USING ARDUINO

A Real-Time Project Report

Submitted to

Jawaharlal Nehru Technological University Hyderabad

In partial fulfillment of the requirements for the

award of the degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS & COMMUNICATION ENGINEERING

By

NAMANI SAI AKASH (22VE1A04A1)

TAMIRI SREE HARSHA (22VE1A04C3)

Under the Guidance of

Mr. CHINNAM S V MARUTHI RAO

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Approved by AICTE, New Delhi | Affiliated to JNTUH, Hyderabad | Accredited by NAAC "A" Grade & NBA| Hyderabad | PIN: 500068

(2022 – 2026)

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SREYAS
INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUTONOMOUS

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Certificate

This is to certify that the Real-Time Project Report on "***AUTOMATIC TIMETABLE DISPLAY USING ARDUINO***" submitted by **NAMANI SAI AKASH, TAMARI SREE HARSHA** bearing Hall Ticket No's. **22VE1A04A1, 22VE1A04C3** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology in Electronics & Communication Engineering** from Jawaharlal Nehru Technological University, Kukatpally, Hyderabad for the academic year 2023-24 is a record of bonafide work carried out by him / her under our guidance and Supervision.

Guide	**Head of the Department**
Mr.CHINNAM V MARUTHI RAO	**Mr.CHINNAM V MARUTHI RAO**

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DECLARATION

We, **NAMINI SAI AKASH, TAMIRI SREEHARSHA** , bearing Roll No's **22VE1A04A1, 22VE1A04C3** hereby declare that the Real-Time Project titled "***AUTOMATIC TIMETABLE DISPLAY USING ARDUINO***" done by us under the guidance of **Mr. CHINNAM S V MARUTHI RAO**, which is submitted in the partial fulfillment of the requirement for the award of the B.Tech degree in **Electronics & Communication Engineering** at **Sreyas Institute of Engineering & Technology** for Jawaharlal Nehru Technological University, Hyderabad is our original work.

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TABLE OF CONTENTS

ABSTRACT

This project proposes an Automatic timetable schedule display in a classroom. This System can display digital texts on a board made of LED array. The information it displays is preprogrammed using a Arduino UNO microcontroller. The Arduino UNO is selected because of low cost and efficiency in that price range. A monochrome (single colour) LED dot matrix display is used for displaying the Characters and Symbols which is interface with a microcontroller. This project will deliberate on displaying a scrolling text message on a 48×8 LED dot matrix display. In this project we aim to automate the display according to a class timetable as a prototype using a timer.

Keywords: Arduino Microcontroller, Monochrome LED, Timer

Software / Hardware: Arduino UNO, Arduino IDE, LEDs, 555 Timer, PCB, Power Supply with Transformer.

LIST OF FIGURES

LIST OF TABLES

CHAPTER-1 INTRODUCTION

1.1 Project Background

The integration of LED display technology with wireless communication modules presents an exciting avenue for innovation and interactive displays. In the realm of digital signage and information dissemination, LED displays have gained prominence due to their energy efficiency, vibrant visual output, and versatility. These displays have found applications in various domains, including advertising billboards, public transportation signs, and indoor information displays. Our project builds upon this technology by combining P10 LED display boards, an Arduino Uno microcontroller, scrolling LED display that can be controlled Automatically .The background of this project lies in the desire to harness the potential of LED technology and wireless communication to create an engaging and customizable information display system.

1.2 Problem Statement

Traditional static signage and information displays often lack the ability to convey dynamic and updated information effectively. In many scenarios, there is a need for a more engaging and adaptable solution. The problem we aim to address is the limited interactivity and dynamism of conventional displays. Our project seeks to tackle this problem by developing a scrolling LED display once the code is dumped . This allows for real-time customization and the display of dynamic content, making it suitable for various applications, including retail advertising, event announcements, and public information dissemination.

1.3 Objectives and Scope

The primary objective of this project is to design, build, and demonstrate a scrolling LED display system that leverages Arduino Uno . The scope of the project encompasses the following key aspects: Hardware Setup: We will configure and connect two P10 LED display boards, an Arduino Uno microcontroller.

Software Development: We will develop the necessary software code to control the LED displays .

Real-time Updates: The system will support real-time updates, enabling the display of scrolling text, animations, and custom messages.

1.4 Significance of the Project

The significance of this project lies in its potential to revolutionize information display systems. Scrolling LED displays, with their real-time customization and remote control capabilities, offer a versatile solution for various industries and applications. They can enhance communication in retail spaces, provide dynamic information at public transportation hubs, and serve as eye-catching advertising mediums. Furthermore, this project has educational value as it provides hands-on experience with LED displays, microcontrollers, and wireless communication, making it accessible to hobbyists and enthusiasts.

1.5 Project Overview

In this project, we harness the power of LED display technology, Arduino microcontrollers, to create a dynamic scrolling LED display. Two P10 LED display boards are arranged in a matrix configuration, controlled by an Arduino Uno. Users can interact with the display by dumping the code into the aurdino sending text messages and commands through code customize the displayed content. The Arduino Uno acts as the central controller, driving the LED displays to create engaging visual effects.

CHAPTER-2 HARDWARE

2.1 Arduino Uno

The Arduino is a small development board with a brain (also known as a microcontroller) that you can program. It interacts with the real world through LEDs, sensors, motors, LCDs, buzzers, etc If you type on your search engine the query “Arduino projects”, you will find tons of amazing Projects.

FIGURE 2.1.1: ARDUINO UNO R3 WITH ATmega328P

Features:

Here is a list of ARDUINO UNO R3 with ATmega328P features:

• The ATmega328P can easily be replaced, as it is not soldered to the board.
• The ATmega328P also features 1kb of EEPROM, a memory which is not erased when powered off.
• Low cost, compact and powerful board
• The Arduino UNO features a barrel plug connector, that works great with a standard 9V battery.

ARDUINO UNO PINOUT:

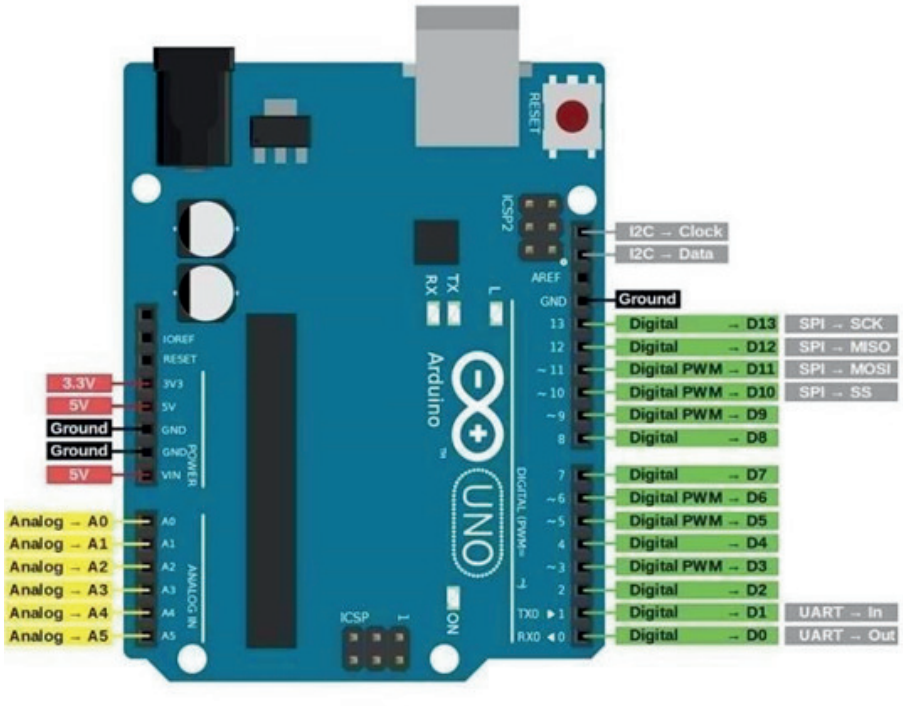


FIGURE 2.1.2 :: ARDUINO UNO PINOUT DIAGRAM

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0- 5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

Parameter	Value
CPU type	8-bit AVR
Performance	20 MIPS at 20 MHz
Flash memory	32 kB
SRAM	2 kB
EEPROM	1 kb
Pin count	28-pin PDIP, MLF, 32pin TQFP, MLF
Maximum operating frequency	20 MHz
Number of touch channels	16
Hardware Acquisition QTouch	No
Maximum I/O pins	26
External interrupts	24
USB Interface	No
USB Speed	No

TABLE 2.1: KEY PARAMETERS OF ATmega328

2.2 P10 LED display

•P10 LED display screen is made up of the modules whose pixel
pitch is 10mm. The P10 full color LED display screen is widely applicable for advertisement, gymnasium, factory and mining enterprises, transportation, station, wharf, airport, building, educational system and other public occasions. The function of P10 full color LED display screen.

1. It can display various of fonts, font sizes and different languages.

2. It can connect scanner from exterior, to input various of images and patterns.

3. It can input video signal (Television, Camera, Laser Disc), real-time to display dynamic video picture, and it can display other graphic and animation at the same time.

4. It can input computer signal, real time to display the content which is supervised by computer monitor, such as various of charts, curve, image which is processed by computer, at the same time, it also can display weather forecast, various of news, current affairs, etc. The display mode and retention time can be controlled.

5. There are many ways for animation display, such as up and down, left to right, etc.

6. The display time of each frame picture can be controlled, and being able to switch automatically.

7. The programming can be changed at any time, including its content, playing direction, playing time, etc. The amendment programming can be displayed timely.

8. It can take computer control as network station, to read data from designated server, to display on screen. In a word, P10 LED display screen is widely applicable for most of outdoor occasions, it can connect with exterior video devices, such as television, VCD, camera, and computer, etc. which has wide compatibility to digital devices.

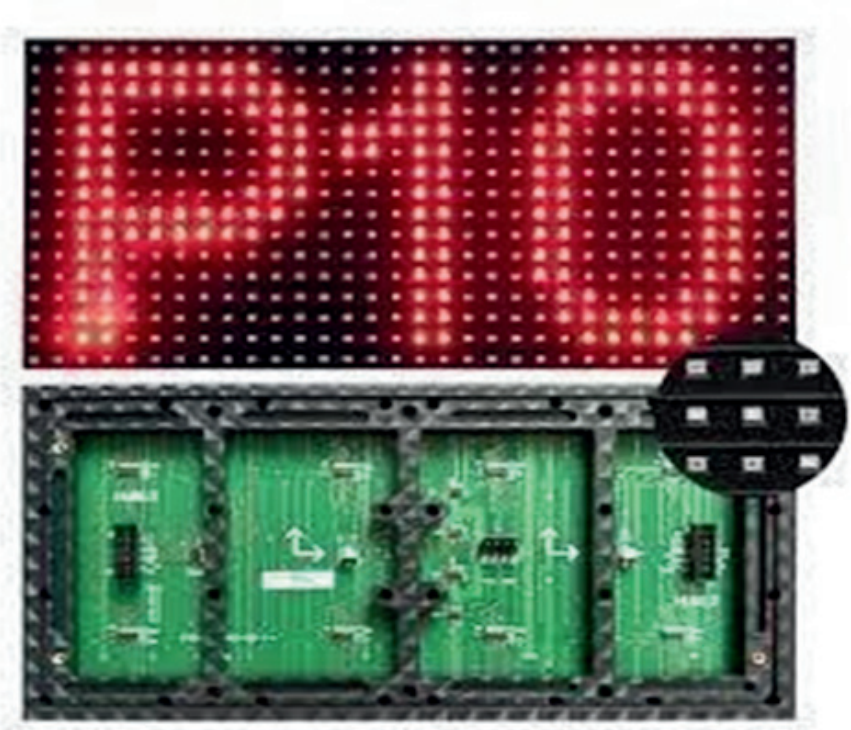


FIGURE 2.3.1:: P10 Display Module

Pin Description of P10 Display Module

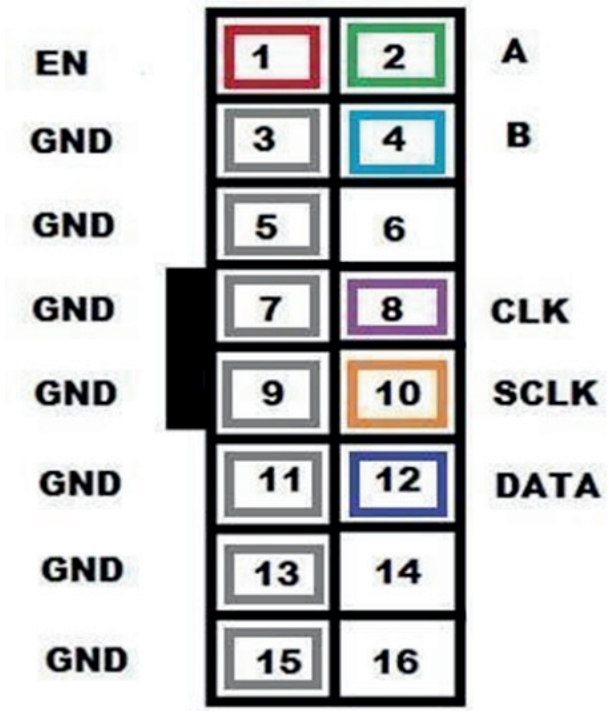


FIGURE 2.3.2:: P10 Module Pinout

•Enable: This pin is used to control the brightness of the LED panel, by giving a PWM pulse to it.

•A, B: These are called multiplex select pins. They take digital input to select any multiplex rows
•Shift clock (CLK), Store clock (SCLK): These are the regular shift register control pins

•Data: This pin is for data input in PWM form.

Features of the P10 Display module:
•¼ duty scan type [one out of four LEDs on the module are driven by IC at one time]
•Brightness:3500nits to 4500nits
•Max Power Consumption: 20W
•DC 5V Voltage Input
•IP65 Waterproof
•High contrast ratio and viewing angle
•1W pixel configuration
Specification of the P10 Display Module:
•Input voltage: 5V
•Max current input: 4A
•Average power consumption: 8W-10W
•Colour: Red
•Pixel Pitch: 10mm
•Led Pixel Size: 32X16 = 512

2.3 Flat Ribbon Cable

FRC is also known as multi wire planar cable because they are the type of cables formed by joining insulated wires in a flat plane forming the Ribbon shape. In other words, Ribbon cable have many conducting wires running parallel to each other on the same flat plane. These wires are commonly used for internal peripherals in computers, such as hard drives, CD drives, wired robots, etc. The ribbon cable was invented in 1956 10

by Cicoil Corporation, California. This ribbon cable then allowed major companies to replace bulky, stiff round cables with sleek, flexible ribbon cables. This cable consists of 4,6,8,9,10,14,16,18,20,24, etc. upto 80 conducting wires stuck together in parallel. FRC is an ideal way to connect two device digitally. The resultant impedance for any two adjacent wires within the cable is 120 Ohms. FRC also fold and bend readily, conforming to the mounting area, and they fasten easily with clamps, adhesive, or double-faced tape. Since the conductors are visible and in a fixed position within the dielectric coding, inspection and circuit tracing are simplified.

FIGURE 2.4:: FRC Cable

2.4 5V DC adapter

A DC 5V power supply is a type of power supply that provides a regulated and stable 5V DC (direct current) output voltage. This low-voltage power
18 supply is commonly used to power electronic devices that require a 5V DC supply, including microcontrollers, sensors, LED lights, USB charging devices, and other low-power electronic components.

FIGURE 2.5:: 5V DC Adapter

CHAPTER-3 SOFTWARE

3.1 PROGRAMMING ARDUINO UNO

Arduino IDE (Integrated Development Environment) is required to program the ARDUINO BOARD.

Once the Arduino IDE is installed on the computer, connect the board with the computer using USB cable. Now open the Arduino IDE and choose the correct board by selecting Tools>Boards>Arduino/Genuino Uno, and choose the correct Port by selecting Tools>Port. ARDUINO UNO is programmed using Arduino programming language based on Wiring. To get it started with the ARDUINO UNO board and blink the built-in LED, load the example code by selecting Files>Examples>Basics>Blink. Once the example code (also shown below) is loaded into your IDE, click on the 'upload' button given on the top bar. Once the upload is finished, you should see the Arduino's built-in LED blinking.

3.2 ARDUINO IDE INSTALLATION

After learning about the main parts of the NODE MCU board, we are ready to learn how to set up the Arduino IDE. Once we learn this, we will be ready to upload our program on the NODE MCU board. In this section, we will learn in easy steps, how to set up the Arduino IDE on our computer and prepare the board to receive the program via USB .

Step 1: About Arduino board First you must have your Arduino board (you can choose your favorite board) and a USB cable. In case you use NODE MCU, Arduino Duemilanove, Nano, Arduino Mega 2560, or Diecimila, you will need a standard USB cable (A plug to B plug), the kind you would connect to a USB printer as shown in the following image.

FIGURE 3.2.1: USB CABLE

In case you use an Arduino Nano, you will need an A to Mini-B cable instead as shown in the following image

FIGURE 3.2.1: USB CABLE

Step 2: Download Arduino IDE Software You can get different versions of Arduino IDE from the download page on the Arduino Official website. You must select your software, which is compatible with your operating system. After your file download is complete, unzip the file.

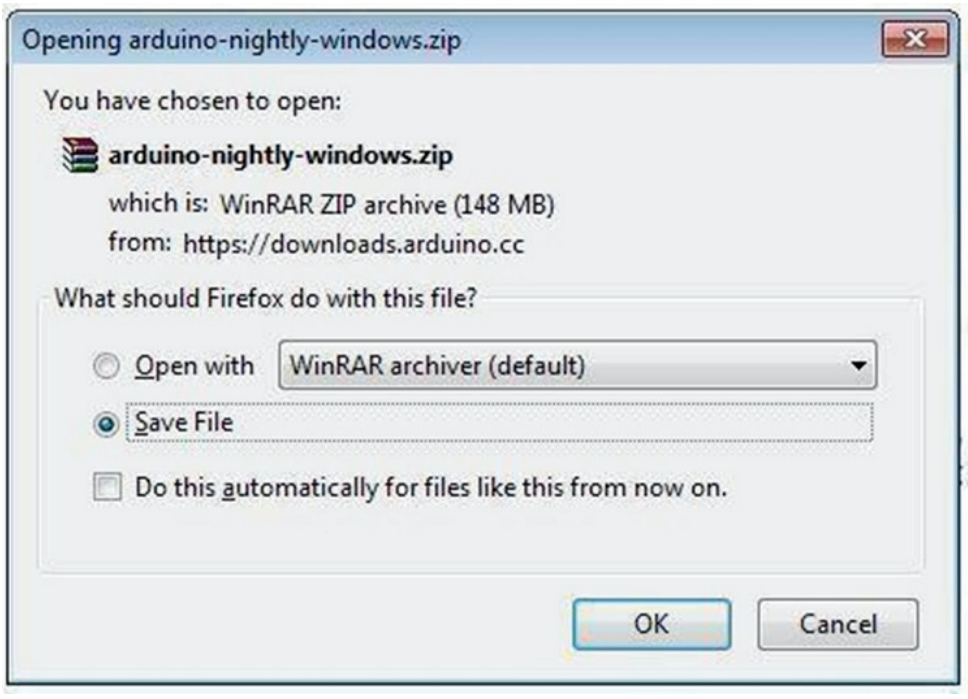


FIGURE 3.2.3: OPENING ARDUINO

Step 3: Power up your board The NODE MCU, Mega, Duemilanove and Arduino Nano automatically draw power from either the USB connection to the computer or an external power supply. If you are using an Arduino Diecimila, you have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port. Connect the Arduino board to your computer using the USB cable. The green power LED (labelled PWR) should glow.

Step 4: Launch Arduino IDE After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). DoubleClick the icon to start the IDE.

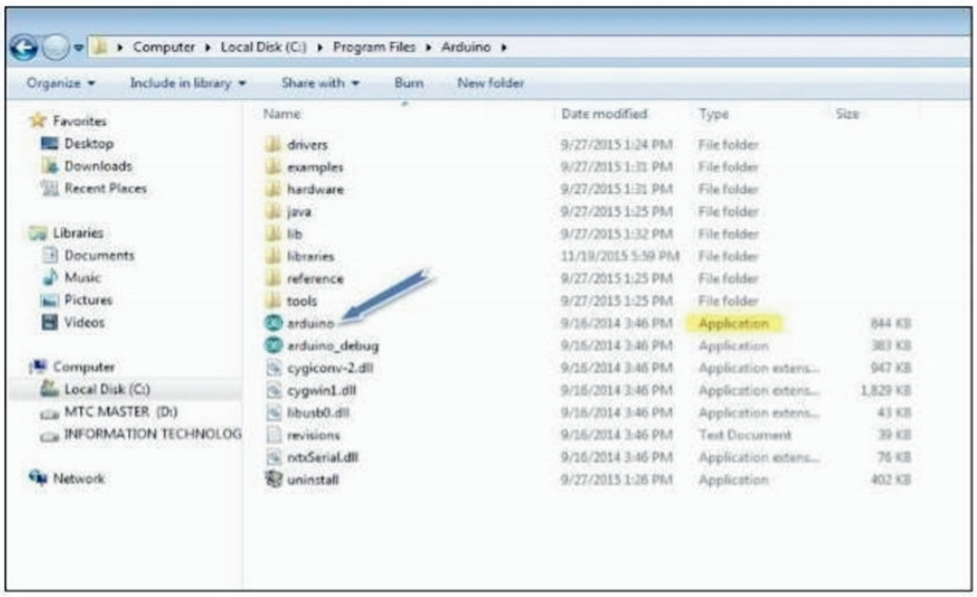


FIGURE 3.2.4: LAUNCHING ARDUINO IDE

Step 5:

Open your first project Once the software starts, you have two options:

- Create a new project
- Open an existing project example

To create a new project, select File --> New

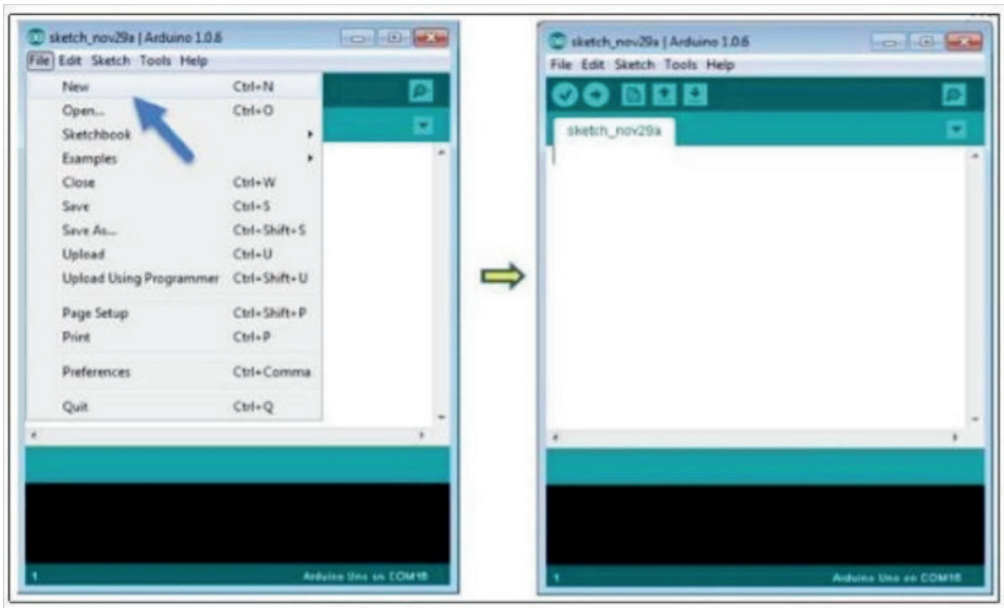
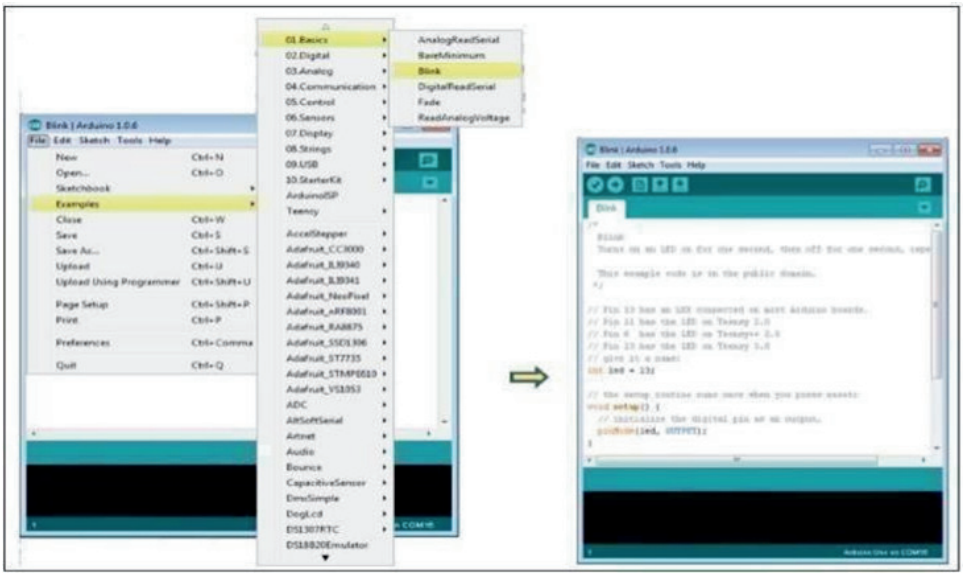
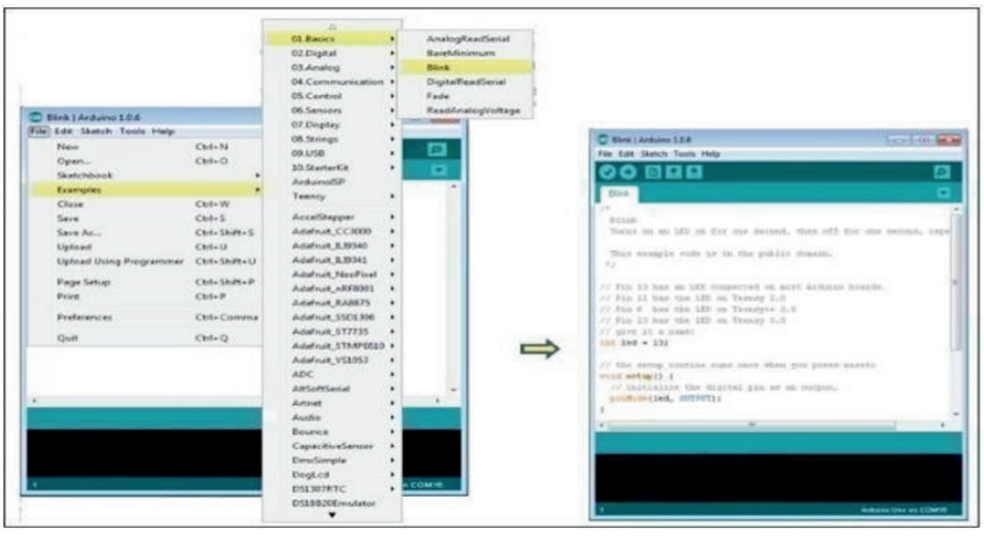


FIGURE 3.2.5: IN ARDUINO SOFTWARE OPENING NEW FILE

To open an existing project example, select File -> Example





To open an existing project example, select File -> Example

FIGURE 3.2.6: SELECTING FILE TYPE

Here, we are selecting just one of the examples with the name Blink. It turns the LED on and off with some time delay. You can select any other example from the list

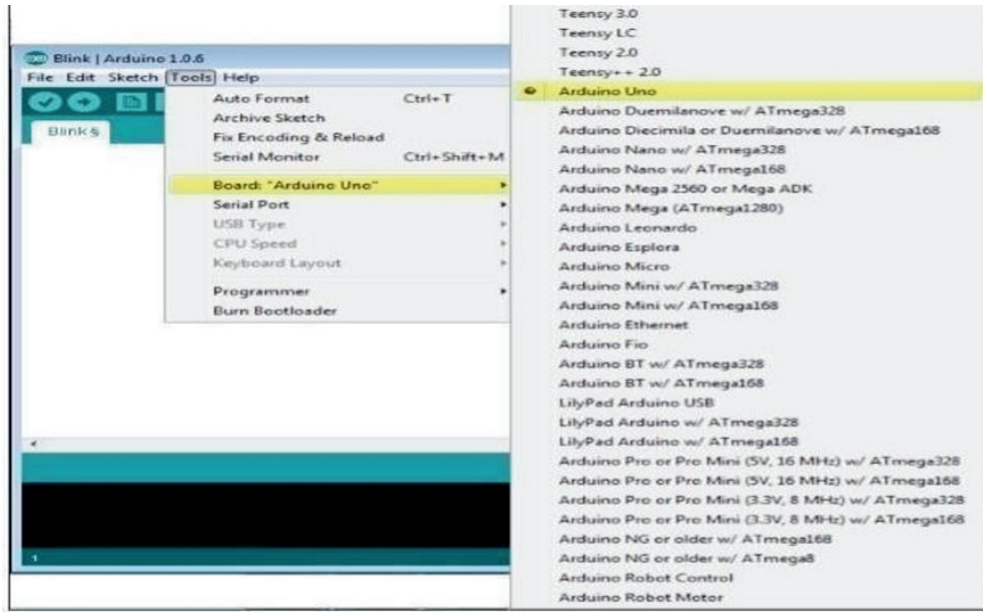


FIGURE 3.2.7: SELECT YOUR ARDUINO BOARD

Step 6: Select your Arduino board

To avoid any error while uploading your program to the board, you must select the correct Arduino board name, which matches with the board connected to your computer. Go to Tools -> Board and select your board. Here, we have selected the Arduino Uno board according to our tutorial, but you must select the name matching the board that you are using.

Step 7: Select your 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, you can disconnect your 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.

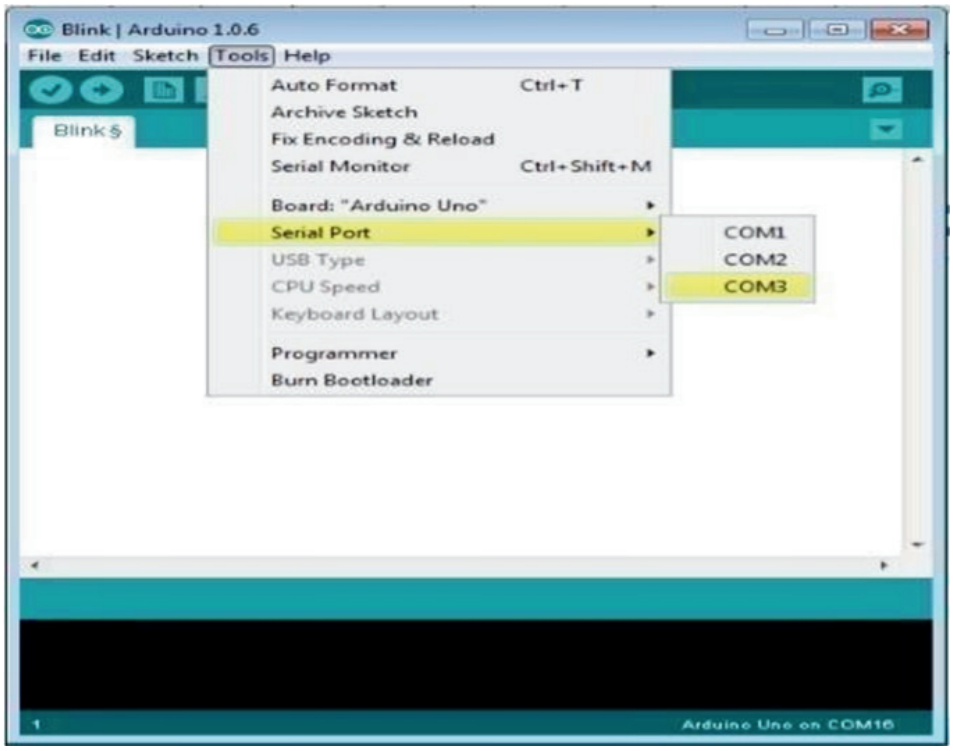


FIGURE 3.2.8: SELECTING SERIAL PORT

Step 8: Upload the program to your 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

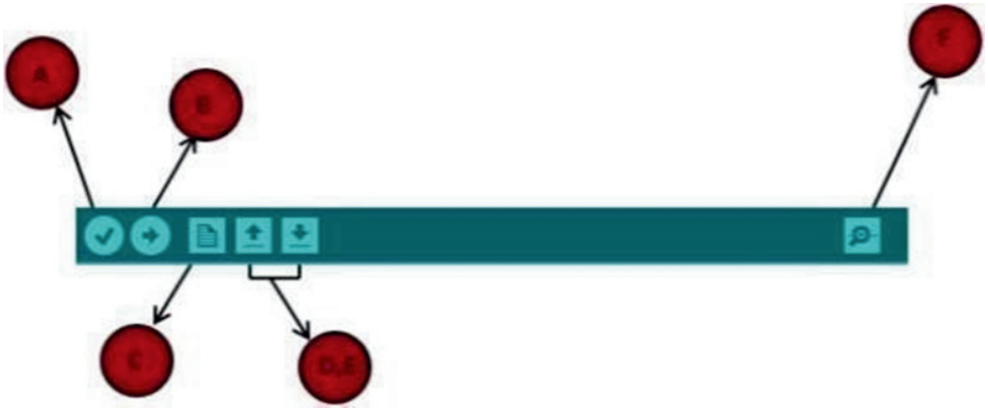


FIGURE 3.2.9: TOOLBAR

A-Used to check if there is any compilation error. B-Used to upload a program to the Arduino board. C-Shortcut used to create a new sketch.
DUsed to directly open one of the examples. E-Used to save your sketch.
F-Serial monitor used to receive serial data from the board and send the serial data to the board. Now, simply click the “Upload” button in the environment.
Wait a few seconds; you will see the RX and TX LEDs on the board flashing. If the upload is successful, the message “Done uploading” will appear in the status bar.
Note: If you have an Arduino Mini, NG, or other board, you need to press the reset button physically on the board, immediately before clicking the upload button on the Arduino software.

CHAPTER-4 WORKING

4.1 Interfacing P10 Module with Arduino Uno

• Connect the positive (VCC) and negative (GND) terminals of the P10 LED module to the 5V and GND pins on the Arduino Uno. Ensure that you provide a stable 5V power supply with sufficient current capacity for the LED module(s).
• Connect the data input (DIN) of the P10 LED module to one of the digital pins on the Arduino Uno (e.g., Pin 6). This connection allows the Arduino to send data to the LED module.
Connect a ground (GND) pin on the Arduino Uno to the GND pin on the P10 LED module. This establishes a common ground reference between the Arduino and the LED module.

P10 LED Module	Arduino UNO
ENABLE	9
A	6
B	
CLK	7
	13
SCLK	
	8
DATA	
	11

TABLE 4.1 Interfacing Arduino and P10 Module

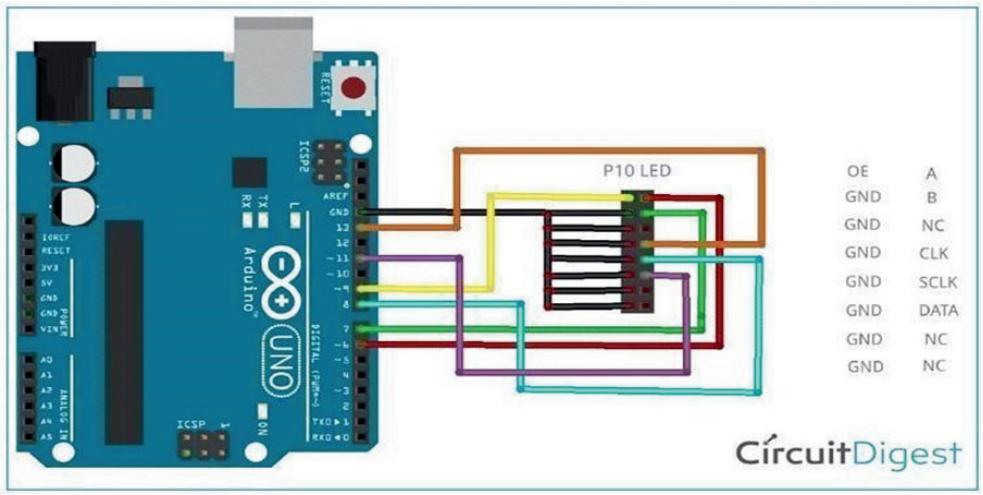


FIGURE 4.1: Interfacing Arduino Uno with P10 Module

4.2 Implementation

The circuit operation for this project is simple. When the 12V supply is provided to the circuit, it will start operating. The Arduino board receives a string (message) from the code and will pass it on to the Matrix LED board.
The scrolling message will then be displayed on this board.
• Initially, the default message "WELCOME" is displayed and continuously scrolled on the board (though it's easy to set any preferred default message).
• The user can send a message (string) through a Smartphone using the Bluetooth-based application. However, to display the new message, the user first has to connect and pair its

Smartphone with the HC-05 module (this requires the passkey, "1234"). Make sure the module remains open

•Type in the message on the Smartphone and send it to the system via the Bluetooth application.
•Arduino will temporarily store the message in its internal RAM. Once the message is completely received, Arduino will send it serially to the scrolling message P10 LED board for display.
•Arduino's digital pin D3 works as the serial data TX pin that sends the message to the P10 LED board.

FIGURE 4.3: Schematic Diagram

CHAPTER-5 RESULTS

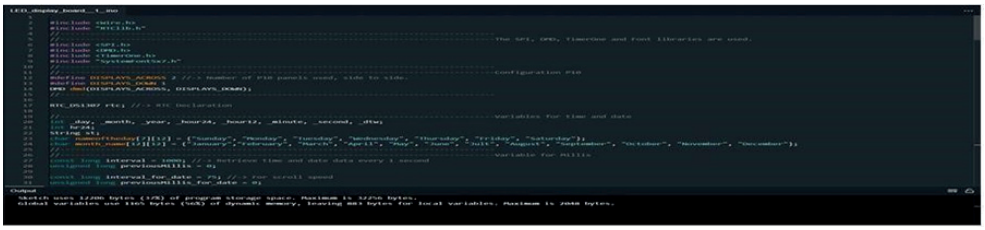


FIGURE 5.1: Software results

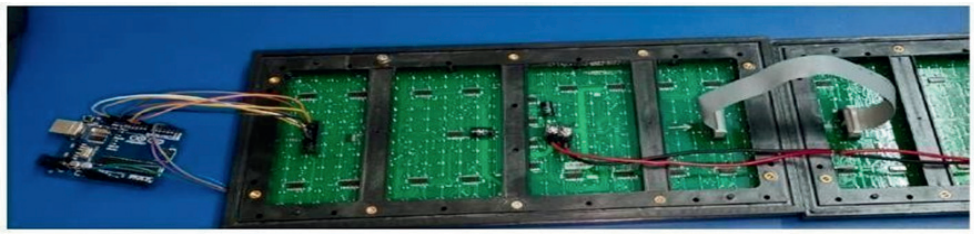


FIGURE 5.2.1: Hardware setup Backside

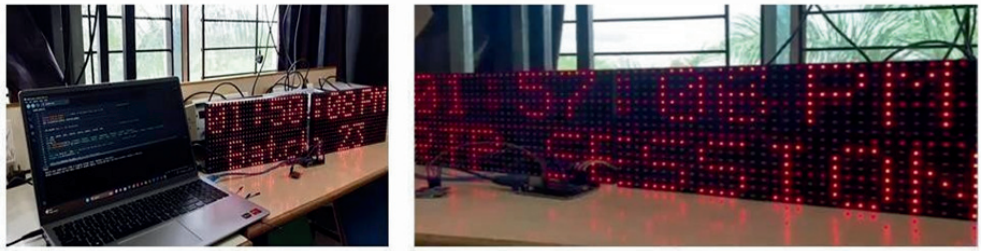


FIGURE 5.2.2: Hardware setup Frontside

FIGURE 5.3: Results

CHAPTER-6 ADVAN TAGES AND APPLICATIONS

6.1 Advantages

• **User friendly:** Messages are only to be typed on a mobile or a computer, which in turn are displayed wirelessly on the display unit.

• **Eliminates use of printers:** Since we don't use papers to display information, printers are also of no use in this system.

• **Faster means of transferring information:** There is no delay in transmission of information. Messages are displayed in a matter of seconds after typing

• **Future Enhancement**:

- A commercial model can be able to display more than one message at a time.
- In our system we are sending messages via GSM network and displaying on a LED by utilizing AT commands. The same principle can be applied to control electrical appliances at a distant location.

This technology could be further modified and more upgraded as per individual need and interest. We have discussed some basic ideas of this technology. And depending on innovative applications user can upgrade as per requirement.

6.2 Applications

• **Educational Institution and Organization:** Currently we rely on putting up papers on notice boards to inform people of events. This method can be discarded by using GSM based LED display to display

27

• information in real time. Eg. Placement news, cultural activities news, etc.

• **Advertisement:** In shopping malls we get to hear the offers on various products from time to time. Instead we continuously display the information regarding the products and related offers on electronic display boards.

• **Railway Station:** Instead of announcing the delay in arrival of trains we can display the information.

• **Hotels:** To display the availability of the rooms and the room rents the type of rooms.

• **Nursing homes:** To display the staff attendance, the availability of the doctors, the list of the specialized doctors, no. of in patients etc.

CHAPTER 7

SOFTWARE CODING

```
• #include <Wire.h>
#include <Adafruit_GFX.h>

#include
<Adafruit_LEDBackpack.h>
#include <RTClib.h>
#define LED_MATRIX_WIDTH 48
#define LED_MATRIX_HEIGHT 8
Adafruit_BicolorMatrix matrix = Adafruit_BicolorMatrix(); RTC_DS3231 rtc; const char*
weekMessages[7][7] = {
{ "Mon: Math", "Mon: Science", "Mon: English", "Mon: History", "Mon:
Lunch", "Mon: Physics", "Mon: Chemistry" },
{ "Tue: Math", "Tue: Science", "Tue: English", "Tue: History", "Tue: Lunch",
"Tue: Physics", "Tue: Chemistry" },
{ "Wed: Math", "Wed: Science", "Wed: English", "Wed: History", "Wed:
Lunch", "Wed: Physics", "Wed: Chemistry" },
{ "Thu: Math", "Thu: Science", "Thu: English", "Thu: History", "Thu: Lunch",
"Thu: Physics", "Thu: Chemistry" },
{ "Fri: Math", "Fri: Science", "Fri: English", "Fri: History", "Fri: Lunch",
"Fri: Physics", "Fri: Chemistry" },
{ "Sat: Math", "Sat: Science", "Sat: English", "Sat: History", "Sat: Lunch",
"Sat: Physics", "Sat: Chemistry" },

{ "Sun: Math", "Sun: Science", "Sun: English", "Sun: History", "Sun: Lunch", "Sun:
Physics", "Sun: Chemistry" }
};
unsigned long previousMillis = 0;
const long interval = 5000; // Change message every
5 seconds int messageIndex = 0; int textX =
LED_MATRIX_WIDTH;

void setup() {
Serial.begin(9600);

// Initialize the LED matrix
matrix.begin(0x70); // Initialize with the I2C address for the LED
matrix (0x70 is the default)
matrix.setTextWrap(false);
matrix.setTextSize(1); matrix.setTextColor(LED_ON) ; // Initialize the RTC module if
(!rtc.begin()) {
Serial.println("Couldn't find RTC"); while (1);
}
```

```
if (rtc.lostPower()) {
Serial.println("RTC lost power, let's set the time!");
// Set the current date and time, uncomment and set to the correct date and time
// rtc.adjust(DateTime(F(_DATE), F(TIME_)));
} } void loop() { unsigned long currentMillis = millis();
// Update message
if (currentMillis - previousMillis >= interval) {
previousMillis = currentMillis; messageIndex++;
if (messageIndex >= sizeof(weekMessages[0]) / sizeof(weekMessages[0][0])) {
messageIndex = 0;
}
textX = LED_MATRIX_WIDTH;
}

// Get the current time
DateTime now = rtc.now(); char
timeBuffer[9];
snprintf(timeBuffer, sizeof(timeBuffer), "%02d:%02d:%02d",
now.hour(), now.minute(), now.second());
// Get the current day of the week (0 = Sunday, 1 = Monday, ..., 6 =
Saturday) int dayOfWeek = now.dayOfTheWeek();
 // Clear the
 display matrix.clear();
// Display the current time
matrix.setCursor(0,
0);
matrix.print(timeBuff
er);
// Display the scrolling message for the current day
33
matrix.setCursor(textX, 1);
matrix.print(weekMessages[dayOfWeek][messageIndex]);
// Scroll the text to the left
if (--textX < -6 *
strlen(weekMessages[dayOfWeek][messageIndex])) { textX = LED_MATRIX_WIDTH; }
// Update the
display matrix.writeDispla y(); delay(100);}
```

CHAPTER-8 CONCLUSION AND FUTURE SCOPE

8.1 Summary

In a convergence of creative ingenuity and technological prowess, our scrolling LED display project has come to life, offering a captivating and interactive visual communication platform. This endeavor was conceived with the aim of harnessing the power of Arduino, , P10 LED display modules, and FRC cables to craft an innovative LED display system that transcends traditional static signage.

Project Foundation and Components:

The foundation of our project rests upon the harmonious integration of essential hardware components. These include the versatile P10 LED display modules, renowned for their vivid and dynamic visual capabilities, the Arduino Uno microcontroller, a reliable orchestrator of display functions. FRC cables serve as the unsung heroes, weaving intricate connections to ensure seamless data and power transmission.

Dynamic Content Creation:

A defining feature of our project is its ability to showcase dynamic content. Through carefully crafted Arduino code, we've unlocked the potential for scrolling text messages, eye-catching animations, and a canvas for artistic expression. With user- friendly interfaces and customizability at the forefront, we've created a display system that empowers individuals to convey their messages and creativity effectively.

Educational Resource and Beyond: Our project is more than a technical feat; it's a valuable educational resource. By meticulously documenting hardware configurations, coding procedures, and troubleshooting insights, we've created a comprehensive guide for enthusiasts, students, and creators eager to explore the realm of electronics and LED .

8.2 Conclusion

Overall, the use of a Bluetooth-controlled LED scrolling board produced great results and illustrated the strength and adaptability of contemporary LED technology. LED scrolling boards are anticipated to keep improving in sophistication and usability as technology progresses, making them increasingly more beneficial in a number of contexts.

This model can be used very efficiently in establishments like chain restaurants wherein the order and special discounts can be displayed at all branches simultaneously,

in colleges wherein students and staffs can be informed simultaneously in no time. It can be set up at public transport places like railways, bus station, and airport and also at roadside for traffic control and in emergency situations, it is cost efficient system and very easy to handle. Latency involved in using of papers in displaying of notices is avoided and the information can be updated by the authorized persons.

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