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Garden of Knowledge and Virtue

LABORATORY REPORT

MECHATRONICS SYSTEM INTEGRATION

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LAB: DIGITAL LOGIC SYSTEMS

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GROUP: 6

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Abstract

This project is about interfacing a 7-segment display with an Arduino to create a numeric display that cycles from 0 to 9 and resets to 0, with an increment button to cycle the numbers. In this project, we use an Arduino Mega to control the numeric display and controls for the button. This simple circuit demonstrates basic digital logic systems and Arduino programming to help the students get used to more complex systems. The experiment highlighted the potential usage and applications of systems like digital counters, and interactive displays which showcase the core of electrical systems and Arduino programming.

Introduction

This report describes how a 7-segment display is integrated with an Arduino Board to create a cyclable numeric display from 0 to 9 when a button is pressed. This project aims to help students understand the key ideas in microcontroller programming, digital electronics and others. From the manual, the students will connect the components to a breadboard, program the Arduino microcontroller, and construct an algorithm for the counter. This project allows students to dig deep into the world of microcontrollers and electrical systems and bring their creative ideas to life.

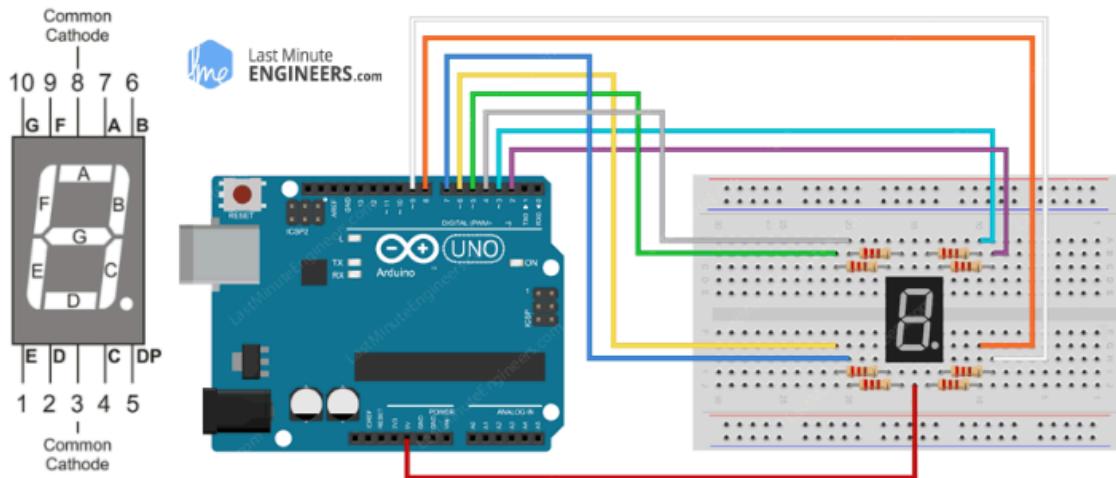
Materials and Equipment

- Arduino board (preferably Arduino Uno)
- Common cathode 7-segment display
- 220-ohm resistors (7x)
- Pushbuttons
- Male to Male Jumper wires
- Breadboard

Setup

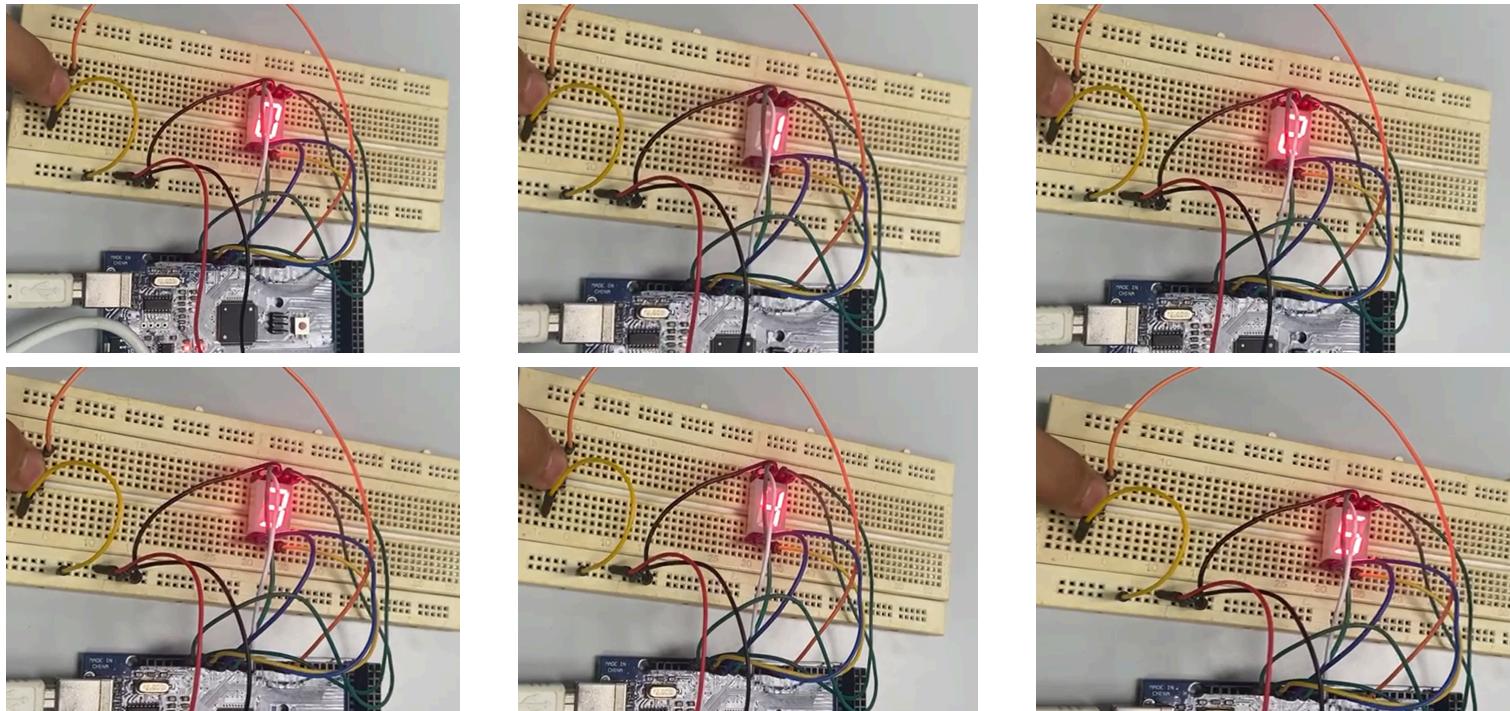
1. From 7-segment display to Arduino
 - 1.1. 7 segments (a-g) of the display are connected to the pin at the Arduino board separately.
 - 1.2. The common cathode pin is connected to the GND (ground) pin on the Arduino.
 - 1.3. The resistors are set in between the segment pin to the Arduino to limit the current.
2. From buttons to Arduino
 - 2.1. Each leg of the buttons is connected to a separate digital pin on the Arduino meanwhile the other leg is connected to the ground.

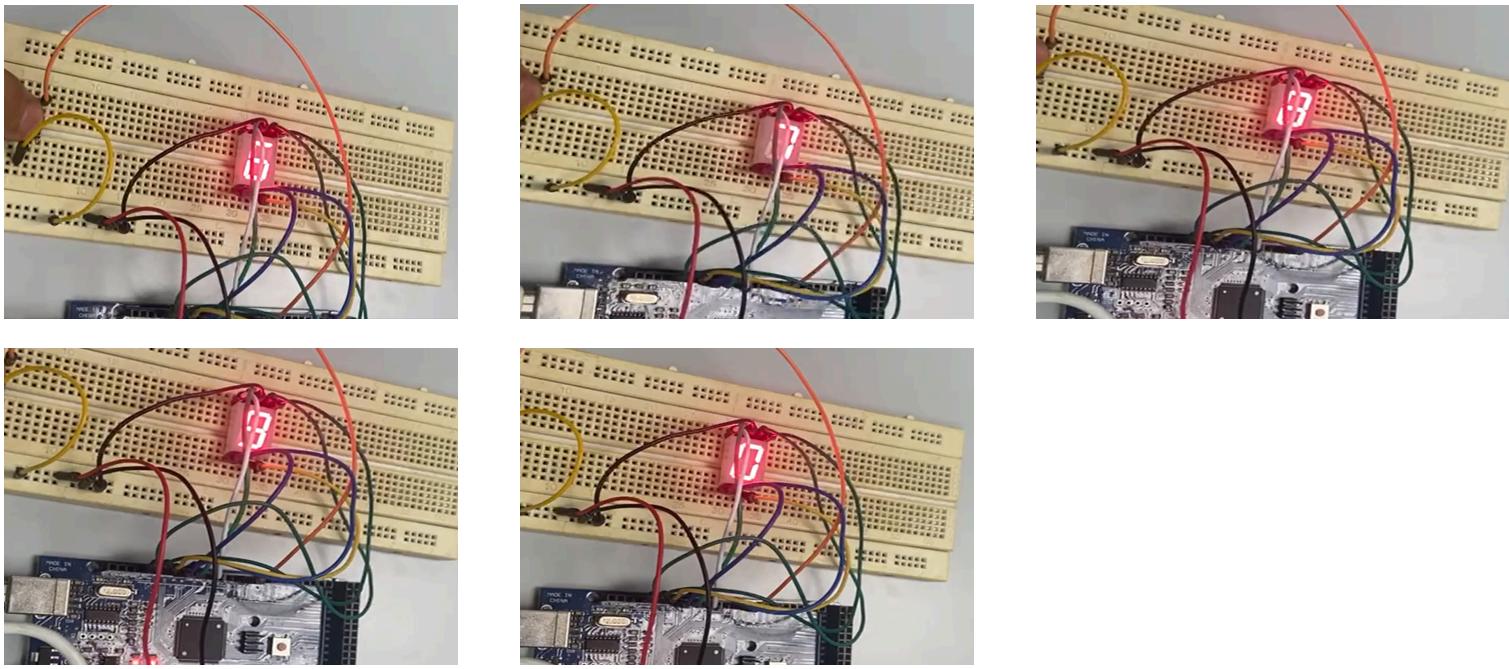
Methodology



1. Build the circuit according to the circuit setup instructions.
2. Upload the Arduino code to your Arduino Uno.
3. Open the Serial Monitor in the Arduino IDE.
4. Press the increment button to increase the count. The 7-segment display should show the numbers from 0 to 9 sequentially.
5. Press the reset button to reset the count to 0.

Results





Question

How to interface an I2C LCD with Arduino? Explain the coding principle behind it compared with 7 segments display and matrix LED.

To interface an I2C LCD with Arduino, we need to connect the LCD module via the I2C communication protocol which utilizes a specific library to simplify the programming. Comparing the coding principles between the LCDs, I2C LCDs require initialization with the module's address and display size which utilize library functions to control it. Meanwhile, the 7-segment display uses a more direct segment control and the Matrix LED employ managing rows and columns with bit manipulations. Despite all the differences, I2C LCDs offer a more user-friendly approach to text-based information thanks to its higher-level commands.

Discussion

1. Hardware

The setup for this project requires a 7-segment display with an Arduino board connected to it. The display is the main component for this project which requires a connection to the ground and several digital pins onto the Arduino. Each segment is also connected with a resistor to limit its current preventing excessive current draw that could damage the LEDs. A pushbutton is used to increment the counter display. This simple project allows for it to be assembled on a basic breadboard which helps the students make modifications and troubleshoot problems.

2. Software

Arduino IDE is used to assemble the code for this project as it provides a robust environment for writing and uploading code to the Arduino. The program is structured with a clear setup where pins are defined for each segment and the main loop handles the logic of incrementing numbers for the display. The code is designed for easy scalability and modification allowing for adjustments.

Conclusion

The project aims to demonstrate the simplicity of a simple electronic component, in this case, a 7-segment display and how it can be interfaced with a microcontroller to create a functional counter. In the project, we get to know the importance of electrical characteristics and the basic requirements of electric components. Meanwhile, on the software side, we learn the need for effective programming techniques to create a responsive interface. This labwork lays the groundwork for more advanced projects and serves as a practical introduction to electronics and programming.

Recommendations

A few recommendations in mind are that we can include a simple buzzer that emits sound with each button press to enhance user interaction which provides the user auditory feedback. We can also add a functionality where the user can hold the button down which can cause the display to increment after a brief initial delay continuously. This is to make it easier for users to cycle through the numbers quickly without repeatedly pushing the button.

Acknowledgement

I would like to express my sincere gratitude to the lab technician for their invaluable guidance, support, and encouragement throughout this project. Their expertise and insights have been instrumental in shaping the direction of this work. I would also like to extend my thanks to my fellow peers for their assistance and collaboration, which greatly contributed to the successful completion of this project.

Declaration

We hereby declare that the work presented in this report is entirely my own, except where otherwise acknowledged. I affirm that I have adhered to the principles of academic integrity and have not engaged in any form of plagiarism or unethical conduct in the completion of this project. All sources of information and assistance used in this work have been properly cited and acknowledged.