LABORATORY PROJECT REPORT
DIGITAL LOGIC SYSTEM

MCTA 3203

SEMESTER 2, 2024/2025

Date of submission : 23 March 2025
Group : 10
Section : 1

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Abstract

The experiment involved connecting a 7-segment display to an Arduino Uno and displaying numbers from 0 to 9 successively. To set up the circuit, connect the display to the Arduino via digital pins and resistors, program the microcontroller to control the display, and use push buttons for manual counting. To increase the displayed count, use the increment button after uploading the code. Pressing the reset button returns it to zero.

The study also found that good interface procedures and precise segment activation led to successful number display. The experiment demonstrated that learning the fundamentals of digital logic and interface improves practical electronics skills and lays the groundwork for future sophisticated projects.

Introduction

In electronics, the 7-segment display can offer a simple method for displaying numerical data. The seven individual segments that are found in the component are used to represent digits from 0 to 9. The common cathode configuration means all cathodes are connected to ground, while each segment is activated by applying a high signal. When the display is put together with a pushbutton and used with an Arduino Uno microcontroller, a digital counter is set up, allowing users to provide commands through simple interaction. The purpose of the task was to understand the interfacing of a 7-segment display with Arduino, focusing on basic logic gates and electronic circuit interfacing principles. It was expected that by correctly wiring the components and programming the Arduino, the display would successfully show numbers from 0 to 9 upon pressing designated buttons. The following report will highlight the methodology used in the experiment, the obtained results and further discussions on the findings with the conclusion regarding the significance of this project in the field of electronics and programming.

Materials and Equipment

- Arduino Uno Board
- Common cathode 7-segment display
- 220-ohm resistors (7 of them)
- Pushbuttons (2 or more)
- Jumper wires
- Breadboard

Experimental Setup

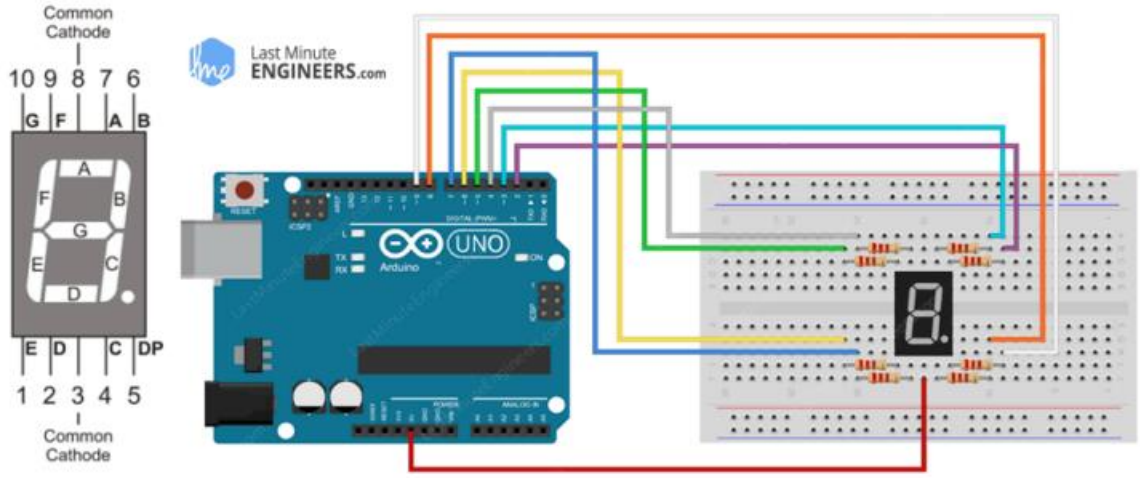


Figure 1

Circuit setup

1. Each segment (a, b, c, d, e, f, g) of the 7-segment display was connected to separate digital pins (D0 to D6) on the Arduino.

2. The common cathode pin of the display was connected to one of the GND (ground) pins of the Arduino.

3. 220-ohm resistors were connected between the Arduino pins and the 7-segment segments to limit the current flowing to the LEDs.

4. Two pushbuttons were connected to digital pins D9 and D10 for incrementing the count and resetting it to 0.

5. 10K-ohm pull-up resistors were added to the pushbuttons by connecting one end of each resistor to the digital pin and the other end to the 5V output of the Arduino, to stabilize their inputs

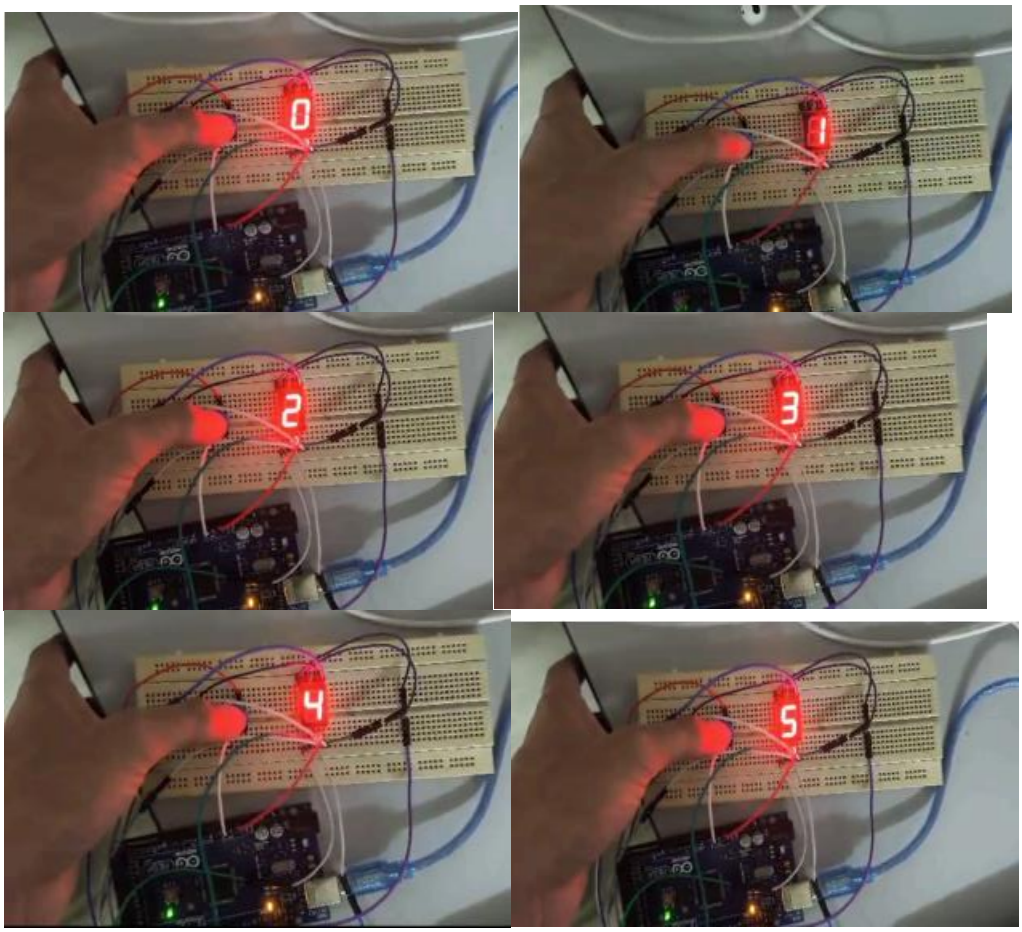
Methodology

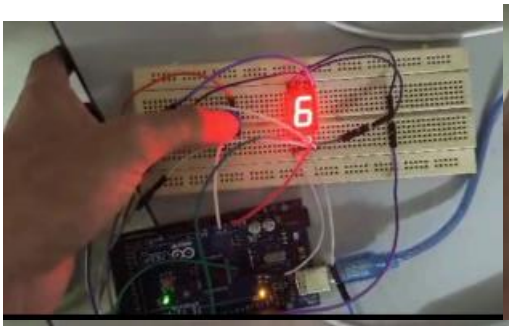
1. Circuit is built according to the instructions in the experimental setup.
2. Arduino code is uploaded to the Arduino Uno.
3. The Serial Monitor in the Arduino IDE is opened.
4. Increment button is pressed to increase the count. The 7-segment display should show the number from 0 to 9 sequentially.
5. The reset button is pressed to reset the count to 0.

Result

BUTTON PRESSED	DISPLAYED OUTPUT
Increament	Sequentially counts from 0 to 9
Reset	Resets count back to 0

The data confirmed that each button press resulted in expected behaviour, which accurately incrementing the count or resetting the displayed number when required, as designed in the code logic.

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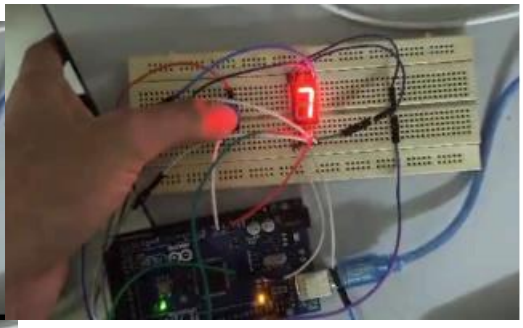
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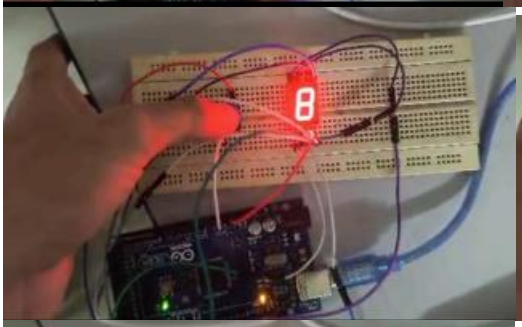
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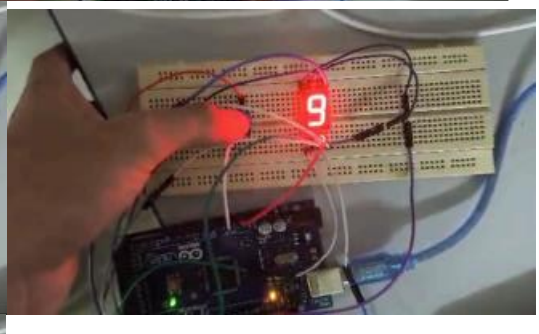
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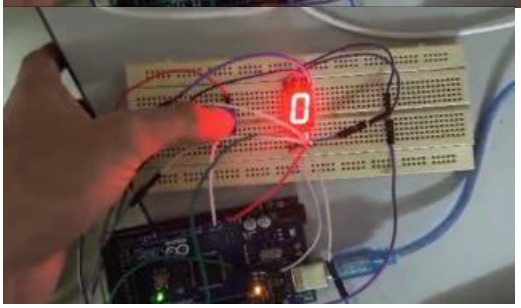
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Discussion

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

To connect an I2C LCD to an Arduino, connect the LCD's VCC and GND pins to the Arduino's 5V and GND, and link the LCD's SDA pin to A4 and SCL pin to A5 on the Arduino. After wiring, open the Arduino IDE and install the LiquidCrystal_I2C library. The code initializes the LCD and uses instructions like lcd.print() to show text.

Compared to a 7-segment display or matrix LED, the I2C LCD is easier to use. Using only two data lines (SDA and SCL) simplifies device management. A 7-segment display has many pins for each segment and requires human control via digitalWrite commands. I2C LCDs simplify wiring and coding, making them an ideal choice for projects.

The results confirmed that a 7-segment display can be interfaced with Arduino and controlled using digital logic. The idea was to use a pushbutton to operate the display and manually count from 0-9. Using pushbuttons to operate the display, we discovered how human input impacts digital outputs. As we hit the increment button, the counter increased and the display changed to reflect the new number. This method demonstrates the practical application of digital logic, where simple inputs (button presses) result in meaningful outputs (displayed numbers). Successful operation confirmed the notion of adequate wiring and coding for effective display control. Uncertain circumstances, such as poor wire connections, damaged components, or coding flaws, can cause inaccurate display readings at first, leading to desired outcomes later. These concerns underscore the significance of meticulous circuit building and testing. It demonstrated how programming logic affects hardware behavior, providing a practical application for theoretical notions in digital electronics.

Conclusion

This experiment successfully interfaced a 7-segment display with an Arduino Uno and used pushbuttons to regulate the counting sequence, resulting in a rudimentary counting system. The experiment emphasized the need for good circuit design, particularly the use of resistors to safeguard components and maintain stable functioning. It demonstrated how various electronic components might work effectively together. This incident highlights the need of understanding electronic interfaces. This hands-on experiment taught us circuit design and Arduino programming, which will be useful for future microcontroller-related projects. The skills obtained can be applied to sophisticated tasks, such as designing digital clocks or scoreboards with many displays and input modalities. Overall, this work was successful in improving comprehension of digital logic systems principles. This experience has enhanced our technical skills and inspired us to pursue more sophisticated projects in electronics and programming.

Recommendation

Future experiments with display and microcontroller interfacing could benefit from changes and modifications to enhance the learning experience. Comparing an I2C LCD to standard displays can help us understand variations in wiring, code complexity, and output capabilities. Experiments could include displaying text messages or dynamic data on the LCD and numerical output on a 7-segment display.

Another interesting experiment could involve adding extra functionalities to the existing setup. For example, we could try displaying letters or symbols on the 7-segment display or matrix LED. This would require modifying the code to control which segments light up for each character, giving us a deeper understanding of how these displays work.

Acknowledgment

A special thank you to Dr. Wahju Sediono and Dr. Zulkifli Bin Zainal Abidin, my teaching assistant, and peers, for their outstanding assistance and support in completing this report. Their advice, input, and expertise have had a significant impact on the quality and comprehension of this work. Their time, patience, and dedication to my academic progress are deeply appreciated.

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Student's Declaration

Certificate of Originality and Authenticity

This is to certify that we are responsible for the work submitted in this report, that the original work is our own except as specified in the references and acknowledgement, and that the original work contained herein have not been untaken or done by unspecified sources or persons.

We hereby certify that this report has not been done by only one individual and all of us have contributed to the report. The length of contribution to the reports by each individual is noted within this certificate.

We also hereby certify that we have read and understand the content of the total report and no further improvement on the reports is needed from any of the individual's contributors to the report.

We therefore, agreed unanimously that this report shall be submitted for marking and this final printed report has been verified by us.

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