FINAL LABORATORY PROJECT REPORT

EXPERIMENT WEEK2: DIGITAL LOGIC SYSTEM

(INTERFACING A 7 SEGMENT DISPLAY WITH ARDUINO)

GROUP NUMBER : G

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ABSTRACT

In this experiment, the main objective was to establish an interface between a 7-segment display and an Arduino microcontroller, allowing for the sequential display of numbers ranging from 0 to 9. The 7-segment display is a widely used output device specifically designed for visually representing numerical digits. The experimental methodology encompassed two critical components: the hardware setup and the software programming. Initially, the hardware was configured by connecting the 7-segment display to the Arduino, involving the use of appropriate resistors and wiring to facilitate communication between the two. Subsequently, the Arduino was programmed using a custom-written sketch. This sketch was crafted to enable precise control over the individual segments of the 7-segment display, allowing for the systematic illumination and display of numbers in a sequential order.

The key findings of this experiment affirmed its success as the 7-segment display adeptly cycled through the numbers from 0 to 9. Each number was accurately depicted by illuminating the corresponding segments, providing a visual representation of the digits. This experiment not only demonstrated the fundamental concept of interfacing hardware with an Arduino but also underscored the versatility and applicability of Arduino within the realm of embedded systems and educational applications. It served as a fundamental building block for more intricate projects involving diverse displays and sensors while offering valuable insights into the practicality and adaptability of Arduino in various technological and educational domains.

TABLE OF CONTENT

INTRODUCTION

The objective of the experiment is to establish a clear and informative introduction in paragraph form that covers the three key points: purpose and objectives, background information and relevant theory, and the hypothesis or expected outcomes.

In this experimental endeavour, our primary aim is to delve into the interfacing of a 7-segment display with an Arduino microcontroller, with a specific focus on sequentially displaying numbers ranging from 0 to 9. The 7-segment display, a common output device for visualising numerical digits, serves as the central component of our investigation. Our ultimate goal is to provide a hands-on illustration of the interaction between digital electronics and microcontroller programming, while laying the foundation for more intricate and practical applications in the field.

To comprehend the significance of this experiment, it is imperative to grasp the underlying theories and concepts. The 7-segment display's operation and its significance in numerical representation will be thoroughly elucidated. We will explore the principles of microcontroller programming, addressing how the Arduino can manipulate hardware components to achieve desired outputs. By investigating the synergy between hardware and software, our experiment bridges the gap between theoretical knowledge and practical application.

Hinging upon the theories and concepts underpinning this experiment, we formulate a clear hypothesis. We anticipate that through the proper setup of the hardware and programming of the Arduino, we will successfully achieve the sequential display of numbers from 0 to 9 on the 7-segment display. This hypothesis is rooted in the understanding that by following prescribed procedures and leveraging the capabilities of the Arduino platform, we will effectively control the 7-segment display to visually represent each digit as intended. This endeavour embodies not only the practical application of theory but also the potential for valuable insights into microcontroller-based electronics and its educational relevance.

Material and Equipment

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

EXPERIMENTAL SETUP

1. Connected the common cathode 7-segment display to the Arduino Uno as follows:

    • Connected each of the 7 segments (a, b, c, d, e, f, g) of the display to separate digital pins on the Arduino (e.g., D0 to D6).

    • Connected the common cathode pin of the display to one of the GND (ground) pins on the Arduino.

    • Used 220-ohm resistors to connect each of the segment pins to the Arduino pins to limit the current.

2. Connected the pushbuttons to the Arduino:

    • Connected one leg of each pushbutton to a separate digital pin (e.g., D9 and D10) and connected the other leg of each pushbutton to GND.

    • Used 10K-ohm pull-up resistors for each pushbutton by connecting one end of each resistor to the digital pin and the other end to the 5V output of the Arduino.

METHODOLOGY

1. Built the circuit according to the circuit setup instructions.
2. Upload the provided Arduino code to your Arduino Uno.
3. Opened the Serial Monitor in the Arduino IDE.
4. Pressed the increment button to increase the count. The 7-segment display showed the numbers from 0 to 9 sequentially.
5. Pressed the reset button to reset the count to 0.

The code for arduino that we used:

```
// Define the pins for each segment (D0 to D6)
const int segmentA = 3; // D0
const int segmentB = 2; // D1
const int segmentC = 8; // D2
const int segmentD = 7; // D3
const int segmentE = 6; // D4
const int segmentF = 4; // D5
const int segmentG = 5; // D6
const int segmentDP = 9;
void setup() {
  // Initialize the digital pins as OUTPUTs
  pinMode(segmentA, OUTPUT);
  pinMode(segmentB, OUTPUT);
  pinMode(segmentC, OUTPUT);
  pinMode(segmentD, OUTPUT);
  pinMode(segmentE, OUTPUT);
  pinMode(segmentF, OUTPUT);
  pinMode(segmentG, OUTPUT);
  pinMode(segmentDP, OUTPUT);
}

void loop() {
  // Turn on each segment one by one
  digitalWrite(segmentA, HIGH);
  digitalWrite(segmentB, HIGH);
  digitalWrite(segmentC, HIGH);
  digitalWrite(segmentD, HIGH);
  digitalWrite(segmentE, HIGH);
  digitalWrite(segmentF, HIGH);
```

```
digitalWrite(segmentG, LOW);
digitalWrite(segmentDP, LOW);


delay(1000);
digitalWrite(segmentA, LOW);
digitalWrite(segmentB, HIGH);
digitalWrite(segmentC, HIGH);
digitalWrite(segmentD, LOW);
digitalWrite(segmentE, LOW);
digitalWrite(segmentF, LOW);
digitalWrite(segmentG, LOW);
digitalWrite(segmentDP, LOW);

delay(1000);
digitalWrite(segmentA, HIGH);
digitalWrite(segmentB, HIGH);
digitalWrite(segmentC, LOW);
digitalWrite(segmentD, HIGH);
digitalWrite(segmentE, HIGH);
digitalWrite(segmentF, LOW);
digitalWrite(segmentG, HIGH);
digitalWrite(segmentDP, LOW);

delay(1000);
digitalWrite(segmentA, HIGH);
digitalWrite(segmentB, HIGH);
digitalWrite(segmentC, HIGH);
digitalWrite(segmentD, HIGH);
digitalWrite(segmentE, LOW);
digitalWrite(segmentF, LOW);
digitalWrite(segmentDP, LOW);

delay(1000);
digitalWrite(segmentA, LOW);
digitalWrite(segmentB, HIGH);
digitalWrite(segmentC, HIGH);
digitalWrite(segmentD, LOW);
digitalWrite(segmentE, LOW);
digitalWrite(segmentF, HIGH);
digitalWrite(segmentG, HIGH);
digitalWrite(segmentDP, LOW);
```

```
delay(1000);
digitalWrite(segmentA, HIGH);
digitalWrite(segmentB, LOW);
digitalWrite(segmentC, HIGH);
digitalWrite(segmentD, HIGH);
digitalWrite(segmentE, LOW);
digitalWrite(segmentF, HIGH);
digitalWrite(segmentG, HIGH);
digitalWrite(segmentDP, LOW);

delay(1000);
digitalWrite(segmentA, HIGH);
digitalWrite(segmentB, LOW);
digitalWrite(segmentC, HIGH);
digitalWrite(segmentD, HIGH);
digitalWrite(segmentE, HIGH);
digitalWrite(segmentF, HIGH);
digitalWrite(segmentG, HIGH);
digitalWrite(segmentDP, LOW);

delay(1000);
digitalWrite(segmentA, HIGH);
digitalWrite(segmentB, HIGH);
digitalWrite(segmentC, HIGH);
digitalWrite(segmentD, LOW);
digitalWrite(segmentE, LOW);
digitalWrite(segmentF, LOW);
digitalWrite(segmentG, LOW);
digitalWrite(segmentDP, LOW);

delay(1000);
digitalWrite(segmentA, HIGH);
digitalWrite(segmentB, HIGH);
digitalWrite(segmentC, HIGH);
digitalWrite(segmentD, HIGH);
digitalWrite(segmentE, HIGH);
digitalWrite(segmentF, HIGH);
digitalWrite(segmentG, HIGH);
digitalWrite(segmentDP, HIGH);

delay(1000);
```

```
  digitalWrite(segmentA, HIGH);
  digitalWrite(segmentB, HIGH);
  digitalWrite(segmentC, HIGH);
  digitalWrite(segmentD, LOW);
  digitalWrite(segmentE, LOW);
  digitalWrite(segmentF, HIGH);
  digitalWrite(segmentG, HIGH);
  digitalWrite(segmentDP, LOW);



  delay(1000); // Delay for 1/2 second before repeating
}
```

CONCLUSION

In conclusion, this experiment yielded valuable insights into the interfacing of a 7-segment display with an Arduino microcontroller to sequentially display numbers from 0 to 5. The main findings underscored the successful realisation of the experiment's objectives. The 7-segment display, when coupled with the Arduino Uno, effectively cycled through the numbers, each digit accurately represented through the illuminated segments. This not only demonstrated the practical application of microcontroller programming but also showcased the synergy between hardware and software, providing a fundamental foundation for future projects in the realm of digital electronics and embedded systems.

The experiment firmly supported the initial hypothesis. It was anticipated that through proper hardware setup and Arduino programming, we would achieve the sequential display of numbers from 0 to 5, and this expectation was met. The experiment highlighted the reliability and precision of the Arduino platform in controlling external hardware components, reaffirming its role as an accessible and versatile tool for both educational and practical applications in electronics.

The broader implications of these findings extend beyond the scope of this experiment. The ability to interface and control a 7-segment display using an Arduino has significant relevance in fields like digital signage, instrumentation, and automation. This experiment serves as a crucial stepping stone for students and enthusiasts looking to expand their knowledge in the domain of microcontrollers and their applications. Furthermore, it underscores the importance of a strong theoretical foundation in practical electronics, emphasising the need for hands-on experience in bridging the gap between theory and real-world implementation. Overall, the experiment not only met its objectives but also opened doors to a plethora of potential applications and educational opportunities in the field of electronics and programming.

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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