INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Garden of Knowledge and Virtue

MECHATRONICS SYSTEM INTEGRATION (MCTA 3203)

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ACTIVITY REPORT

WEEK 2:
DIGITAL LOGIC SYSTEM

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TABLE OF CONTENTS

<u>INTRODUCTION</u>

The experiment aims to display a sequential order of numbers from 0 to 9 using a 7-segment display controlled by a microcontroller.

The 7-segment initially displays the number 0 when switched on. Each time a push button is pressed, the number displayed will increase incrementally until it reaches the number 9. The display can be reset by pressing the reset button on the microcontroller.

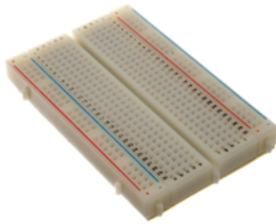This experiment challenges the understanding of electrical, electronics and programming knowledge in making sure of a smooth operation.

MATERIAL AND EQUIPMENT

1. 7-segment display
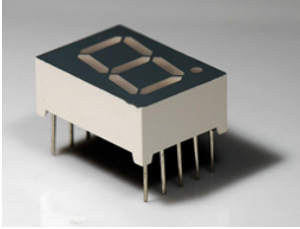
2. Breadboard

3. Arduino Mega

4. Push button

5. Wires

<u>CIRCUIT SETUP</u>
1. Connect the common cathode 7-segment display to the Arduino Uno as follows:
   - Connect 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).
   - Connect the common cathode pin of the display to one of the GND (ground) pins on the Arduino.
   - Use 220-ohm resistors to connect each of the segment pins to the Arduino pins to limit the current.
2. Connect the pushbuttons to the Arduino:
1. Connect one leg of each pushbutton to a separate digital pin (e.g., D9 and D10) and connect the other leg of each pushbutton to GND.
2. Use 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.

<u>EXPERIMENT SETUP</u>
3. Build the circuit according to the circuit setup instructions.
4. Upload the provided Arduino code to your Arduino Uno.
5. Open the Serial Monitor in the Arduino IDE.
6. Press the increment button to increase the count. The 7-segment display should show the numbers from 0 to 9 sequentially.
7. Press the reset button to reset the count to 0.

<u>METHODOLOGY</u>

First, assemble the circuit on a breadboard according to the circuit setup instructions. Second, upload the provided Arduino sketch to the Arduino Uno. Next, open the Serial Monitor in the Arduino IDE to monitor debugging outputs and press the increment button to cycle through the numbers 0 to 5 on the 7-segment display.

Then, press the reset button to return the display to 0. Observe and document how different combinations of segments light up to form numbers. Lastly, repeat the process multiple times to ensure the circuit functions as expected.

The 7-segment display responded accurately to button presses. This demonstrates the successful integration of the hardware and software components. The setup effectively implemented a mechanism that incremented the count with each press of the button. The digits from 0 to 9 were displayed in order on the 7-segment display.

The system performed consistently, correctly registering each button press without any unintended skips or repeats in the count. This indicates that the system is adaptable for various applications that require counting or tracking, offering a straightforward and efficient solution for practical use.

DISCUSSION

CONCLUSION

In conclusion, this project demonstrates how to control a 7-segment display using an Arduino and a push-button switch. Despite the seemingly simple tasks, we encountered several challenges and setbacks during development. Through careful review of the code and experimenting with different solutions, we were able to resolve the issues and get the system working.

This experience highlighted the importance of persistence and attention to detail in programming. We also learned that understanding the functionality of the 7-segment display and how its circuit connections interact with the code was crucial for writing effective code.

Overall, this project provides a strong foundation in digital control systems and paves the way for future enhancements and more complex projects.

RECOMMENDATIONS

For the next steps, adding a second push button to decrease the count can further improve the setup. This would give users the ability to both increase and decrease the displayed number, enhancing the system's versatility and improving user input functionality. Additionally, expanding the project by integrating a multi-digit 7-segment display would allow for the presentation of larger numbers or more complex outputs, such as a four-digit counter or clock. Lastly, it would be beneficial to introduce an external debounce component, like a capacitor, to enhance input reliability. This would ensure more consistent button-press registration, minimizing the risk of missed or incorrect counts.

APPENDICES

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

       Differing from the 7-segment display, the I2C LCD can be connected to the Arduino by connecting the VCC pin to 5V, the GND pin to the ground, the SDA pin to A4 and the SCL pin to A5. This setup allows for easy communication between the Arduino and the LCD.

       For the programming, the I2C LCD communicate using libraries such as LiquidCrystal_I2C. This way, users can use pre-built functions for easier control.

STUDENT'S DECLARATION

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 has not been taken or done by unspecified sources or persons. We hereby certify that this report has not been done by only one individual and that 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 contributors to the report. We, therefore, agreed unanimously that this report should be submitted for marking, and this final printed report has been verified by us.

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