MECHATRONICS SYSTEM INTEGRATION MCTA3203

MINI PROJECT

DATE: SECTION: 2

GROUP: 18

SEMESTER 1, 2025/2026

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1.0 Introduction

Washing machines are an essential household appliance designed to automate the process of cleaning clothes, providing convenience and efficiency in daily life. Modern washing machines integrate mechanical, electrical, and electronic components to control water intake, washing cycles, agitation, and spinning, ensuring optimal cleaning performance while conserving energy and water.

The objective of this mini project is to design a functional washing machine prototype that demonstrates basic automation principles. This involves controlling the motor for drum rotation, regulating water levels using sensors, and implementing timed washing cycles through a microcontroller. By completing this project, we can gain hands-on experience in integrating sensors, actuators, and control logic, as well as programming microcontrollers for real-time system operation.

Through this project, we will also explore the principles of mechatronics in domestic appliances, bridging theoretical knowledge with practical implementation. The project emphasizes system design, sensor integration, and automation, providing insight into how modern appliances achieve intelligent operation.

2.0 Materials and Equipment

Software:

- Arduino IDE: For writing, compiling, and uploading firmware to the microcontroller.
- Python (VS Code/IDLE): For running the serial data processing script.

Hardware:

- Arduino Mega 2560: Used to provide multiple hardware Serial ports (Serial and Serial1) for simultaneous debugging and sensor communication.
- ESP32 Board
- Servo motor
- Breadboard & Jumper Wires: For circuit connections.
- USB Cable: For programming and serial communication.
- Motor Driver
- Water Level Sensor
- Water Pump+Tube
- Push Button
- LCD
- 12V Power Supply
- IR Sensor
- LED

Non-Electronics:

- Plastic Container-2
- Acrylic Perspect

3.0 System Flow-Chart

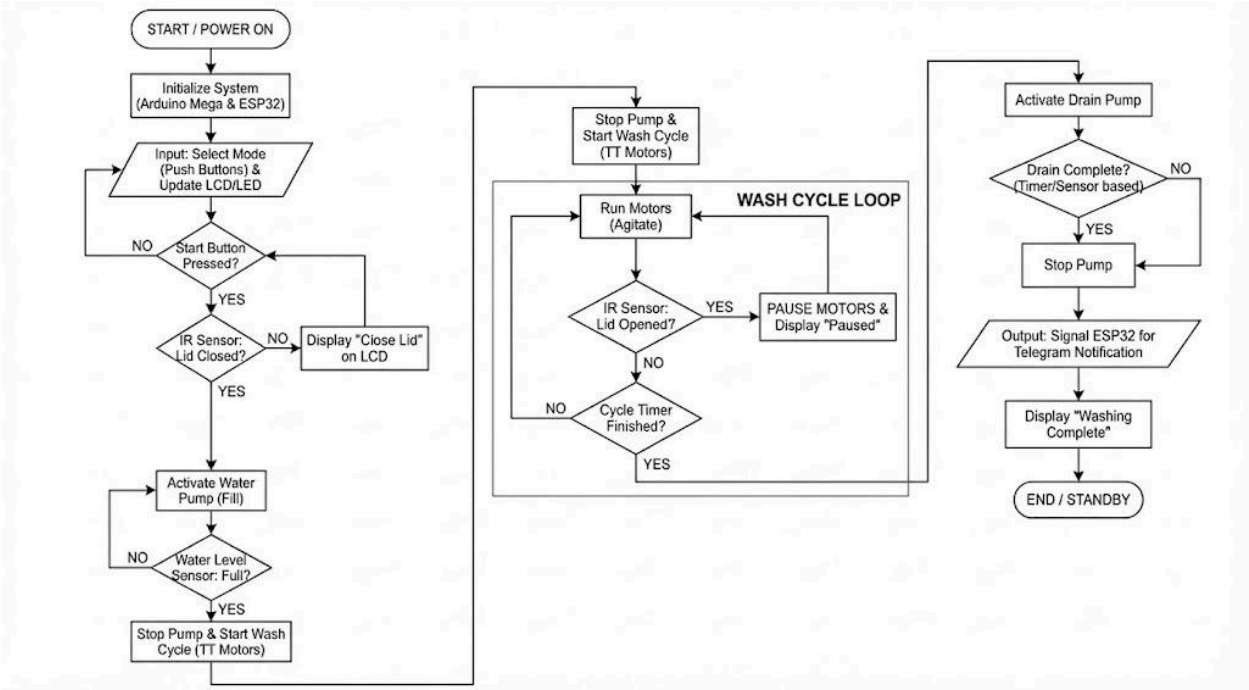

Figure 3.0 Flow Chart Diagram

4.0 Wiring Diagram

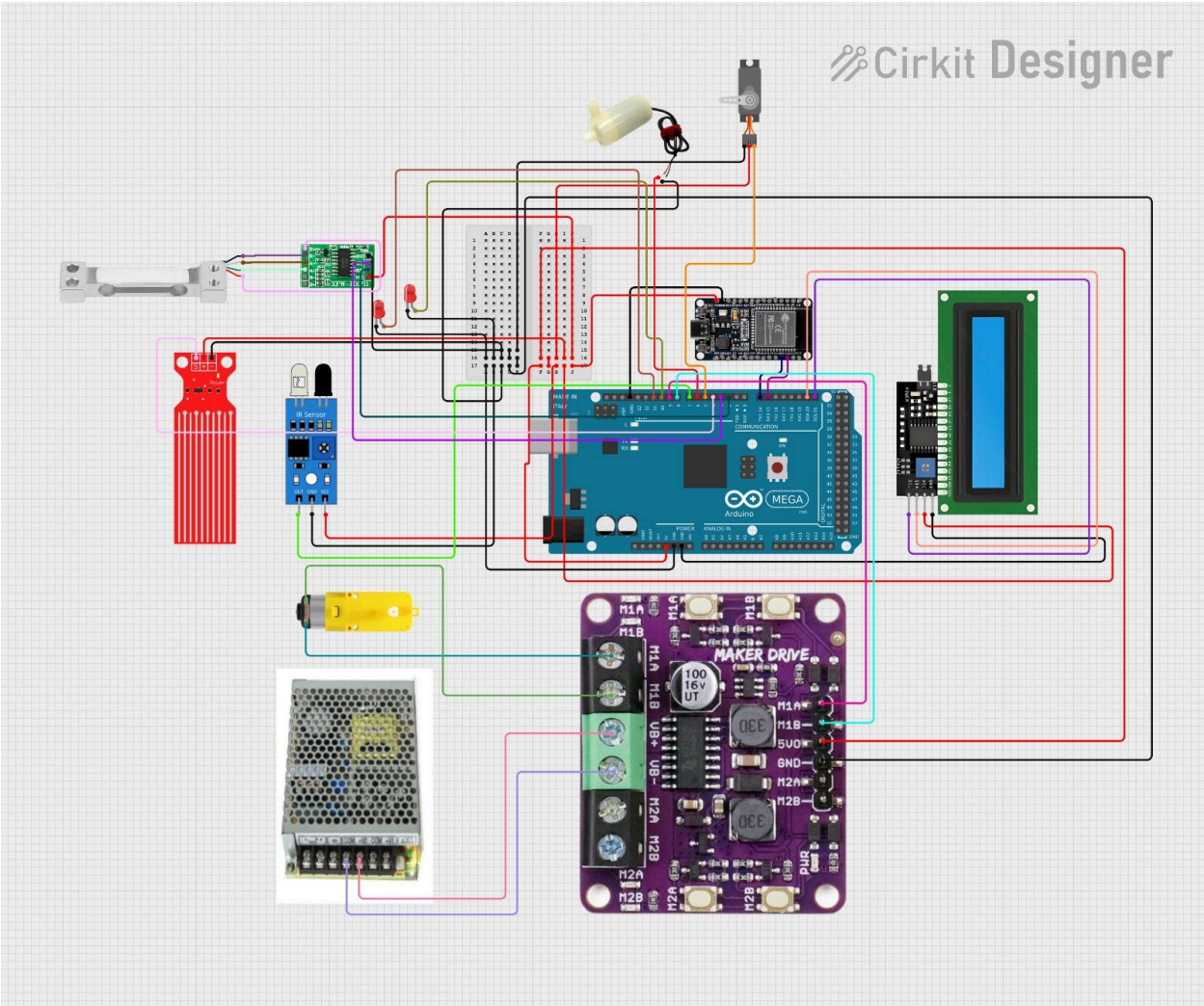

Figure 4.0 showing the complete wiring diagram for our Washing Machine Mini Project

5.0 System Architecture

1. Control Layer (Arduino Mega)

The Arduino Mega serves as the central brain. It handles all real-time sensor monitoring and controls the physical hardware.

- Logic Processing: Manages the washing states (Filling, Washing, Draining).
- Safety Interlocks: Uses the IR Sensor data to pause the Motor TT immediately if the lid is opened.
- User Interface: Reads inputs from the 4 Push Button Modules and updates the LCD and LED indicators.

2. Connectivity Layer (ESP32)

The ESP32 acts as the bridge between your physical machine and the internet.

- Communication: Receives a "Finished" signal from the Mega via Serial (UART).
- IoT Function: Connects to your local Wi-Fi network.
- Telegram Bot: Executes an HTTP request to the Telegram API to send the "Washing Complete" notification to your phone.

3. Peripherals Layer (Inputs & Outputs)

Inputs: * IR Sensor: Positioned at the lid to detect open/closed status.

- Water Level Sensor: Placed in the "Wash Tub" (bekas container) to detect when the water level is sufficient.
- Push Buttons: Dedicated to Power, Mode Selection, and Start.
- Outputs:L298N Motor Driver: Drives the two TT Motors (for agitation) and the Water Pumps (for filling and draining).
- LCD Display: Shows current status (e.g., "Filling...", "Washing...", "Paused").
- LEDs: Visual indicators for the current selected mode.

6.0 References

1. Mechatronics System Integration (MCTA3203). (2025). *Week 9: Image/Video input interfacing with microcontroller (ver. 2a)*. International Islamic University Malaysia.

7.0 Acknowledgement

We would like to express my sincere gratitude to Dr. Wahju Sediono, Dr. Zulkifli Bin Zainal Abidin, our teaching assistant, and our peers for their invaluable guidance and support throughout the completion of this report. Their insights, feedback, and expertise greatly contributed to the depth and quality of this work. We truly appreciate their time, patience, and commitment to our academic growth.

8.0 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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