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liquid machine Using PIC16F877A Microcontroller

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Abstract

This report presents an embedded system project designed a machine like a Cooler with to pumps, The project utilizes the PIC16F877A microcontroller as the core component. The report outlines the system's architecture, hardware, and software components, as well as the implementation details and testing results.

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1 INTRODUCTION

This report provides a comprehensive overview of an embedded system project utilizing the PIC 16F877A microcontroller. The project focuses on designing and implementing a machine with two pumps the first one to pump the good liquid and the other one to pump the dirty liquid , with five buttons and one for the second pump. The machine provided with laser to set the size of the cup .

1.1 OBJECTIVES

* **User Interface:** If the project involves user interaction, there might be a focus on creating a user interface using components like buttons, switches, LCD displays, or other input/output devices.
* **Learning and Skill Development:** we are doing the Embedded system project for educational purposes, providing individuals with the opportunity to learn and develop skills in microcontroller programming, hardware interfacing, and embedded systems design.

1.2 THEORY

The machine project uses the PIC16F877A microcontroller. Testing and debugging procedures are essential to ensure the system's functionality and reliability. The theoretical understanding of the microcontroller, analog-to-digital conversion, control signal generation, and motor control is essential for successful implementation.

List of components and how they work:

1.Pic (16F877A): The PIC16F877A is a microcontroller developed by Microchip Technology. It is based on the PIC architecture and is commonly used in embedded systems and other control applications. The PIC16F877A has a wide range of features including: -An 8-bit CPU -35 I/O pins - 8K bytes of Flash program memory -368 bytes of RAM -A variety of peripheral modules such as timers, A/D converters, and communication interfaces.

The PIC16F877A is programmed using a specialized programming language called assembly, or using a high-level language such as C or Basic with the help of a compiler. Once programmed, the PIC16F877A can be used to control various devices and systems by processing inputs and outputs, performing calculations, and making decisions based on the program code.

2. DC Motors: DC (Direct Current) motors are commonly used in the liquid machine . These motors convert electrical energy into mechanical motion. By varying the voltage and polarity applied to the motor terminals, the speed and direction of the motor can be controlled. DC motor is the pump in our project .

3. H-Bridge: an electronic circuit that allows for controlling the direction and speed of a motor. It typically consists of four switches (transistors or MOSFETs) arranged in an H shape. By selectively turning on and off the switches, the motor's polarity can be reversed, enabling forward and backward motion. The H-bridge is an essential component in controlling the DC motors used

in the machine .

4. Laser : Laser, which stands for "Light Amplification by Stimulated Emission of Radiation," is a technology that has various applications across different fields due to its unique properties , and we use it here in the project to set the size of the cup (medium , large , small) .

5. LCD (20x4):

A 20x4 LCD refers to a Liquid Crystal Display with a display format of 20 characters per line and 4 lines. This specification indicates the number of characters (letters, numbers, or symbols) that can be displayed horizontally and vertically on the LCD screen. , and we use it here to display the situation of the tank if it is full or empty , and the situation of the cup as user choice (large , medium , small).

6. Ultrasonic Sensor: ultrasonic sensor is a device that uses high-frequency sound waves to detect objects or measure distances. It emits ultrasonic waves and measures the time it takes for them to bounce back after hitting an object, allowing it to calculate the distance. These sensors are commonly used in various applications, such as proximity detection, distance measurement, and collision avoidance systems. They offer non-contact operation, a wide detection range, and good accuracy, making them valuable in industries like robotics, automation, and security.

Other Components:

* Oscillator – 1
* Buttons -5
* Breadboard – 1
* Tube -1
* LDR sensor
* Wires (male-male, female-male, female-female)

2 PROCEDURE AND METHODS

Procedure:

a) Hardware setup: Begin by setting up the hardware components, including the PIC16F877A microcontroller, H-bridge, DC motors. Connect the necessary wires and ensure proper power supply arrangements.

b) Software development: Develop the firmware for the PIC16F877A microcontroller using a suitable programming language such as C. Implement the necessary code to read analog inputs process the data, and generate appropriate control signals for the H-bridge and DC motors.

c) Testing and debugging: Conduct comprehensive testing and debugging procedures to ensure the functionality and reliability of the system. Make necessary adjustments and corrections as required.

3 DESIGN

Software Design (Flow Chart):

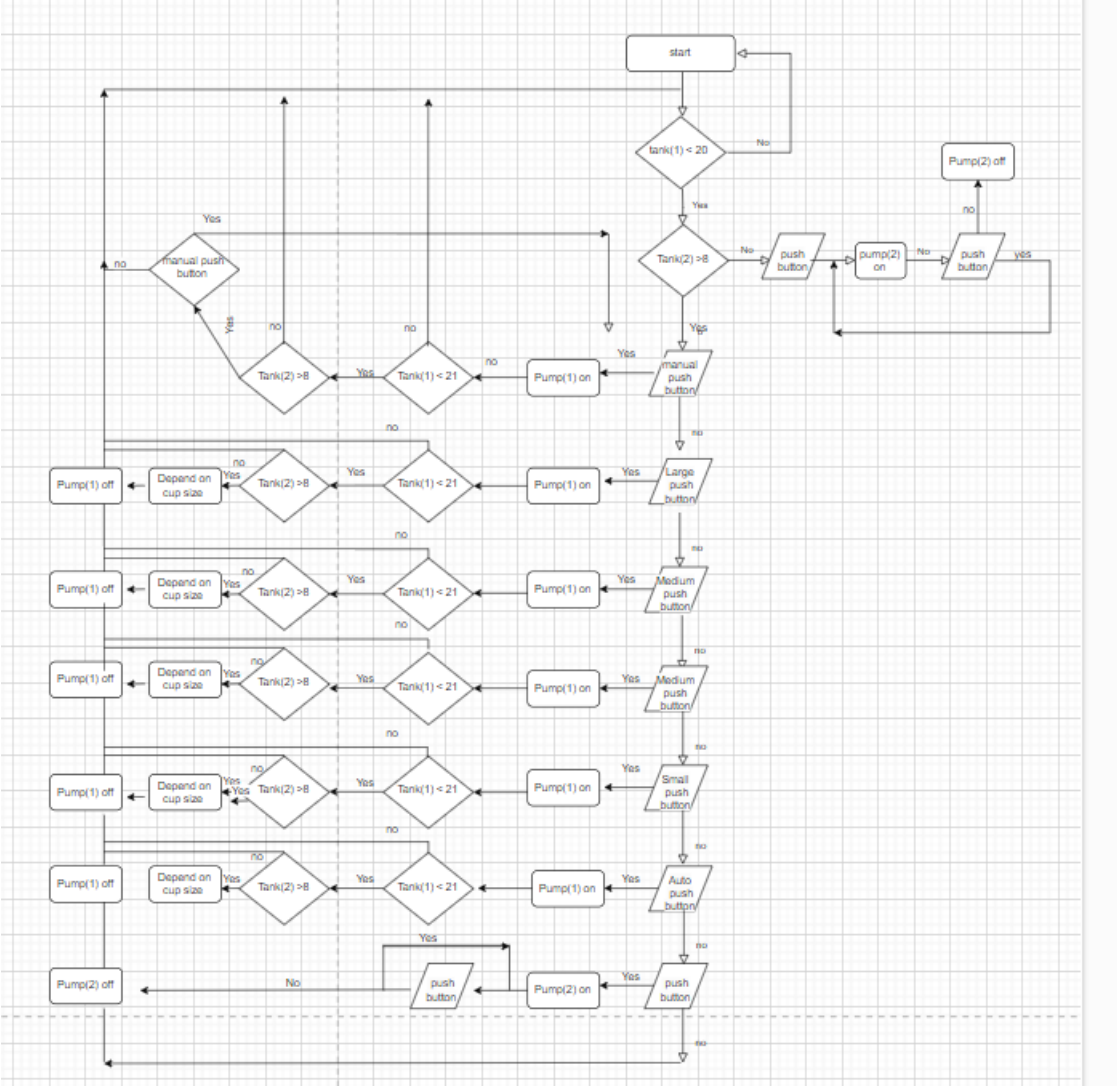

Figure 1: Flow Chart

Electrical Design:

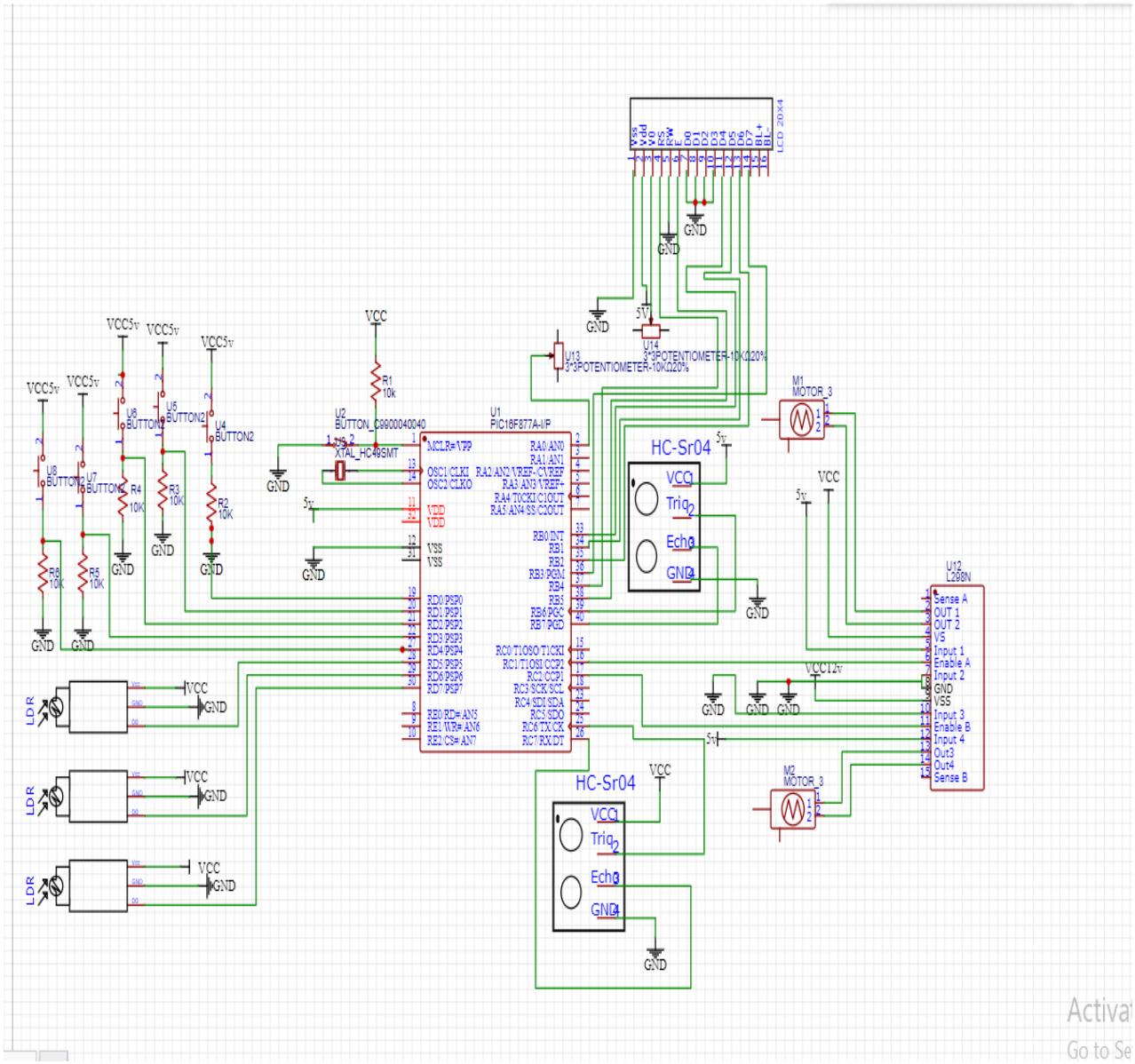

Figure 2: Electrical Design

Hardware Design:


Pump for Dirty
tank
Manual
Large
Meduim
Small
Auto

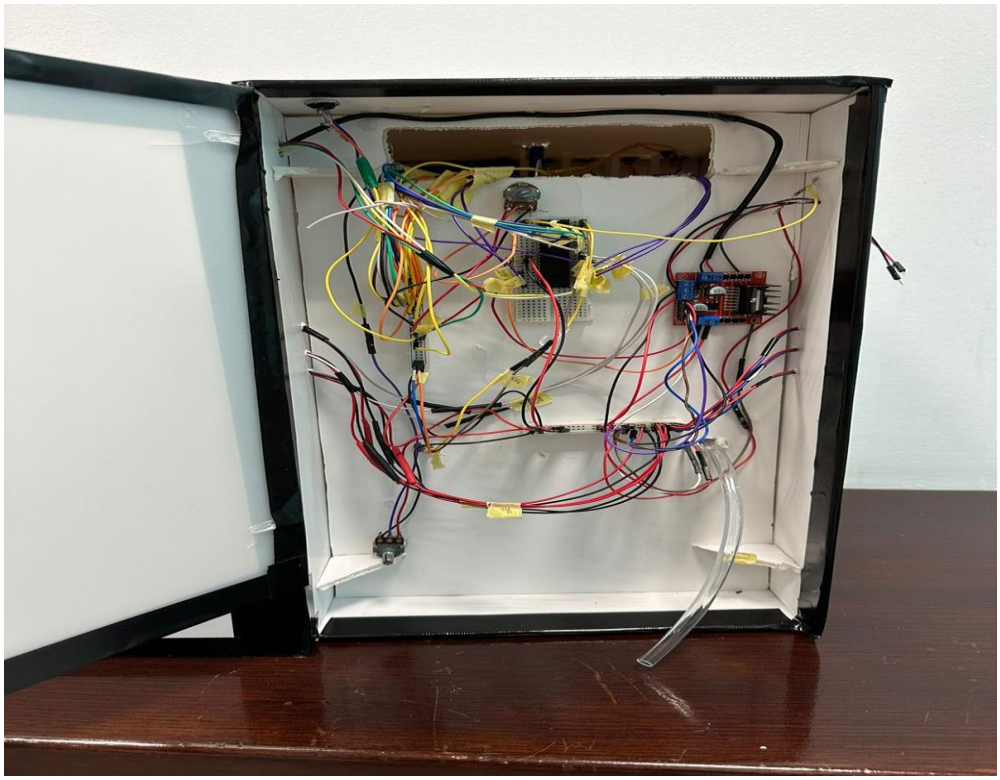

Figure 3: Hardware Design

4 Problems and Recommendations

Problem (1) : In the beginning we faced a problem that we wanted to fill the cup depend on the length of the cup and the height of the water in the cup , so the real problem here that the ultra-sonic sensor didn't take the all the sizes in the right way .

How we dealt with the problem ?

we change the idea we add laser light with LDR to identify the level of the cup and the machine fill the water depend on this level using delay time , the purpose from this idea is applying it in our real life .

Problem (2) : It was difficult to determine the exact PWM duty cycle used for giving enough force for the pump actuators .

Problem (3) : We took along time to understand how to print using LCD(20x4)

5 CONCLUSIONS

In conclusion, a liquid machine embedded project using the PIC16F877A microcontroller, excluding direct temperature control, can still achieve notable outcomes. Key focuses include designing a user-friendly interface, optimizing liquid flow mechanisms, ensuring efficient power management, incorporating safety features, and possibly enabling optional remote monitoring.

Recommendations for improvement encompass thorough testing, modularity for scalability, detailed documentation, integration of energy-efficient components, enhanced feedback mechanisms, security measures (if applicable), and compliance with relevant standards.

6 REFERENCES

https://youtu.be/ftDjjdE7Zlo?si=4TLRa8ofeFeXaj2H