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# Smart Sanitary System

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## Introduction

Touchless hygiene and easy waste disposal help stop the spread of germs. Our Smart Sanitary System uses simple sensors and motors to make both tasks hands-free. An IR-triggered 3D-printed trash can lid opens automatically, and an ultrasonic-monitored water tank pumps water without touch. Both use infrared sensors to detect when the presence of a hand, activating the relevant system. This design works in any home or public space for safer everyday hygiene.

Our system is comprised of two subsystems that interface with one another with an array of sensors and actuators, and the microcontroller used is the PIC16F877A.

## Design

Our Smart Sanitary System splits into two coordinated subsystems: the hands-free trash can and the touchless water dispenser. Both use the same PIC16F877A microcontroller running on an 8 MHz crystal. A digital IR sensor mounted under the trash-can lid detects a hand and triggers a PWM-driven hobby servo to swing the lid open. After a short delay, the servo closes the lid again.

The water dispenser uses a second IR sensor to detect a hand under the spout and then drives a 5 V DC pump via an H-bridge. A potentiometer on the front panel lets the user adjust the pump speed. An ultrasonic sensor continuously measures the water level: if the distance to the surface exceeds a set threshold, the microcontroller lights a set of LEDs to signal “Refill tank”. All power and ground rails tie into common 5V and GND rails, and two 11 pF capacitors stabilize the clock crystal inputs.

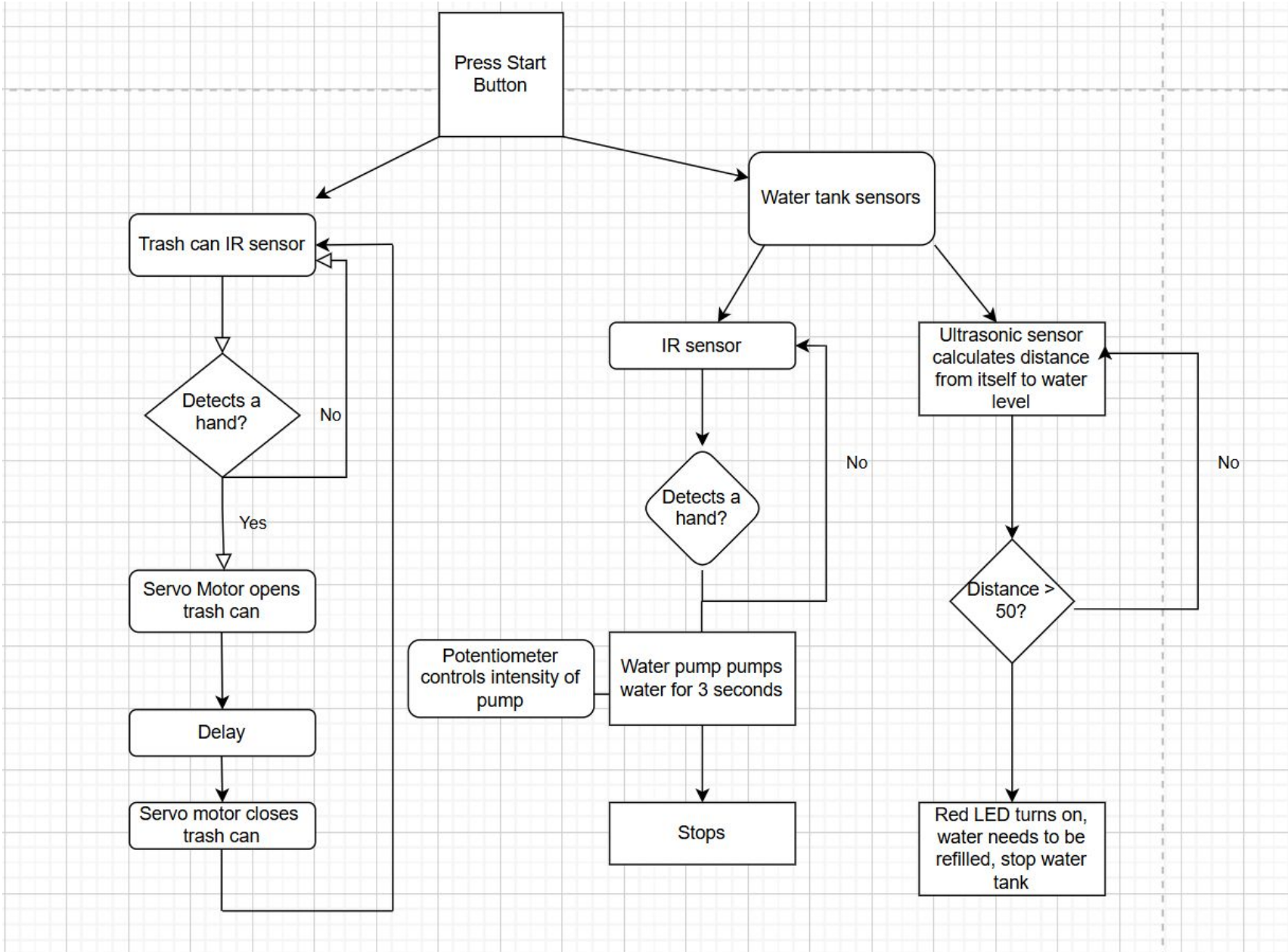


Figure 1: Software Algorithm Design

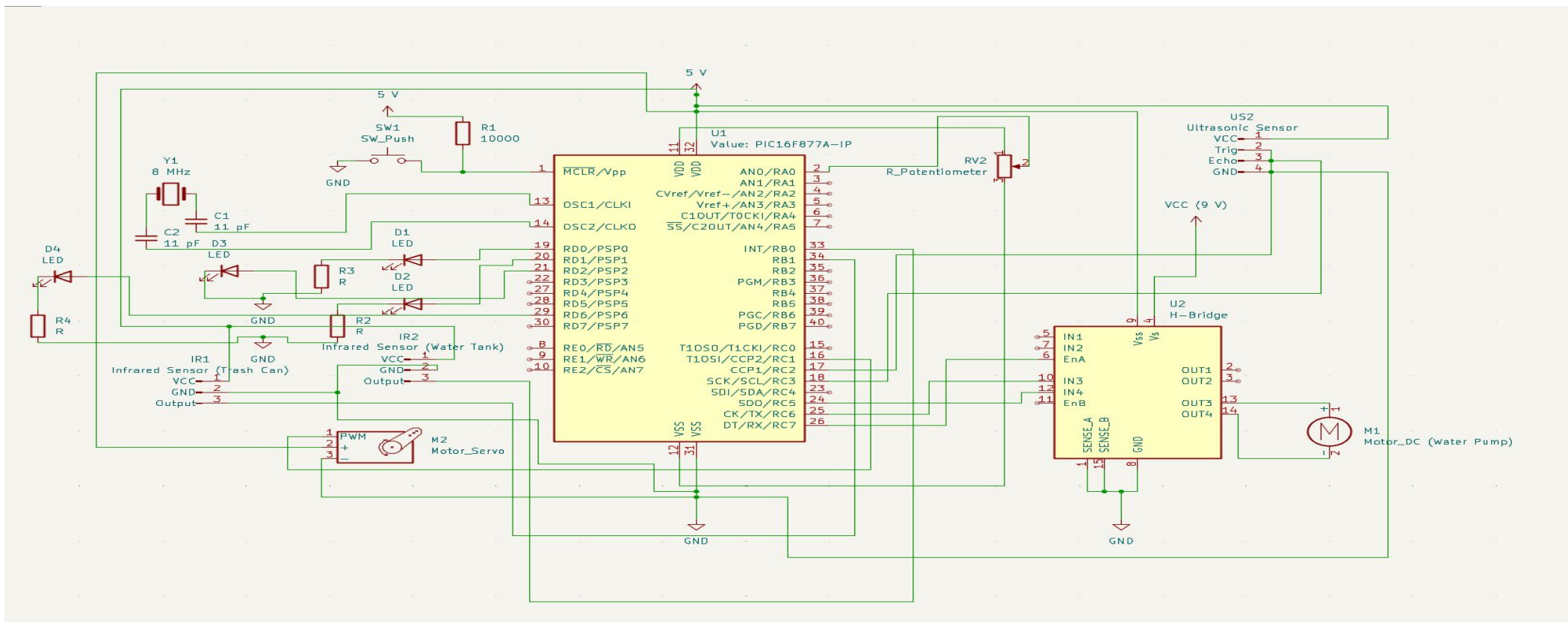


Figure 2 Electrical Design

## Results

The trash can perfectly worked, opening when the IR sensor detected an object and closing, after some delay, when no object is detected.

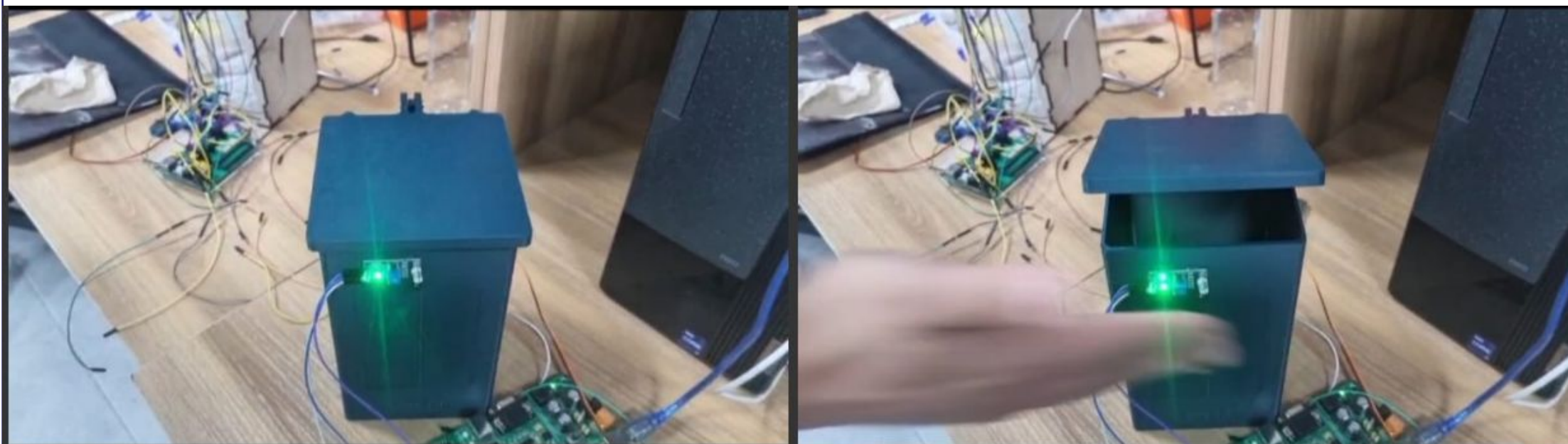


Figure 3: closed when not detecting

Figure 4: open when detecting

The water tank also functioned perfectly, using a motor as a water pump to push water out of the tube.



Figure 5: no detection; no water is being pumped

Figure 6: water being pumped when a hand is detected.

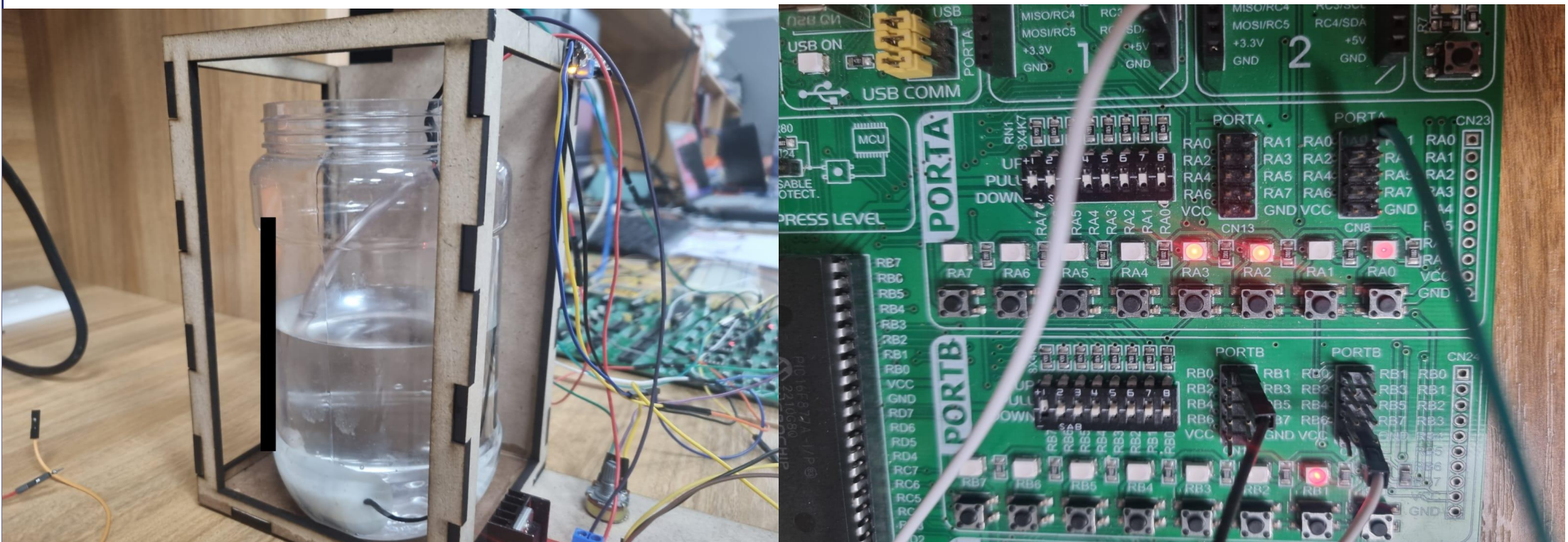


Figure 7: Water tank

Figure 8: LEDs indicating 75%

In figure 7, the water level is calculated only along the distance along the black line on the left side of the tank. RA2 & RA3 in Figure 8 indicate that the water level along the black line is 75%, a level partially obscured by the perspective of the tank.

## Conclusion

Our Smart Sanitary System meets its goal of making two everyday tasks—waste disposal and hand washing—touchless, clean, and convenient. By combining automatic trash-can opening with a hands-free water pump and refill alert, we reduce surface contact, lower the risk of germ spread, and encourage consistent hygiene in homes, offices, or public venues. In testing, the IR sensors and servo lid mechanism opened and closed the trash can reliably in under 300 ms, while the potentiometer-adjusted pump delivered water on demand and the ultrasonic refill warning activated at the correct tank level every time. This low-cost, battery-powered design can be scaled to larger facilities or modified for other fluids and sensors, offering a practical solution for healthier environments everywhere.