

Calvin Li

Engineering Portfolio

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1 Automated Water Dispenser System

Role: Mechanical Design & Systems Integration

Project Overview

Engineered a fully automated, touchless hydration station designed to improve office hygiene and accessibility. The system integrates a high-flow 12V DC pump with an APDS-9960 IR proximity sensor to deliver hands-free operation. The device features a custom T-shaped chassis designed for stability and splash resistance, accommodating standard 16.9oz reservoirs while isolating sensitive electronics from liquid exposure[cite: 92, 117].

Key Technical Achievements

- **Dual-Voltage Power Architecture:** Designed a unified power system using a single 12V source to drive the high-torque DC pump, while integrating an L298N motor driver's onboard voltage regulator to supply a stable 5V logic level to the Arduino Uno and sensors[cite: 95, 230].
- **Embedded Control Logic:** Developed C++ firmware implementing a finite state machine. The system includes a 15-second auto-shutoff safety timer to prevent overflow, an emergency interrupt button that disables the sensor for 5 seconds, and real-time LCD status updates ("Dispensing," "Paused," "Ready")[cite: 126, 199, 220].
- **Engineering Problem Solving (Sensor Integration):** Diagnosed a critical failure in the initial prototype where the acrylic housing panel reflected IR signals, causing false triggers. Redesigned the chassis to flush-mount the sensor, eliminating interference and restoring 100% detection reliability[cite: 142, 143, 144].
- **Performance Validation:** Conducted rigorous testing over 20 trials, achieving a consistent sensor response time of < 0.5 seconds and a verified average flow rate of 16.558 mL/s[cite: 131, 247].

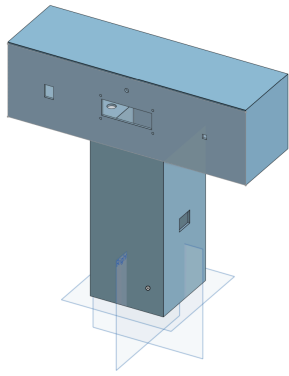


Figure 1: CAD Assembly: T-Shaped Housing Design



Figure 2: Final Prototype with LCD & Sensor Integration

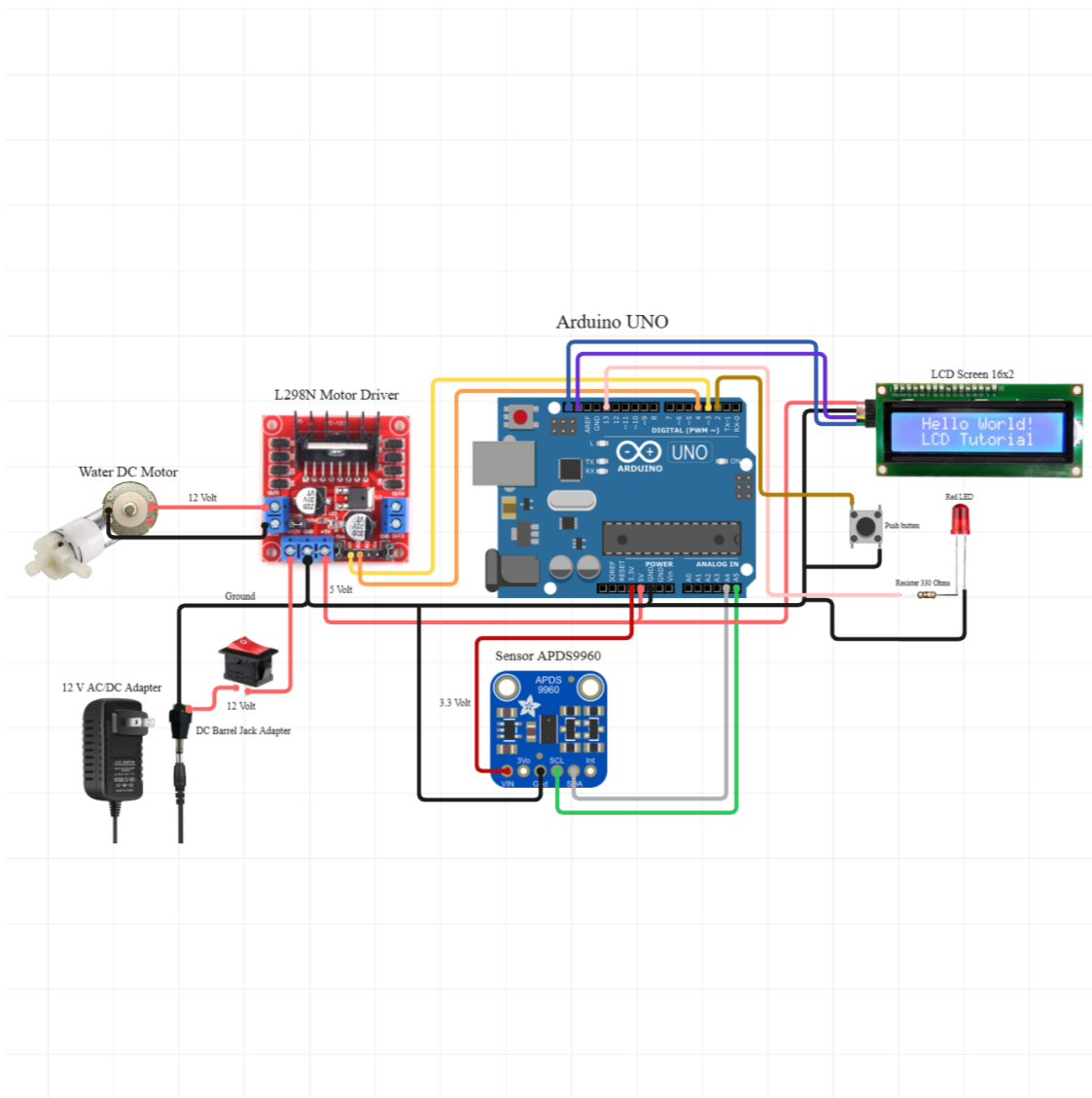


Figure 3: Wiring Schematic: Interfacing 12V pump load with 5V Arduino logic.

