Sensors And Metrology

Milestone 1 Report

Automated Hand Sanitizer Dispenser

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1. Detailed Project Description and Implementation Plan

1.1 Introduction

This project aims to design and implement an automated touchless hand-sanitizer dispensing system using an Arduino-based control platform. The system uses an ultrasonic sensor to detect the presence of a hand and a servo motor to actuate a sanitizer container mechanism. The goal is to provide a hygienic, non-contact dispensing solution that reduces surface contamination and improves user safety.

1.2 Objectives

- Develop a fully functioning automated sanitizer dispenser using readily available electronic components.
- Detect user hand proximity reliably using an ultrasonic sensor.
- Control a servo motor that mechanically dispenses sanitizer.
- Build the supporting mechanical structure using accessible materials.
- Produce complete hardware/electrical documentation, schematics, and a verified component list.

1.3 System Functionality

1. The ultrasonic sensor continuously measures distance.
2. When an object/hand is detected within a pre-set threshold, the Arduino triggers the servo.
3. The servo rotates to press or open the sanitizer mechanism and then returns to its initial position.
4. The system resets and waits for the next detection.

1.4 Implementation Plan (Step-by-Step)

I. **Sensor Interface Setup**

- Connect HC-SR04 ultrasonic sensor to Arduino pins (Trigger, Echo, VCC, GND).
- Program Arduino to read distance using pulse measurement.

II. **Servo Control Setup**

- Connect SG90 servo to Arduino PWM pin, VCC, and GND.
- Program servo angles for opening and closing positions.

III. **Integration Phase**

- Combine sensor reading logic with servo actuation.
- Add distance thresholds and debouncing to avoid false triggers.

IV. **Mechanical Assembly**

- Mount the ultrasonic sensor at the front of the unit.
- Attach servo to a lever or push-arm that presses the sanitizer bottle.
- Build the frame using materials such as 3D-printed parts or acrylic.

V. **Testing & Verification**

- Validate detection accuracy at various hand distances.
- Adjust servo angles for consistent dispensing.
- Ensure power stability and structural integrity.

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2. Hardware Schematic

The mechanical assembly includes:

- A front panel containing the ultrasonic sensor.
- A servo mounted on a structural bracket.
- A sanitizer bottle firmly held in place.

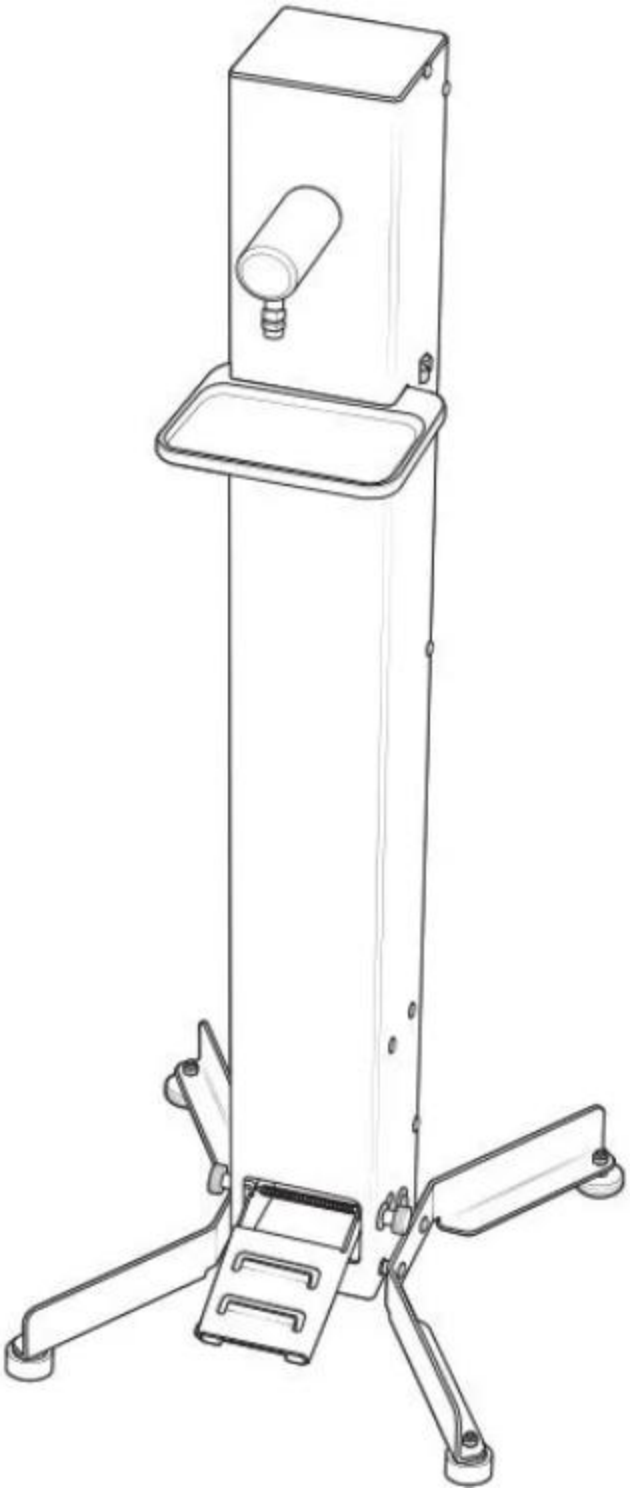
Key structural elements:

- Sensor mount aligned horizontally.
- Servo placed above/behind the bottle with a lever arm.
- Fixed base for bottle stabilization.

Example models (we'll use one of 2):

Either wood or plastic will be used.


Apply hand rub
Rub backs hand and back
Rub between fingers
Rub until dry



3. Electrical Circuit Diagram

Below is the full wiring description needed for Proteus/Fritzing schematic creation:

3.1 Arduino to Ultrasonic Sensor (HC-SR04)

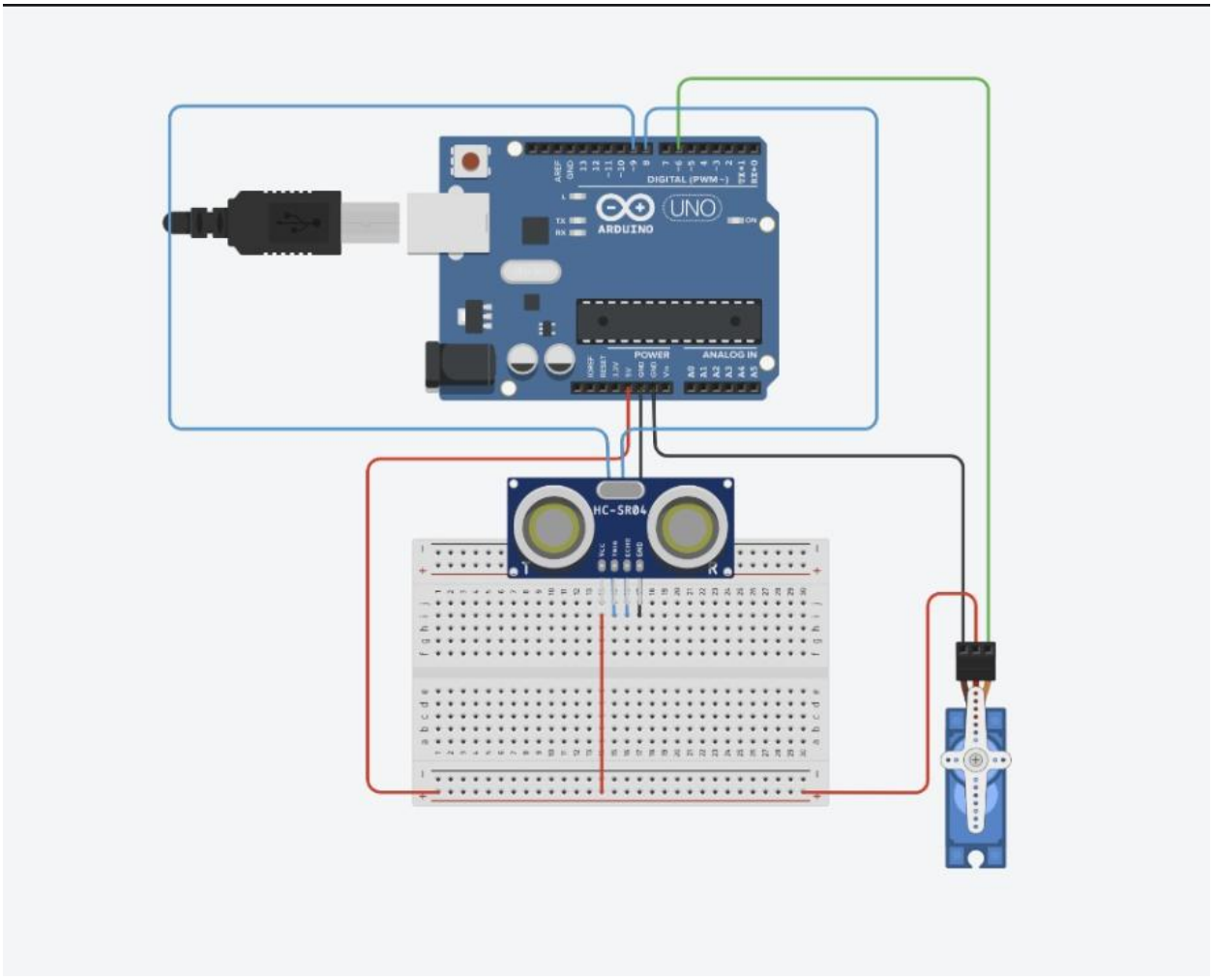
- VCC → Arduino 5V
- GND → Arduino GND
- TRIG → Arduino Digital Pin **9**
- ECHO → Arduino Digital Pin **8**

3.2 Arduino to Servo Motor (SG90)

- VCC (Red) → Arduino 5V
- GND (Brown) → Arduino GND
- Signal (Orange) → Arduino PWM Pin **6**

3.3 Power Considerations

- The Arduino is powered via USB or 5V supply.
- Servo draws more current than the sensor; however, for SG90 light loads, Arduino 5V is sufficient.


DIGITAL (PWM~)
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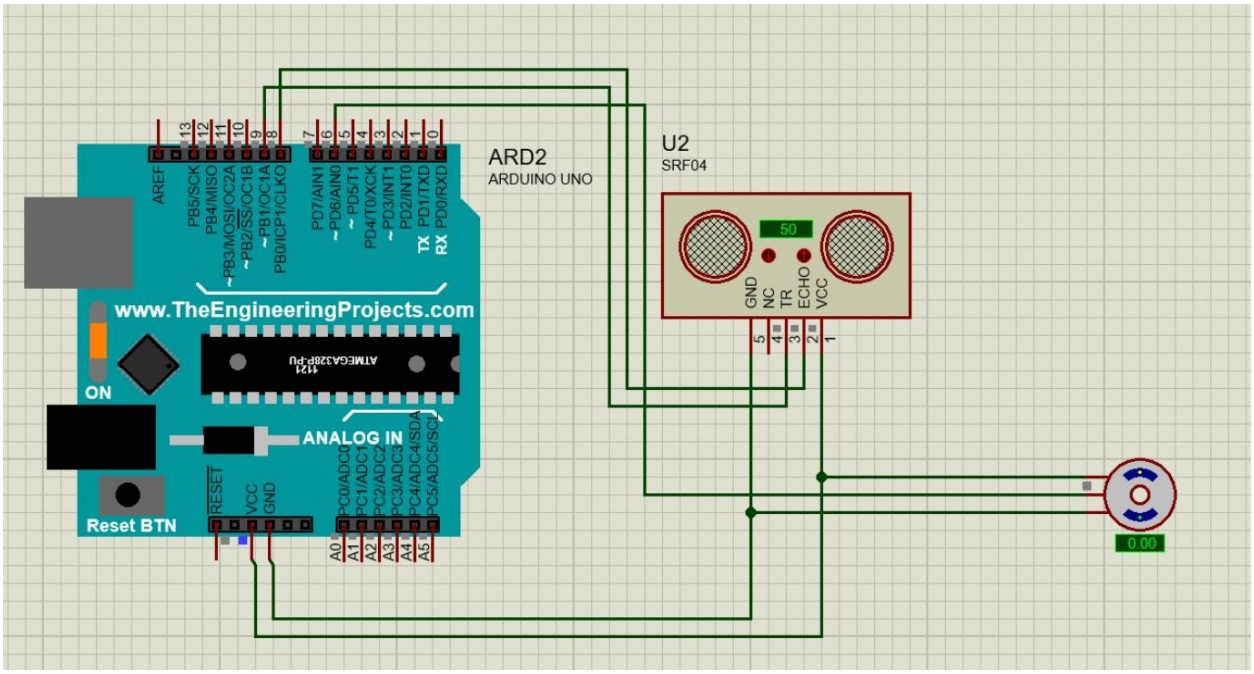
HC-SR04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4. Component List with Prices and Availability (Egypt Market)

Prices sourced from RAM Electronics, UGE, Ampere Electronics, and other Egyptian online suppliers.

Component	Quantity	Approx. Price (EGP)	Availability
Arduino Uno (Compatible)	1	375–450 EGP	Widely available
HC-SR04 Ultrasonic Sensor	1	40–85 EGP	Widely available
SG90 Micro Servo	1	40–100 EGP	Widely available
Jumper Wires	1 pack	9–60 EGP	Widely available
Breadboard (optional)	1	45 EGP	Available
USB Cable	1	28 EGP	Available

Total estimated cost: **~500–700 EGP** depending on vendor and component brand.

5. Summary

This milestone presents the full conceptual and implementation outline for an automated touchless hand sanitizer dispenser using Arduino. The system uses an ultrasonic sensor for proximity detection and a servo motor for mechanical actuation. All electrical connections are detailed for schematic construction, and a complete price-verified component list is provided. Mechanical assembly guidance and materials are also clearly defined to support the next milestone involving prototyping and testing.