Automatic Hand Sanitizer Dispenser Project

Project Description:

The **Automatic Hand Sanitizer Dispenser** is a system that uses an **ultrasonic sensor** to detect the presence of a hand at a certain distance (typically 20 cm or less). Once the sensor detects a hand, it triggers a **servo motor** to release a certain amount of sanitizer. This project aims to provide a contactless solution for sanitizing hands, ensuring hygiene and convenience.

Components Used:

1. **Arduino Board (e.g., Arduino Uno)**
    - **Purpose:** Controls the sensor and servo motor, processes input data, and outputs the response to activate the sanitizer dispenser.
    - **Working Principle:** An Arduino microcontroller is programmed to process sensor data (from the ultrasonic sensor) and control outputs (servo motor).
    - **Application:** Used to interface all the components and manage the control flow of the project.
2. **Ultrasonic Sensor (HC-SR04)**
    - **Purpose:** Measures the distance between the sensor and an object (e.g., hand) to detect its presence.
    - **Working Principle:** The sensor emits a sound wave from the **Trig** pin. The wave hits an object and returns to the **Echo** pin. The time taken for the wave to return is used to calculate the distance.
    - **Application:** Used for detecting the presence of a hand in front of the sensor. If the distance is within the threshold (e.g., 20 cm), it triggers the dispenser.
3. **Servo Motor**
    - **Purpose:** Controls the mechanism that dispenses the sanitizer when triggered by the ultrasonic sensor.
    - **Working Principle:** The servo motor receives PWM (pulse-width modulation) signals from the Arduino, which allows it to rotate to specific angles (e.g., 90° to dispense sanitizer and 0° to reset).
    - **Application:** Used to control the movement that releases the sanitizer when the hand is detected.
4. **Power Supply**
    - **Purpose:** Provides the necessary power for the Arduino and other components.
    - **Working Principle:** Typically, the system uses a 5V power supply for the Arduino and servo. An external power source may be used for the servo motor to ensure stable performance.
    - **Application:** Powers the entire system, ensuring that the Arduino and servo motor operate properly.
5. **Jumper Wires**
    - **Purpose:** Connects the components (Arduino, ultrasonic sensor, and servo motor).
    - **Working Principle:** Transmits electrical signals from one component to another.

- **Application:** Used for making connections between the various components of the system.

6. **Breadboard**
   - **Purpose:** Provides a platform for connecting the components without the need for soldering.
   - **Working Principle:** A breadboard allows for temporary and flexible wiring of the components.
   - **Application:** Used to connect all the components in the system.

Working Principle:

1. The **ultrasonic sensor** continuously measures the distance between itself and objects in front of it.
2. When an object (e.g., a hand) enters within a certain range (e.g., 20 cm), the Arduino processes this data and sends a signal to the **servo motor**.
3. The servo motor then moves to a pre-programmed angle (e.g., 90°), which activates the mechanism for dispensing the sanitizer.
4. After a short delay (to allow enough sanitizer to be dispensed), the servo motor returns to its starting position (0°), and the system resets.
5. The system is designed to be contactless, ensuring hygiene and convenience for the user.

Applications of the Project:

1. **Public Places**: Used in hospitals, shopping malls, airports, or any high-traffic area to ensure hygiene without physical contact.
2. **Home or Office**: A personal or office-based hand sanitizer dispenser, especially in environments where hygiene is a priority.
3. **Schools and Colleges**: To encourage students and staff to sanitize their hands frequently, reducing the spread of germs.
4. **Restaurants**: To provide contactless hand sanitization for customers before they enter or while seated.
5. **Labs and Clinics**: Where frequent sanitization is necessary to maintain a sterile environment.