System Design Documentation

1. System Overview

The "Third Eye for the Blind" device is a wearable technology designed to help visually impaired individuals detect obstacles in their path. It leverages ultrasonic sensors to gauge distances and provide real-time feedback through a buzzer. The device is intended to be integrated into a pair of glasses, ensuring that it is both practical and user-friendly.

2. Components List and Specifications

Key Components:

1. **Arduino Nano**:
   - **Function**: Acts as the microcontroller, processing data from the ultrasonic sensor and controlling outputs like the buzzer.
   - **Specifications**:
     - Microcontroller: ATmega328
     - Operating Voltage: 5V
     - Digital I/O Pins: 14 (6 PWM outputs)
     - Analog Input Pins: 8

2. **Ultrasonic Sensor (HC-SR04)**:
   - **Function**: Measures the distance to obstacles using sound waves.
   - **Specifications**:
     - Operating Voltage: 5V
     - Measuring Range: 2cm to 400cm
     - Accuracy: ±3mm
     - Trigger and Echo pins for distance calculation

3. **Buzzer**:
   - **Function**: Provides auditory feedback when an obstacle is detected within a critical distance.
   - **Specifications**:
     - Operating Voltage: 3.3-5V
     - Sound Output: 85 dB
4. **9V Battery**:
   - **Function**: Powers the Arduino Nano and other components.
   - **Specifications**:
     - Nominal Voltage: 9V
     - Capacity: 500mAh (varies by brand)

5. **Battery Clip**:
   - **Function**: Connects the 9V battery to the Arduino and the circuit.

6. **Push Button**:
    - **Function**: Acts as a power switch, allowing the user to start or stop the device.
    - **Specifications**:
        - Normally open (NO) configuration
        - Rated Voltage: 12V

7. **Glasses**:
    - **Function**: The platform where all the components are mounted, ensuring a wearable and user-friendly design.

8. **Jumper Wires**:
    - **Function**: Connects the various components, including power, ground, and signal lines.

3. Detailed Schematic Diagram

The schematic diagram provides a clear view of how the components are interconnected:

1. **Ultrasonic Sensor**:
    - **VCC**: Connected to the 5V output of the Arduino Nano.
    - **GND**: Connected to the ground (GND) pin on the Arduino.
    - **Trigger Pin**: Connected to digital pin D2 on the Arduino.
    - **Echo Pin**: Connected to digital pin D3 on the Arduino.

2. **Buzzer**:
    - **Positive Terminal**: Connected to digital pin D5 on the Arduino.
    - **Negative Terminal**: Connected to the ground (GND) pin.

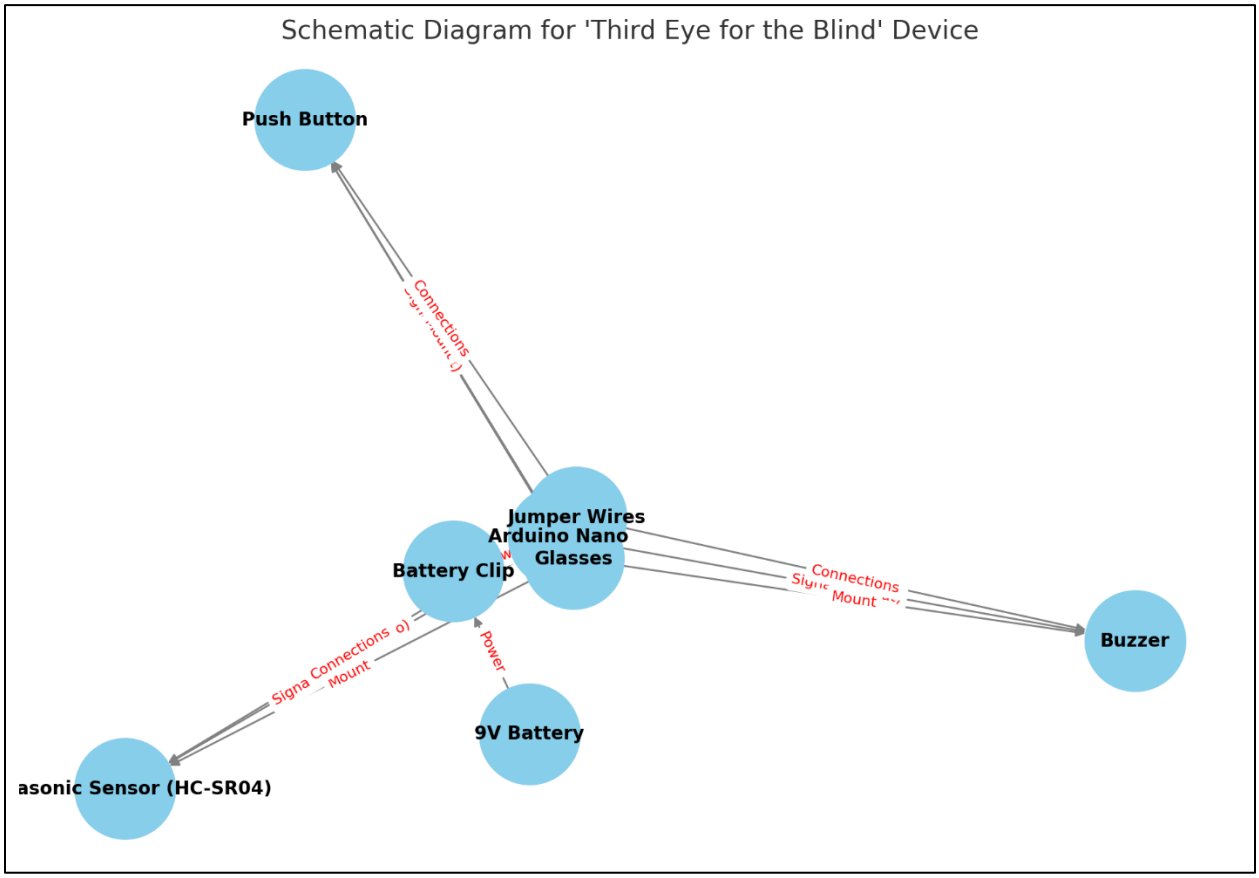
3. **Push Button**:
    - **One Side**: Connected to a digital pin (D7) on the Arduino.
    - **Other Side**: Connected to ground with an internal pull-up resistor configured in the code.

4. **Power Supply (9V Battery)**:
    - **Positive Terminal**: Connected to the VIN pin on the Arduino (which has an onboard voltage regulator).
    - **Negative Terminal**: Connected to the GND pin on the Arduino.

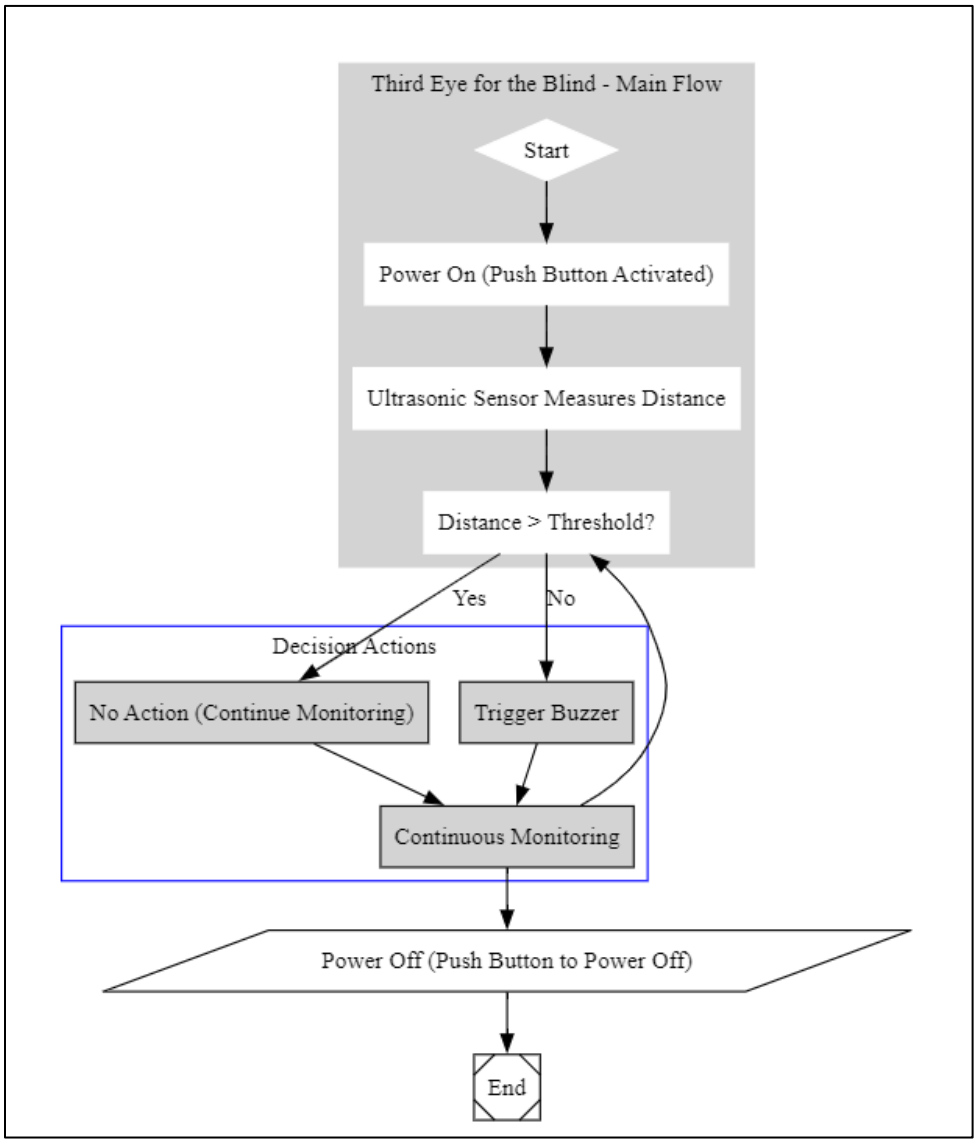
Circuit Design Explanation:

- The ultrasonic sensor continuously sends out sound waves and listens for the echo. When an object is within a set distance (e.g., 100 cm), the Arduino triggers the buzzer to alert the user.

- The push button is used to activate or deactivate the device.



4. Flowchart



- After powering on, the device continuously measures the distance in front of the user.
- If the measured distance falls below a predefined threshold (e.g., 100 cm), the buzzer is activated to warn the user.
- The device remains in this loop until the user deactivates it using the push button.

5. Design Considerations

Mounting the Components on Glasses:

- The ultrasonic sensor is mounted at the front of the glasses, pointing forward to detect obstacles.
- The Arduino Nano and battery are mounted on the sides or behind the user's head for balance and comfort.
- Jumper wires are neatly routed along the frame of the glasses, ensuring they do not obstruct the user's view or interfere with wearability.

Energy Management:

- The 9V battery should be selected based on its capacity to provide sufficient power for at least several hours of continuous use. A low-power design approach is critical to extend battery life.

Safety and Durability:

- All connections should be secure, with appropriate insulation to prevent short circuits.
- The glasses should be lightweight and ergonomically designed for long-term wear.