



Boston University
Electrical & Computer Engineering
EC464 Capstone Senior Design Project

Final Prototype Testing Plan

Halo Smart Drink Protector



by

Team #23
Halo

Team Members

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Required Materials

Hardware:

- Arduino Nano 33 BLE
- Testing Cup
- Strain gauge
- Accelerometer
- IOS phone with Bluetooth.
- Battery case
- Two 3V battery
- Halo enclosure

Software:

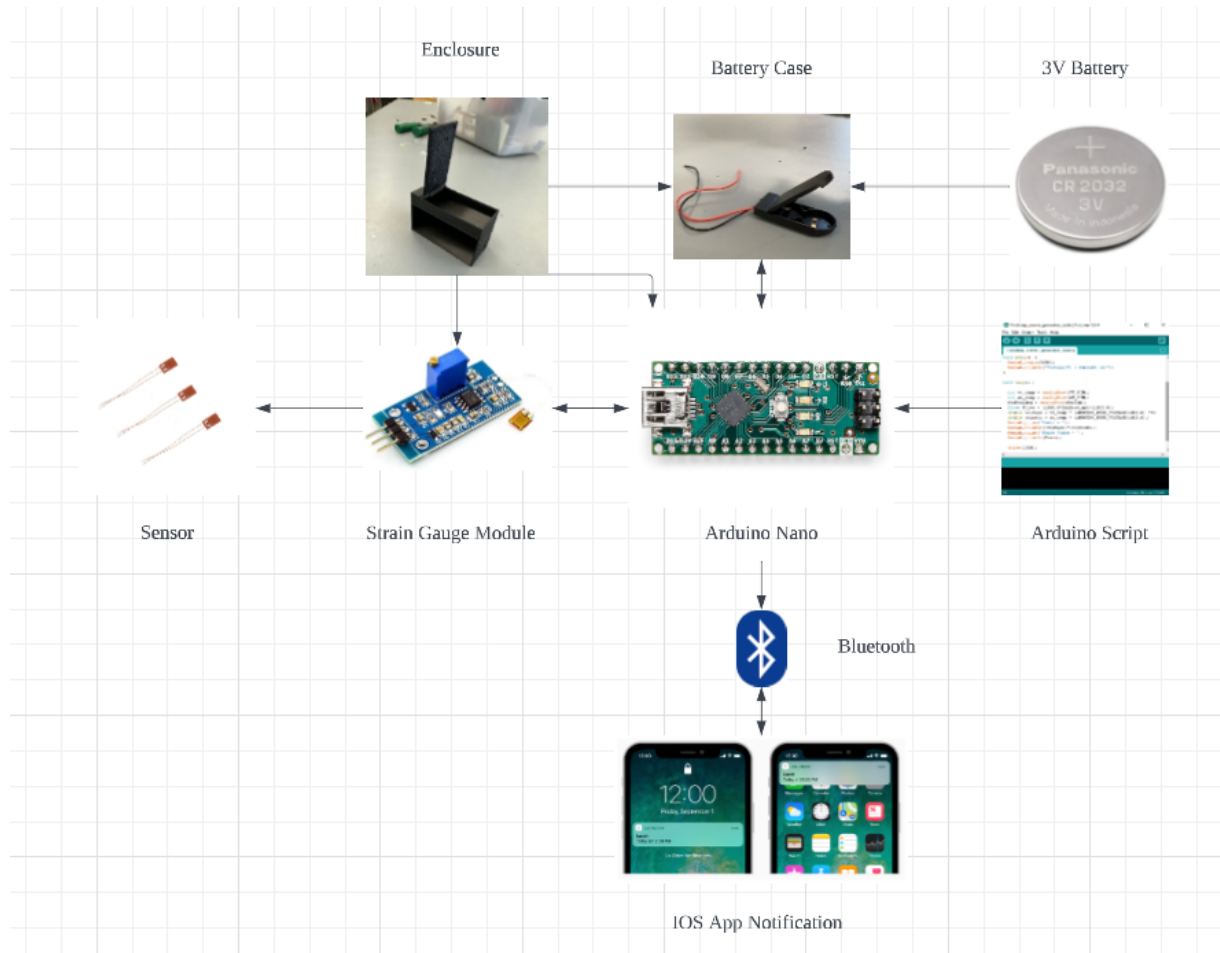
- Arduino script
 - Scans for compatible devices through Bluetooth
 - Connect Halo device to client's phone
 - Monitor the battery level, acceleration, and voltage of the device.
 - Initialize the LED pin when the device is connected.
 - Stops the program and prints the warning message to warn the remote client when the cap is potentially taken off, continues when the reset button is pressed
- IOS Application
 - Scan for Halo devices with Bluetooth
 - Handle Bluetooth connection errors and check for compatibility of the device; print corresponding error messages when Bluetooth connection fails.

- Display the functionalities including a connect button, an info button, and a battery level.
- Send notifications when the cap is taken off.
- Display battery status.
- Direct user to Halo website when pressing the “website” button.

Set Up

The prototype test consists of both software and hardware. We made an IOS app that has Bluetooth searching and connecting functions. We modified the program so it accurately finds our device without having many irrelevant signals. We have our strain gauge connected to an Arduino Nano 33 BLE, soldered the strain gauge sensor to the module, and glued the sensor with to the cover protected by two pieces of plastic. When the plastics are bent, the resistance of the strain gauge changes depending on the direction and depth of bending. The change will be measured and recorded in Arduino Nano BLE 33. Our program in Arduino will detect significant changes in the strain gauge and determine whether there is a risk of our protector being taken off. If the program detects such a risk, it will communicate with our app and display the message showing the user that their drinks might be exposed. In order to prevent the false alarm from triggering by smashing the cup, our device also implemented the accelerometer module and detects the movement of the cup.

Block Diagram



Pre-test Set-Up Procedure

1. Turn on the Arduino power source
2. Open our IOS app on a cell phone
3. Search and connect the Arduino Nano BLE to the phone

Testing Procedure

1. Disconnect the Arduino on the phone
2. Bend the strain gauge up from horizontal and check if the message shows up

3. Reconnect the Arduino on the phone to test if the IOS app and Arduino Nano Bluetooth connection are working
4. Stretch the cover near the sensor to check if the notification appears on the phone
5. Stretch the cover opposite side of the sensor to check if the notification appears on the phone
6. Move the device left to right horizontally to check if any false alarm appears.
7. Move the device up and down vertically to check if any false alarm appears.

Measurable Criteria

1. After disconnecting the Arduino on the phone, the app should no longer react to the change in the strain gauge
2. By scanning for Bluetooth devices and connecting to the Halo Device, the IOS app will display all the compatible devices and successfully connect when pressing the corresponding options listed.
3. When pressing the connect option on the app, it should display the halo device status and refresh the last checked status
4. Status change when stretching the cover from different angles
5. There should be no notification displayed on the app when simply moving around the strain gauge without bending it