Safety Sensor Suite (SSS)

EE4820 Senior Capstone Project

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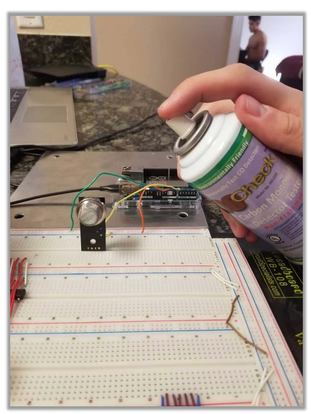
Gas Sensor

The MQ-7 gas sensor uses an electrochemical fuel cell to signal trace amounts of Carbon Monoxide to the controller.



Objectives

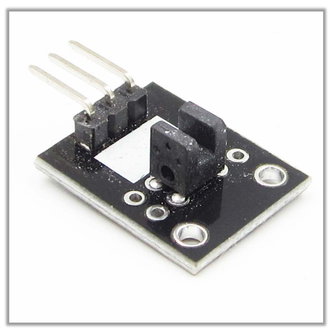
The Safety Sensor Suite is a product designed to give families peace of mind in regard to home disasters when they are not home. Tragedies such as hazardous gas leaks, floods, and fires will be detected. The home owner will receive a message from Twilio's web service notifying him/her of a home irregularity.

Engineering Requirements

1. Size should not exceed 6 in.^{3}
2. Must respond to gas/smoke within 30 sec.
3. Check heat and water levels in 5-minute increments
4. User will be notified if any smoke or temperature exceeds 90^o Fahrenheit
5. Detect water levels from sufficient altitude such that gas can also be detected
6. Utilize 120V AC power source
7. Use Twilio web service to notify user of irregularity
8. Operational status must be clearly indicated
9. Total prototype cost should not exceed $500.00

Smoke Sensor

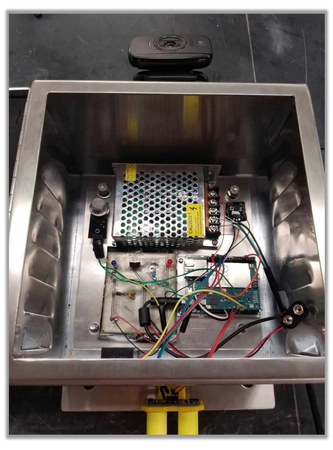
To ensure fire safety within the home, a photoelectric smoke detector was used, which is one of the two popular sensors used on the market. For microprocessor compatibility purposes, the KY-010 Photo Interrupter was specifically chosen. When an object, in our case smoke particles, enters the chamber the sensor's light is interrupted, sending a signal to our microprocessor.



Flood Sensor

The Safety Sensor Suite is equipped with a flood sensor that can determine when a house is flooded and the height of the flood water. Unlike flood sensors that are currently on the market, this flood sensor operates from the ceiling, rather than the floor. An ultrasonic sensor was chosen for this application because ultrasound bounces off the surface of water, rather than penetrating past it. Also, the HC-SR04 ultrasonic sensor is capable of measuring a distance up to 13 feet. Ultrasonic sensors are commonly used to measure fluid height inside of tanks but never used to measure fluid height in a open room, until now.

Finished Product



Heat Sensor

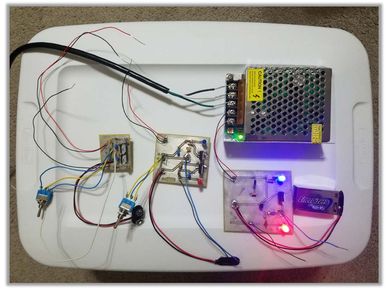
We used a digital temperature sensor to check heat levels within our user's home. For this, the LM35 was chosen based on its linearity, low cost, and accuracy. The sensor's readings range from -55 to +155 Degrees Celsius (-67 to 311 Fahrenheit.) When temperatures are above the threshold level of 90 degrees Fahrenheit (set in our initial engineering requirements) a text alert is sent to the end user.

Camera

A Logitech C510 webcam was used to take a picture when one of the sensors goes off. The webcam will take a control photo once every 12 hours. The photos will be compared pixel by pixel to allow the user to have a visual of his/her home when an irregular event occurs.

Power Supply

The evolution (from left to right) of the power supply for the Safety Sensor Suite can be seen below. Utilizing a manual switch, we could simulate a power outage and easily switch from the house's 120V AC to the backup battery's 9V DC. However, the final product used a N channel MOS depletion mode transistor to automatically make the switch from the home's power to the backup power. An Aiposen 110/220V AC to DC 5V transformer was used in in conjunction with a 9V Energizer lithium battery backup to supply power to the Arduino Yun microcontroller and subsequent sensors.



Results

Power Supply:
The manual switch provided enough power to activate the microcontroller via the battery, but not power from the wall. Also, the transistor failed to provide the necessary 5V.

Gas:
Detected CO & delivered feedback through Twilio.

Flood:
Detected flooding once the water height exceeded an inch and a half. False alarms were eliminated and SMS flood alerts were sent.

Heat:
Detected correct temperature; notified the user via Twilio.

Smoke:
Provided incorrect readouts.

Camera:
Camera did not properly send pictures to the user.