UMassAmherst
The Commonwealth's Flagship Campus

Final Project Review

Team 22 - Coresidium

Advisor: Professor Siqueira

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Coresidium – A School Security System

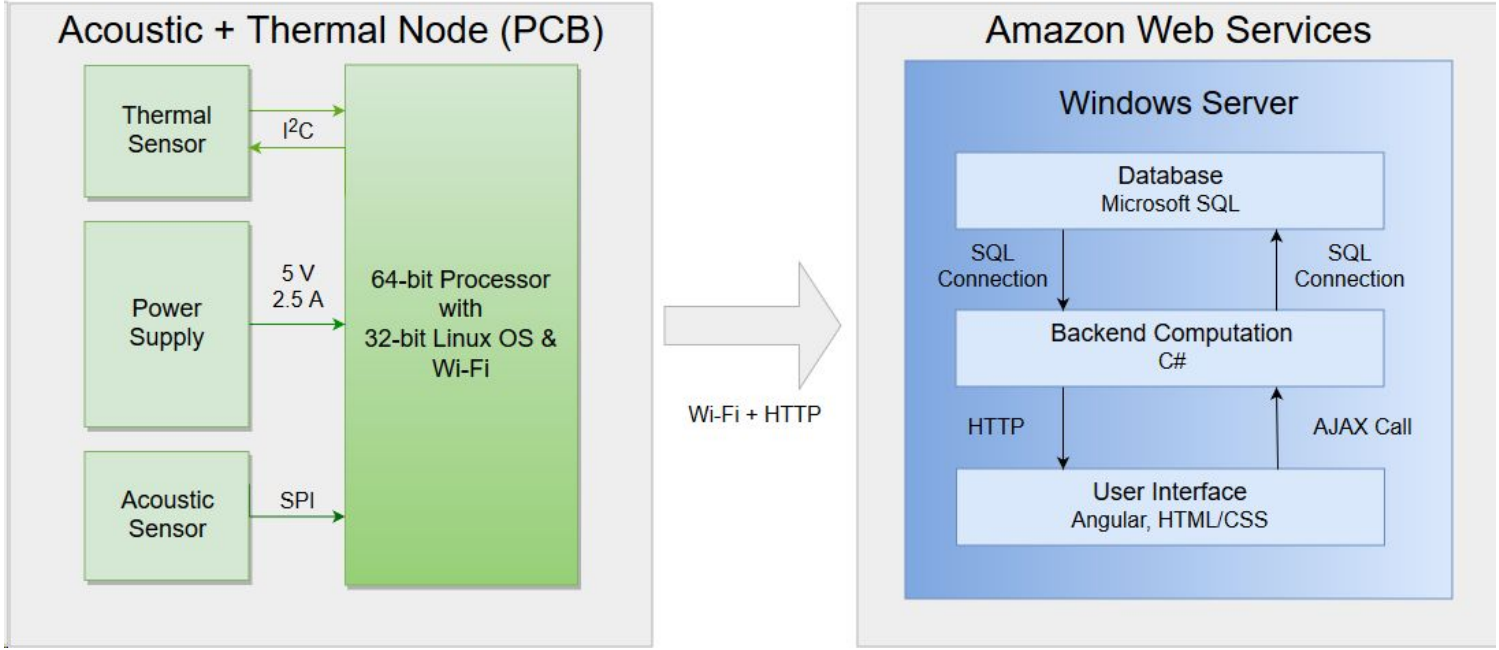
- Members
  - Valentin Degtyarev (CSE) - Acoustic Sensor & PCB Design
  - Andrew Eshak (CSE + EE) - Server Backend & Computation
  - Brandon Cross (CSE) - Thermal Sensor
  - Andrew LaMarche (CSE) - Communication & System Management




Problem Statement

- In the aftermath of a school shooting in the United States, it takes several hours for the campus to be declared safe. Due to this delay, help is not available to those who need it most. Our system aims to reduce this time by providing the relative location of where a shot has been fired. The proposed design uses infrared temperature cameras and acoustic sensors to accurately recognize an active shooting situation and notify the proper authorities.

Block Diagram



Testing Procedure

- Pop 50 balloons from 12 feet away from 3 acoustic sensors
  - Repeat test in environment with different ambient noise
  - Record ratio between success rate and total attempts
  - Varying balloon size
  - Direct line of sight
- Ignite a lighter 25 times from 6 feet away from thermal sensor for 0.5 seconds

Results

- Acoustic Sensors Test #1 (No ambient noise)
  - Average success rate of acoustic sensors - 96%
- Acoustic Sensors Test #2 (With ambient noise)
  - Average success rate of acoustic sensors - 94%
- Thermal Sensor Test #1 (6 feet)
  - Average success rate of thermal sensor - 100%
- Thermal Sensor Test #2 (8 feet)
  - Average success rate of thermal sensor - 100%

FPR Deliverables

- ✓ PCB ordered and assembled
- ✓ Three demo modules assembled
- ✓ Enclosure for module
- ✓ Additional testing of system
- ✓ Demo Ready

Expenses (per device)

Raspberry Pi 3B	$35.00
Thermal Sensor (MLX90640):	$40.00
Analog to Digital Converter (MCP3008):	$2.75
2.2k Ohm Resistor x2	$0.60
1k Ohm Resistor x2	$0.60
8.2K Ohm Resistor	$0.60
10k Ohm Resistor x2	$0.60
100k Ohm Resistor x2	$0.60
1uF Capacitor	$0.25
100nF Capacitor	$0.25
Diodes x2	$0.25
LM393N	$1.00
Header	$0.01
Custom PCB	$0.20
Electret Microphone	$0.67
Case	$5.00
Total:	**$85.63**

System Specifications

Requirement	Desired	Achieved
Range	10 feet per module	12 feet per module
Response Time	<1 second	<1 second
Accuracy	>80%	>90%
Sound Sensitivity Range	>130 dB	>130 dB
Location Accuracy	Relative-Location and floor within building	Relative-Location and floor within building
Timestamp accuracy	<1 second	≈ 1ms
Cost	<$100	$85.63

DEMO