



Audio Environment Gunshot Detection System

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Introduction

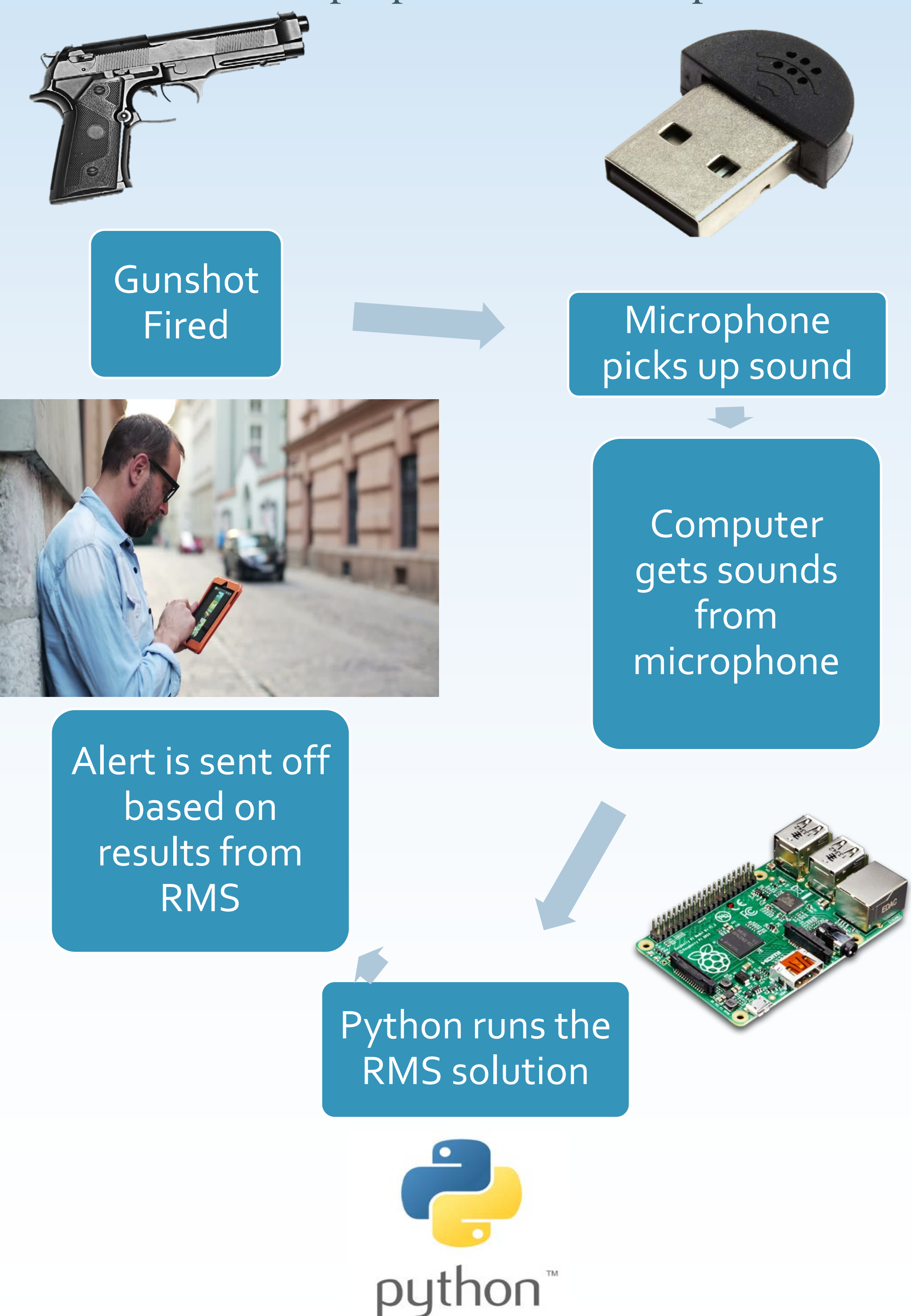
For many years, audio environment detection has focused on measuring various noises to help against illegal activity and wildlife monitoring.

“Seven children and teens (age 19 or under) are killed with guns in the U.S. on an average day.” - Everytown Support Fund

Background & Objective

Background: Humans have an easy time detecting noises that surround them. However, computers have a difficulty in trying to detect different sounds such as explosions, gunshots, or casual conversation.

Objective: Use sound sensors to detect when gunshots are fired in any environment, which can then be alerted to people on their smartphones.



Methods

Use Python to record Two .Wav Files for testing. The RMS values are calculated by the RMS formula and put in an array that holds the comparison aspect for the algorithm

Record a third .Wav file in Python to see if the Root Mean Square value is higher than or equal to the average of the first two.

If the condition is true, system returns an alert that which beeps and informs the user that a gunshot has been detected. If not, the system returns no alert

Root Mean Square Breakdown(RMS)

1. As Python reads the .WAV file, the file is broken into fragments.
2. The values from each fragment are added together and divide by the total length of the file.
3. Lastly, the value square root is taken to get the Root Mean Value, which is measured in voltage.

$$RMS = \sqrt{\frac{x_1^2 + x_2^2 + \dots + x_N^2}{N}}$$

Results

Alert individuals when a gunshot occurs to move out of hazardous environments.

False Positives: Alert would go off in terms of high vibration level activities that isn't a gunshot. Ex. Knocking on a desk.

```

===== RESTART: C:\Users\Jaelin\Documents\AudioClass.py =====
Enter wav file:Test1.wav
* recording
* done recording
558
Enter wav file:Test2.wav
* recording
* done recording
114
[558, 114]
Enter a file for classification Test3.wav
* recording
* done recording
1254
Gunshot detected. Get out of Area.
>>>|
  
```

Conclusions

The ability to classify gunshots can help individuals stay protected at all times especially in taking vacations.

These types of applications can be used for public safety as well as improving national security.



Future Works

- To improve the classification system using a Raspberry Pi as well as sound sensors and amplifiers to improve the accuracy.
- Classify other sounds in different environments that can impact national security.

References

Gun Violence by the Numbers. (2017, June 22). Retrieved July 24, 2017, from <https://everytownresearch.org/gun-violence-by-the-numbers/>