Engineering a Program to Locate Intruders Inside a Building by Comparing Recorded Audio to Predicted Decibel Levels from Computer Simulations

Abrams, Nate (School: Hilton Head Preparatory School)

As school shootings have almost doubled in the past decade, student safety is essential. While many schools have adopted expensive camera based security systems, this project seeks to provide a reliable and cost effective alternative. This prototype program takes predicted values from virtual simulations that replicate the discharge of a firearm to determine a shooter's location, orientation, and weapon type. This program is customizable to each school's layout. To locate the shooter, data is collected from smartphones inside the building. The large pool of devices allows more data points to be collected and higher accuracy in locating the intruder. The probability of the intruder's location is based on analysis of raw audio data from smartphones compared to virtual simulations. This process begins with Blender simulations that predict distance traveled to find the predicted decibel drop off from the initial sound, using the square inverse formula. Then, decibel drop off data is put into Python lists representing each possible building location. Next, the computer compares the raw audio data in a list to simulated data lists using chi squared analysis. Once analysis is complete, the program gives the user the probability of the shooter's location and orientation. This program was tested in a school using a speaker in place of a gun and tests concluded that the program works within a reasonable margin of error. With future improvements to this project, such as better simulation software and AI, I could create a cost effective and accurate way to locate an intruder.