Public Safety Alarm

ECE445 Design Document Check

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1. Introduction

1.1 Objective

In the United States and all over the world, people are victimized in silence. According to the United States Bureau of Justice Statistics, over 3.4 million violent crimes per year went unreported from 2006 until 2010 [1]. Stigma, lack of evidence and lack of personnel remain an issue even in one of the safest countries. To add to this, only 42% of violent crime and 36% of property crime was reported to authorities in 2016 [2]. Although there are always improvements to be made, it is simply not possible for a patrol to monitor every single nook and corner of a community for possible violence or emergent situations. Our objective is then to create a simple alarm system that can be installed in high crime rate locations or areas of importance in order to aid authorities cover these areas without always being present.

Our design will feature two main components, the monitoring device, and the supervisor device. The monitoring device will be fixed at the location of importance and designed to take in both sound and infrared video of the environment. It will be constantly analyzing the video and sounds of the environment, making decisions on whether or not an emergency is occurring or not. The supervisor device will also be a fixed device, designed to sit at a police officer or even gym teacher's desk, ready for alarm in the event of an emergency. This alarm will come to the attention of the supervisor, and allow them to act accordingly in order to try and aid the situation at hand.

1.2 Background

There are several companies that specialize in crime detection systems such as HikVision that has made cameras that claim to be able to detect potential anomalies in public areas [3]. However, there still isn’t a low-cost, easily implementable and widely deployable automated surveillance system in place, and that is why we want to come up with a solution that addresses all these concerns. We are striving to automatically detect potentially dangerous situations while not being too complicated or too expensive to publicly install. While our technology is not entirely new, delivering this essential product at a fraction of the cost will be an enormous improvement given the environment it will most likely be used in. Public safety isn’t exactly overflowing with funding in today’s society so developing a system like ours that isn’t costing thousands of dollars will be of great benefit.

2. High Level Requirements

1. Our system should be able to detect potentially dangerous situations with an accuracy of at least 95%. This means that given a situation, dangerous or not, the device will choose to either trigger or not trigger correctly over 95% of the time.

2. The false negatives of the system, as in not reporting a dangerous situation when one actually occurs, should occur less than 5% of the time. This means that given there is a dangerous situation, the supervisor device should alarm at least 95% of the time.

3. The response delay between the occurrence of alarming audio or video and the supervisor alarm sounding should aim to be less than 5 seconds. This means that given there is a dangerous situation, the supervisor device should alarm within 5 seconds of the first clear sign of a dangerous event.

3. Block Diagram

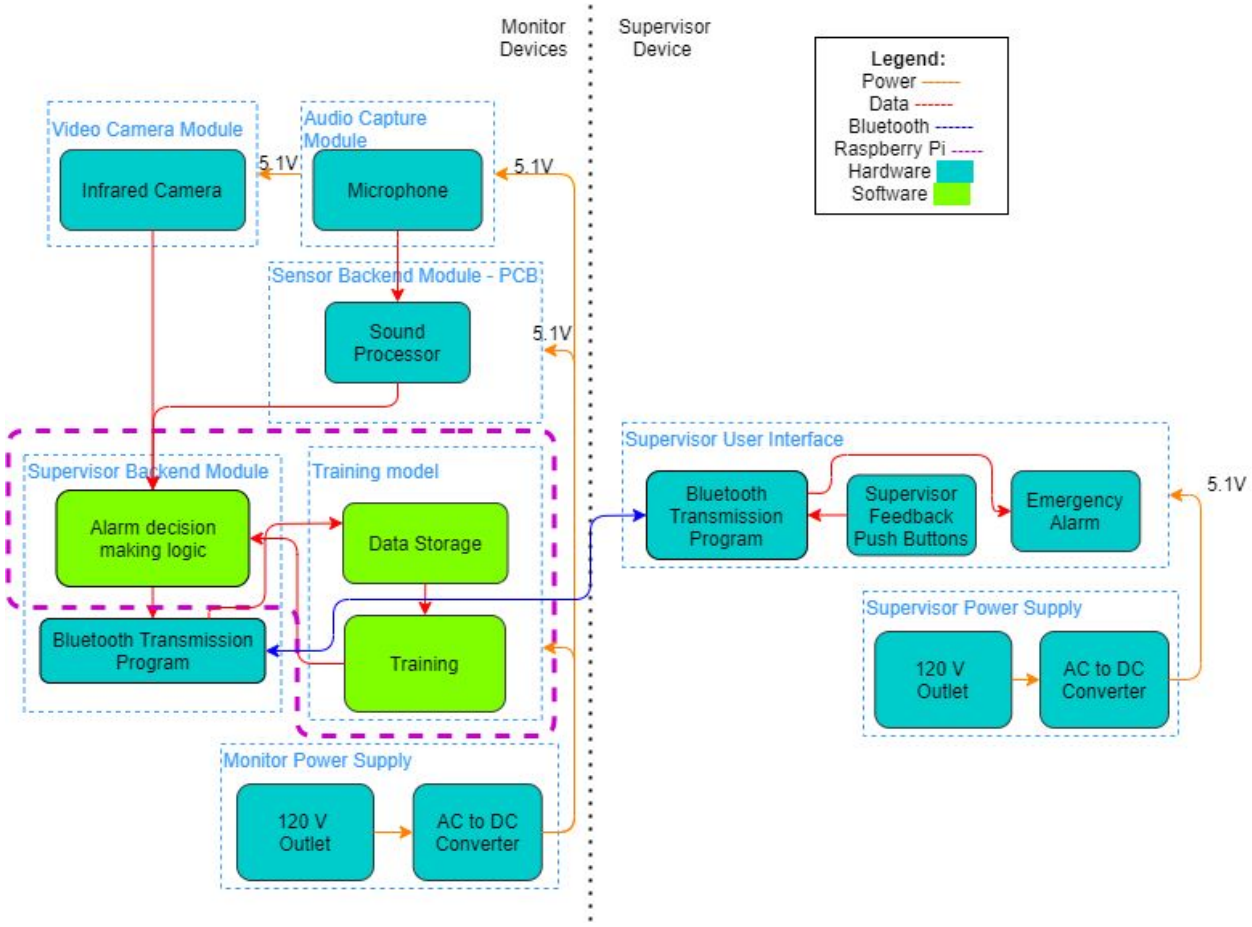

Figure 1. Block Diagram of Public Safety Alarm System

4. Physical Design

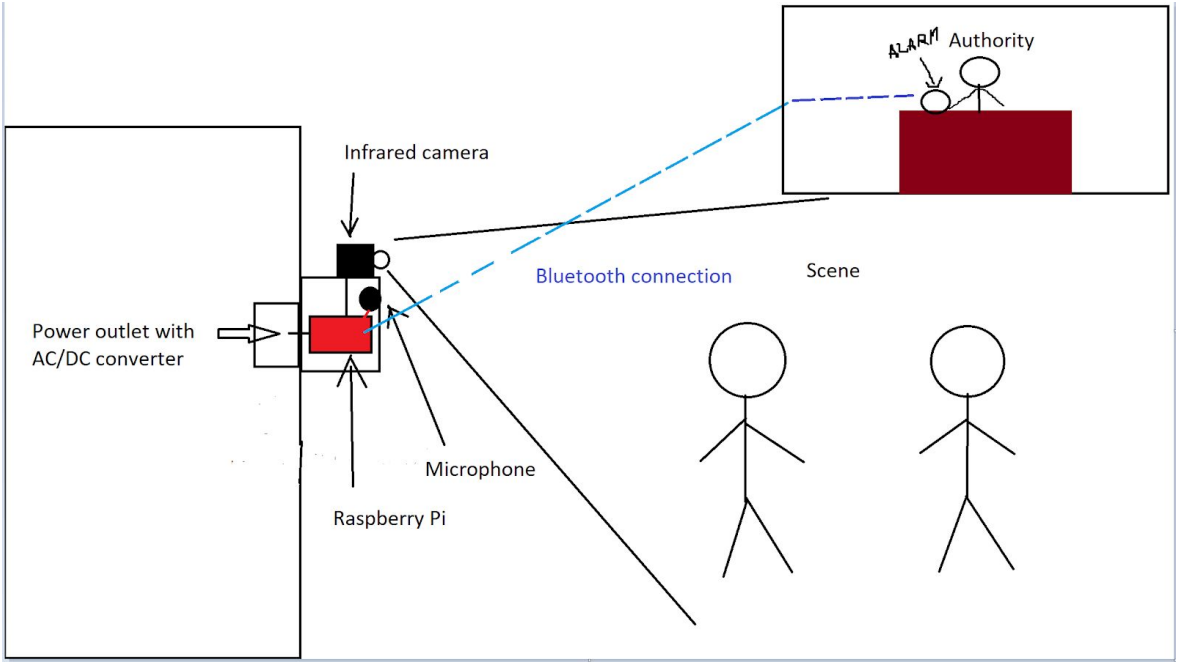

Figure 2. Physical Design of our entire system

5. Requirements & Verification Tables

5.1 Infrared Camera

The infrared camera will be responsible for capturing infrared video from the scene and send it to the image processor at the supervisor end in order to enable monitoring of potentially dangerous scenarios. The aim for this camera is to be able to clearly detect human beings at least 10 feet away and to be able to send the footage to this processor. We are currently looking at the Adafruit AMG8833 IR Thermal Camera Featherwing as a potential option but it is prone to change if we find a better alternative.

Requirements	Verification
1. Infrared (IR) Camera must capture Infrared video at a frame rate of at least 5 Hz. 2. IR Camera must be able to detect a human from 10 feet away 3. IR camera must be able to send the video data to the image processor on the supervisor end	1. Perform some motions in front of the camera in order to see if they are picked up on. 2. Make two people stand 10 feet away from the camera and see if the camera is able to pick up on and distinguish the two people. 3. Test the supervisor computer and see if all the image data from the camera is properly received

6. **Plots**
7. **Circuit Schematics**
8. **Tolerance Analysis**
9. **Safety & Ethics**

There is really only one major ethical concern when discussing our project, with that being protecting the privacy of the people in the monitored location. We are entirely responsible for the data being captured and stored in our system. This valuable data is an implementation of the IEEE Code of Ethics #5: "To improve the understanding of technology; it's appropriate application, and potential consequences" [4]. Our overall goal to use this data to build a safety alarm that can help bring a safer environment to the masses and help anyone feel comfortable at all times in protected public spaces.

Keeping data from for example, a locker room, would be a highly sensitive matter, and not one we take lightly. We must pay very close attention to #7, #8 and #9 of the IEEE Code of Ethics in order to protect the people our system is designed to protect [4]. To address these concerns, any data we save will not be time stamped or labeled in any way in order to maintain entire anonymity . It will strictly contain the infrared video, audio and a binary assertion of whether or not the specific event was an emergency. On top of not labeling data, only a basic infrared camera will be used, which will not take the details of the people's faces, clothes or any other accessories and hardly provide any detail on the physical appearance of the people on screen.

10. **Citations**

[1] B. of J. Statistics, "Victimizations Not Reported to the Police, 2006-2010," *Bureau of Justice Statistics (BJS)*. [Online]. Available: https://www.bjs.gov/content/pub/press/vnrp0610pr.cfm. [Accessed: 02-Mar-2021].

[2] Dispatch, "Why do so many crimes go by unreported in the states?," *The NYU Dispatch*, 31-Aug-2018. [Online]. Available: https://wp.nyu.edu/dispatch/2018/08/31/why-do-so-many-crimes-go-by-unreported-in-the-states/. [Accessed: 02-Mar-2021].

[3] D. Faggella, "AI for Crime Prevention and Detection - 5 Current Applications," *Emerj*, 02-Feb-2019. [Online]. Available: https://emerj.com/ai-sector-overviews/ai-crime-prevention-5-current-applications/. [Accessed: 02-Mar-2021].

[4] "IEEE Code of Ethics," *IEEE*. [Online]. Available: https://www.ieee.org/about/corporate/governance/p7-8.html. [Accessed: 02-Mar-2021].