From Prototype Development to Startup: Commercializing an Innovative Indoor Gunshot Detector Device

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Introduction and motivation

- It is estimated that 31% of public mass shootings occur in the USA, although it has only 5% of the world's population.
  - From January 2023 to September 2023 in the USA, the total number of deaths due to gun violence is 31,394 – among them, 1,273 are children between the ages of 0 to 17, and the total injury is 27,408.
- One way to reduce the loss from gun violence is to detect the incident early and notify the police as soon as possible.

Introduction and motivation

- In my FRF 2022-2023 project, I published an article and developed a novel gunshot detector device that automatically detects the indoor gunshot sound and then sends notifications to the emergency responders smartphones as soon as the shooting happens.
- The proposed device can be attached to the walls or ceilings — similar to smoke detectors.
- The proposed system will help to stop the shooter early and the injured people can be taken to the hospital quickly — thus more lives can be saved.

The overall system

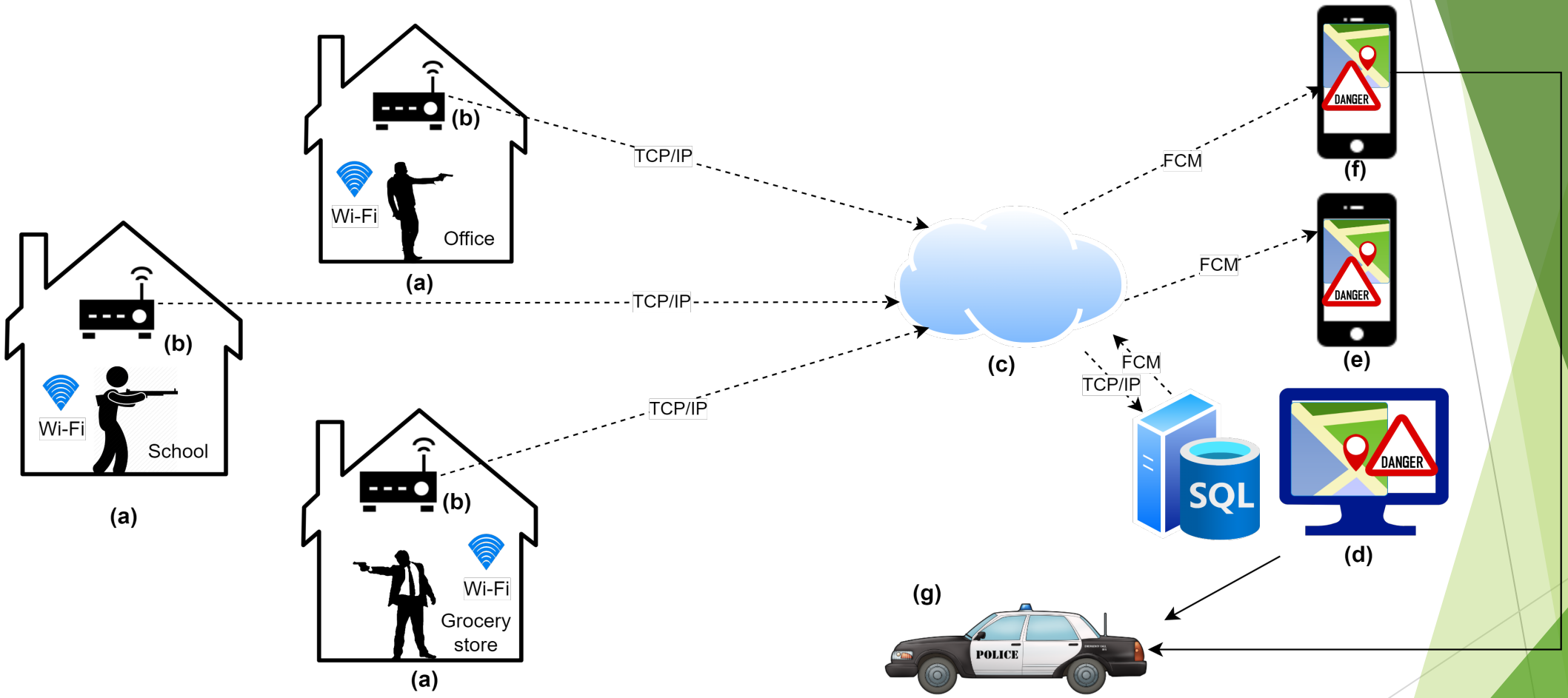
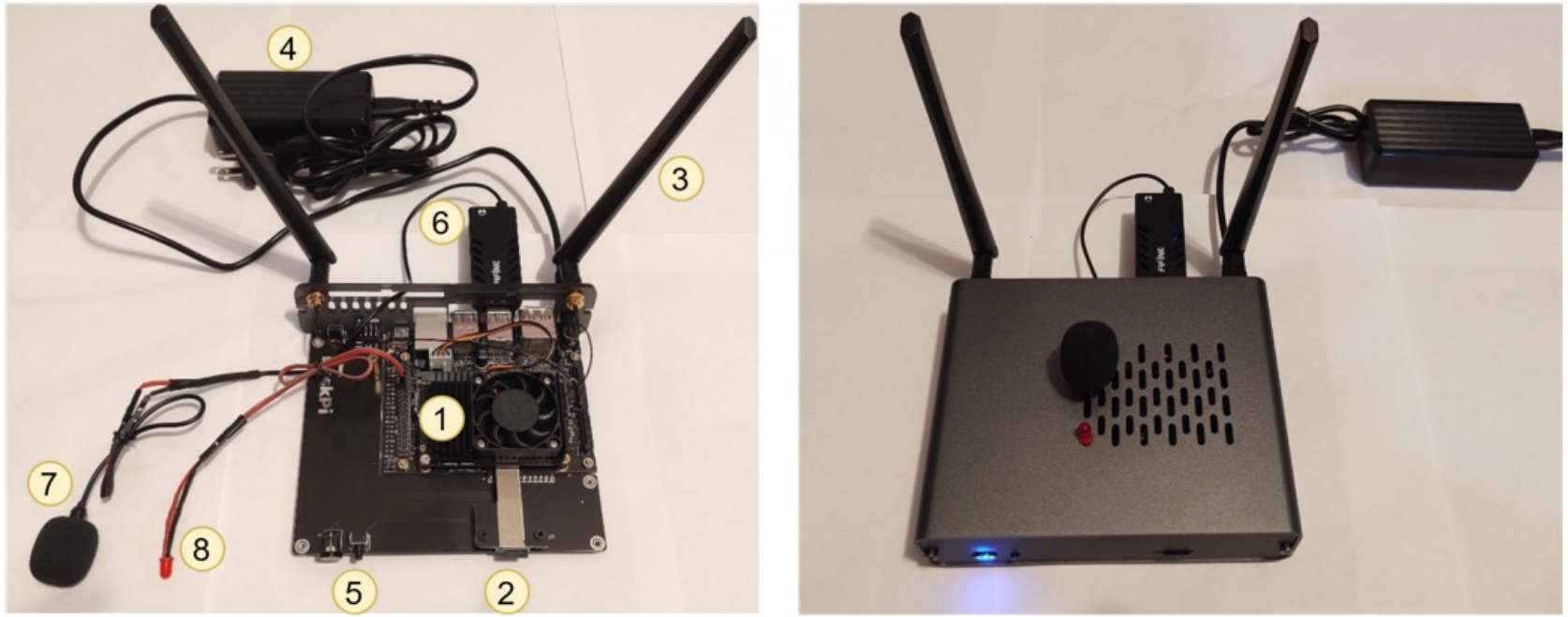


Figure 1. Crime scene (a) where the shooting happened. The gunshot detector device (b) is connected with the Wi-Fi of the building. It detects gunshot sounds and sends data to the central server through the Internet (c) using Transmission Control Protocol/Internet Protocol (TCP/IP) protocol. The crime scene location is marked on the map (d), event data is saved in Structured query language (SQL) database, and the software sends notifications using Firebase Cloud Messaging (FCM) to the user's smartphone app (e) and the emergency responder's smartphone app (f). The emergency responder's car (g) is dispatched.

Prototype



(a) (b)

Figure 9. (a) Photograph of the gunshot detector device: (1) Jetson Nano with a wireless module and cooling fan; (2) SD card; (3) Antenna; (4) DC adapter; (5) power and reset switches; (6) Sound card; (7) Microphone; (8) Heartbeat LED. (b) Gunshot detector device enclosed in a casing.

T. H. Khan, "Towards an indoor gunshot detection and notification system using deep learning," *Applied System Innovation.*, vol. 6, no. 5, article. 94, ISSN 2571-5577, 2023.

Contribution to the literature and entrepreneurship

- Some cities utilize companies such as SoundThinking
  - Sensor modules are installed around the city at outdoor places and it is not used for indoor crimes.
  - Moreover, these systems are extremely expensive to run and maintain.
  - This system is installed by the city authority and not by individuals or institutions for personal use.
- Compared with this work, we plan to form a startup and commercialize the proposed product with a lower price, easier installation — similar to smoke detectors, and better performance.
  - Two potential co-founders from Michigan have already shown interest and we had several meetings.
  - Submitted an Invention Disclosure form to the Technology Transfer Office at EMU for patent application.

Outline of the proposed methodology

Record blank gun sounds in a soundproof chamber	December 2023
Train the deep learning model with the new dataset	January and February 2024
Test and finetune the gunshot detector device	March and April 2024
Write journal article	May and June 2024
Preparation for startup formation	July and August 2024

Thanks!