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**Project Proposal:  
Security and Theft Detection App and Base Station**

**Proposal Summary:**

According to Portland State University's 2017 Annual Campus Safety Report, there were over 70 reported instances of burglary on campus during 2016. This number includes 21 incidents that occurred in on campus student housing. Especially in a dorm environment, where many people might have access to your living area, it is hard to maintain security. It is impossible to tell if anyone has been accessing your room, dresser, or even fridge without your knowledge or consent unless you discover a theft hours, or even days, later.

For our final project, we propose a security and theft detection system that would help give users piece of mind about their private spaces and items. It consists of a portable base station, to be placed where the user wants to detect an intruder (for example, at a door, inside of a dresser, or on top of a valuable item), and a paired phone app. Alternatively it could be used in a more permanent manner, with sensors attached to doors and windows all around a room or home, to secure a larger area.

This base station would contain sensors to detect if anyone comes to close or tries to move the base station. If the base station detects a security issue, it will alert the user via an app on their phone, and will also send a photo of the area. The user can then look at the photo and decide if they want to take action. If so, they can have the base station play an alarm, to deter the intruder, or the user can choose to send voice to the base station, so they can let the culprit know that they have been noticed. This will hopefully deter them from committing any crimes or, in the worst case, gives the user a photo to show to authorities when describing the culprit.

**Project Deliverables:**

Our project will consist of three separate pieces:

- An Android app designed for a smartphone, that will notify the user when there is an attempted break-in or theft.

- A base station, made of a Raspberry Pi, running an Android Things app, which will monitor various sensors to check if there is a security breach, and then send an alert if one occurs
- A Google Firebase database to allow the two parts to pass data.

The base station will be placed where the user wants to maintain security. It will contain various sensors (outlined in the section below) that will be used to determine if there is a security breach. There will be a setup mode for the base station, where the expected values of each sensor reading are determined, followed by an activation mode, where the base station will track all sensor readings to make sure they fall within expected values (with some margin of error). It will also send periodic signals to the database to confirm it is on and running normally.

When in activated mode, any deviation in sensor values, will cause the base station to alert the phone app of a possible security concern. At this point, the base station will take a picture (to attempt to catch the intruder), and then send it to the database. If the user wants to play a recorded message or sound, or if the user wants to speak to the intruder, the base station will play it through it's speakers.

The phone app will allow the user to receive information from the base station, as well as allow the user to arm or disarm the system. The user should be able to open the app and confirm that the base station is running normally and that the sensors are producing valid data. When the base station senses a security concern, or if the base station stops sending a signal, the user will receive a notification alerting them to a possible breakin or security system malfunction. They should then be able to look at the latest sensor readings to determine what the security issue was. If the base station managed to take a picture, the user will be able to view that picture through the app. The user can then choose to play a recorded message or sound through the speakers of the base station, or choose to talk at the intruder (one-way communication) directly.

### **Used for this Project:**

For this project, we will be using the following:

#### **Hardware:**

- An Android phone, to demonstrate the user-facing app
- A Raspberry Pi 3 Model B, to serve as the brains of the base station
- A camera (Raspberry Pi compatible), to take pictures
- Other sensors for the Raspberry Pi. This includes at least a distance sensor, a vibration sensor, and a magnetic contact switch.
- A speaker (Raspberry Pi compatible), to allow the user to talk at intruders or for an alarm to sound.

#### Software:

- Android Studio, for developing the two apps
- Google Firebase, for storing data related to the apps

#### Project Implementation:

For this project, one partner will be in charge of the phone app and setting up and maintaining the database, while the other will be in charge of the base station app and all of its sensors and peripherals.

A successful demonstration for this project would include the following:

- Placement of the base station and having it run the setup procedure.
- Demonstrating that the phone app is able to read sensor data from the base station via the internet.
- Showing that sensor data out of normal range or turning off the base station causes a notification to be sent to the phone.
- Demonstrating the base station taking a photo upon abnormal sensor reading, and then being able to view the photo via the phone app.
- Showing that the user can play a selected sound, or choose to send voice, and have it play out of the speakers of the base station.

#### Project Milestones:

*Week of Nov 11th-17th* - Phone app can send and receive data to Raspberry Pi app (Project # 3 Requirement)

*Week of Nov 18th-24th* - Phone app triggers notifications upon a security issue or base station signal lapse. Phone app can retrieve sensor data from the database. Raspberry Pi app correctly reads sensor data, and sends it to the database. Raspberry Pi app has 'setup' mode to establish normal sensor range, and can determine when sensors are outside of range.

*Week of Nov 25th-Dec 1st* - Phone app can play alarm or send microphone data to base station. Phone can view photos taken by the Raspberry Pi. Raspberry Pi speaker can play sounds sent from base station. Raspberry Pi can take photos on command or on sensor disturbance and send them to the database.

*Week of Dec 1st-7th* - User interface of the phone app is improved, tested, and finalized. Raspberry Pi app setup process and sensor thresholds are tested and finalized to minimize false positives/undetected events.

*If Pressed for Time:*

- Remove ability of phone app to transmit live voice
- Remove speaker from base station and phone app's ability to play recorded sounds
- Remove notification to the phone app when base station loses power/connection.
- Remove camera and photo taking/viewing capability from system

*Stretch goals:*

- Have the phone app allow the user to command the base station to take a photo and upload it to the database, to be viewed in the app (even when there is not a security issue).
- Add additional sensors for the base station, possibly including: microphone/noise level sensor, vibration sensor, door open sensor, etc
- Add additional modes for the system. For example, allow the user to change the sensor sensitivity, or turn off the system at certain times of the day.
- Allow phone app to receive video streaming from the camera on the base station.