GUARDIAN

Discreet Self Defense Device

Senior Design 1 Fall 2016: Group 16

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Sponsored by: KnightGuard

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Introduction:

Safety has become an increasingly larger issue in years past. The news shows everyday that people are getting hurt or they are hurting others, whether for their own safety or because they feel that they need to hurt others. The media outlets are almost constantly showing stories on how police are killing others because they fear for their safety, or that people will specifically target police officers and try to kill them, just over their profession. Everyday women and men face the dangerous possibility of being attacked, kidnapped, or raped. Particularly, women are being subjected to an increasing rate of sexual abuse and rape. According to the National Sexual Violence Resource Center, one in five women and one in sixteen men are sexually assaulted while in college and over ninety percent of the victims never report the crime which left them defenseless. Many people also face the chance to be robbed while leaving work, school, or even while simply outside walking. Recently in Orlando, a tourist was killed while trying to protect his wife during a robbery.

In many instances, the victim has no way to defend themselves, and can be left injured or even killed. Even if the victim has a way to defend themselves, there is a large possibility that for various reasons they will be unable to stop the attack, keeping the user in danger. If a pocket knife is used for defense, the victim may not be able to get to it and open their knife or even be able to grab it to defend against the assailant. Even if a gun is used, it has the possibility to jam or the victim will be disarmed before they can turn off the safely and use it. Pepper spray is a commonly used because it is easy to carry due to its size, but pepper spray is mostly only effective if sprayed directly into the attacker's face, and if unable to do so, the weapon is rendered useless. These are things people cannot rely on in some situations. When being attacked, arms and legs are often restrained so that they will be unable to run or grab their weapon. In both scenarios, a person who is in harm's way has little to no way of defending themselves if they are attacked. This being how things are nowadays, people want to be able to ensure the safety of themselves and their family and friends without any worry that their defense will be effective given any type of attack.

Our proposed project will be a way to reliably ensure the safety of the user, if it would need to be used. The project will not only provide safety of the user, but also peace of mind to their family and friends who may not be around to protect them. The devices that are planned to be created would be a discreet self defense mechanism, that would only require limited movement to engage. The device will be lightweight, and have a low cost so as to be accessible by everyone. Once engaged, the system would disable the attacker while being able to send a signal to a local police station or security company, alerting the authorities to the location of the attack, and allowing them to detain the attacker, thereby stopping the possibility of future victims. This will be done through two to three devices. One will be for activation, one for deployment and the third for signaling. The devices can be used by civilians who may fear the possibility of an attack, or even

by police officers in taking down an assailant without resorting to killing them, taking more people away in handcuffs than in bodybags.

Project Specifications:

- Communication System
    - Secure, not able to be intercepted or hijacked
    - 1 time secure pairing between an individual's' devices
    - Pairing between system components
    - Able to send signal to local police station or security system
    - Able to send signal from 1st device to additional devices
- Microcontroller
    - Able to determine whether 1st device was activated intentionally or accidentally
    - Hold security codes for communication system
- 1st Device
    - Able to activate self-defense mechanism easily
    - Mechanism/programming to prevent false alarms
    - Able to send signal to additional securely paired devices
    - Waterproof up to 1m (IP67)
    - Completely sealed off aside from ability to swap out power supply
    - A power supply life of 12-24 months
        - Lifespan of about 2 years
    - Approximate weight of no more than 20 grams
- 2nd Device
    - Dimensions no more than 40x37x6 mm
    - Water resistant
    - Approximate weight of no more than 85 to 100 grams
    - Power supply life of 24+ hours
        - Lifespan of about 2 years
- Phone Application
    - Bluetooth capabilities
    - GPS tracking
    - Serial code authentication
    - Standby mode if device 1 on only

Project Constraints:

Time: Not everyone will be available at certain times during the time this project is being developed. We will need to work out a schedule that best fits each of us so that way we will be able to produce a working product.

Signal: The signal between devices would need a max range of five feet so that they will only work together, but another signal would have to have a range of several miles, as to reach a police station.

Lifespan: We need to figure out how to keep the amount of power used on the devices low enough so they can meet the design specifications before it runs out. We also need to figure out if wireless charging can be implemented within the allotted time or whether we have to utilize another type of connector. Device 1 can utilize replaceable batteries.

Communication: We need to figure out which way of communication is best suited for this project. A near field communication device would be the easiest implementation, however there may be an alternate system that can provide a more secure connection between the devices.

Cost: The cost of the components need to be minimal so that the final product will be affordable and accessible to everyone, while also having high quality components that will not fail when the device needs to be used.

Budget Predictions

Component	Quantity	Cost
PCB (Built)	6 (2 per device system)	$200
Communication Chip	6	$10
Microcontroller	6	$90
Switch	6	$4.50
Power Supply	6	$20
Total		$324.5

All financing for the project will go through the sponsor.

Most of the costs for the product will come from having to order the designed PCBs with the components attached to the board already, having to use very small components to keep to our size constraints, which will keep the project discrete. Estimated PCB quantity comes enough for three products in case of malfunction in a single PCB.

House of Quality

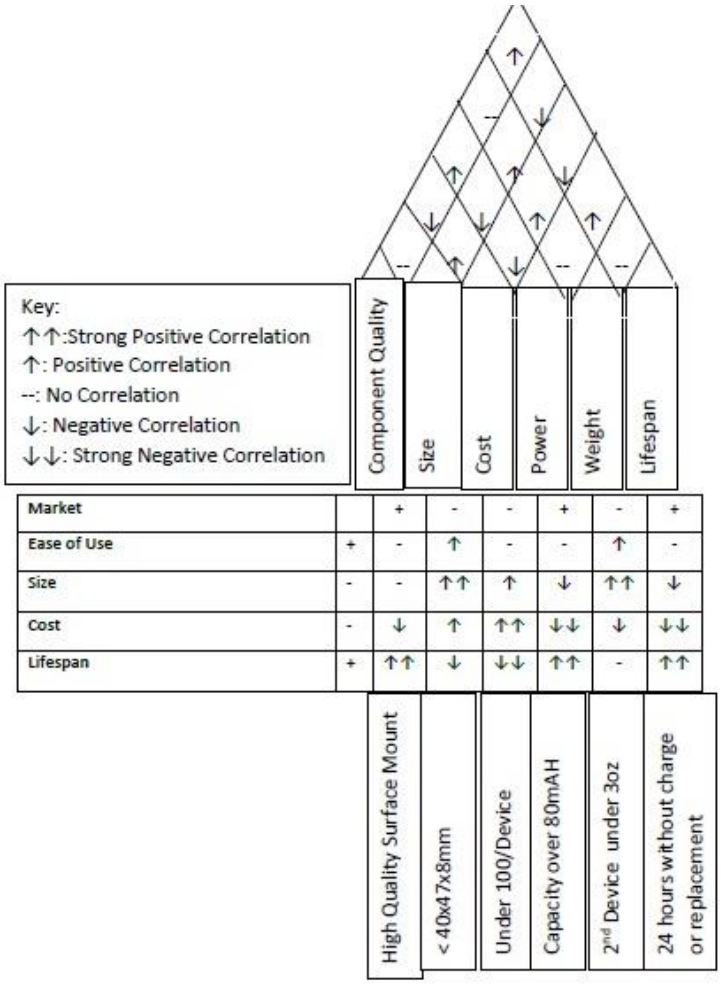

Figure 1: House of Quality

Flowchart of project outline:

Table 1

	Device 1	Device 2	Phone App	Communication/Signaling
Main	**Dominic**	**Matthew**	**Brandon**	**Ralph**
Backup	**Matthew**	**Dominic**	**Ralph**	**Brandon**

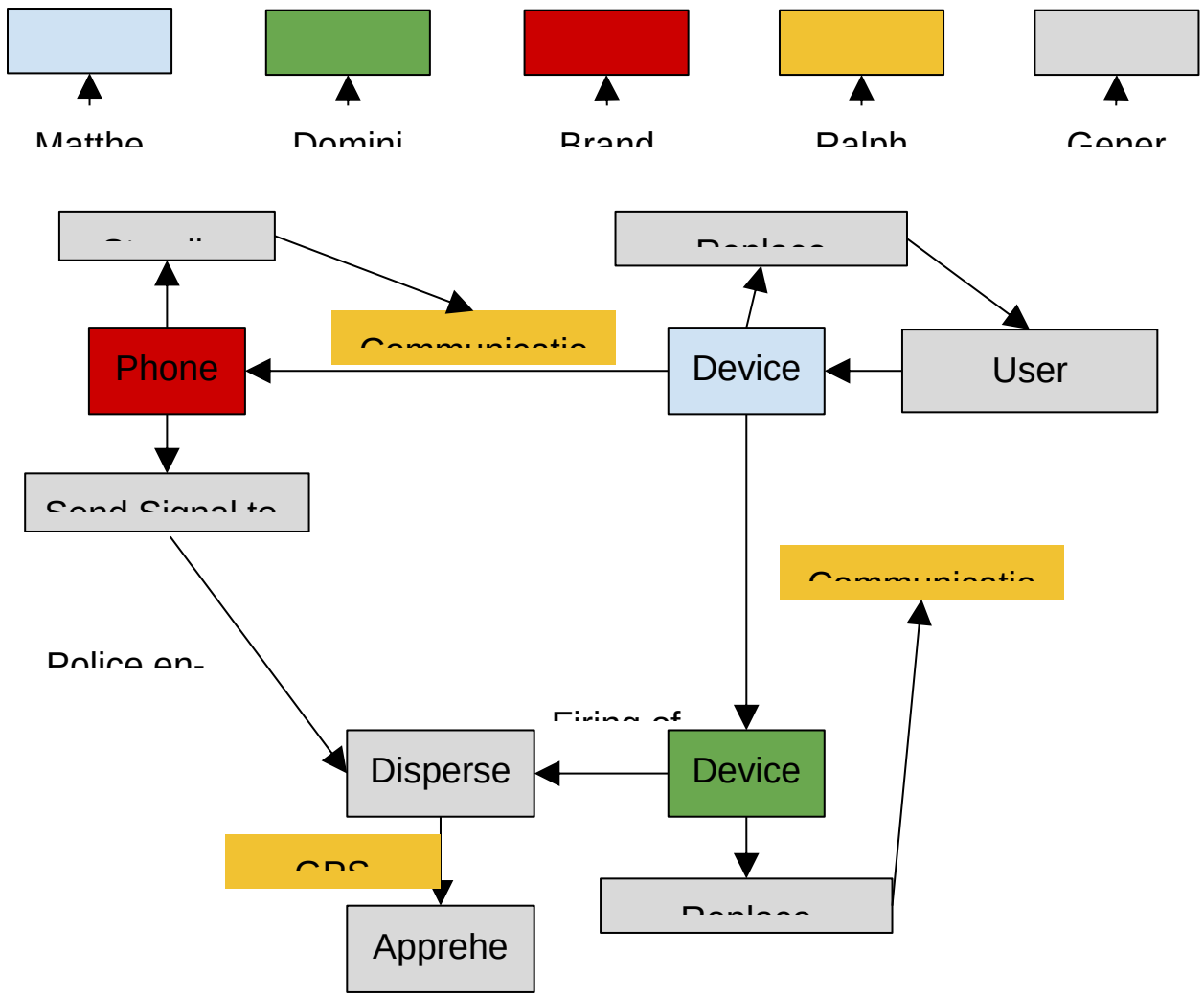

Figure 2: Project outline flowchart

Logic Flowchart:

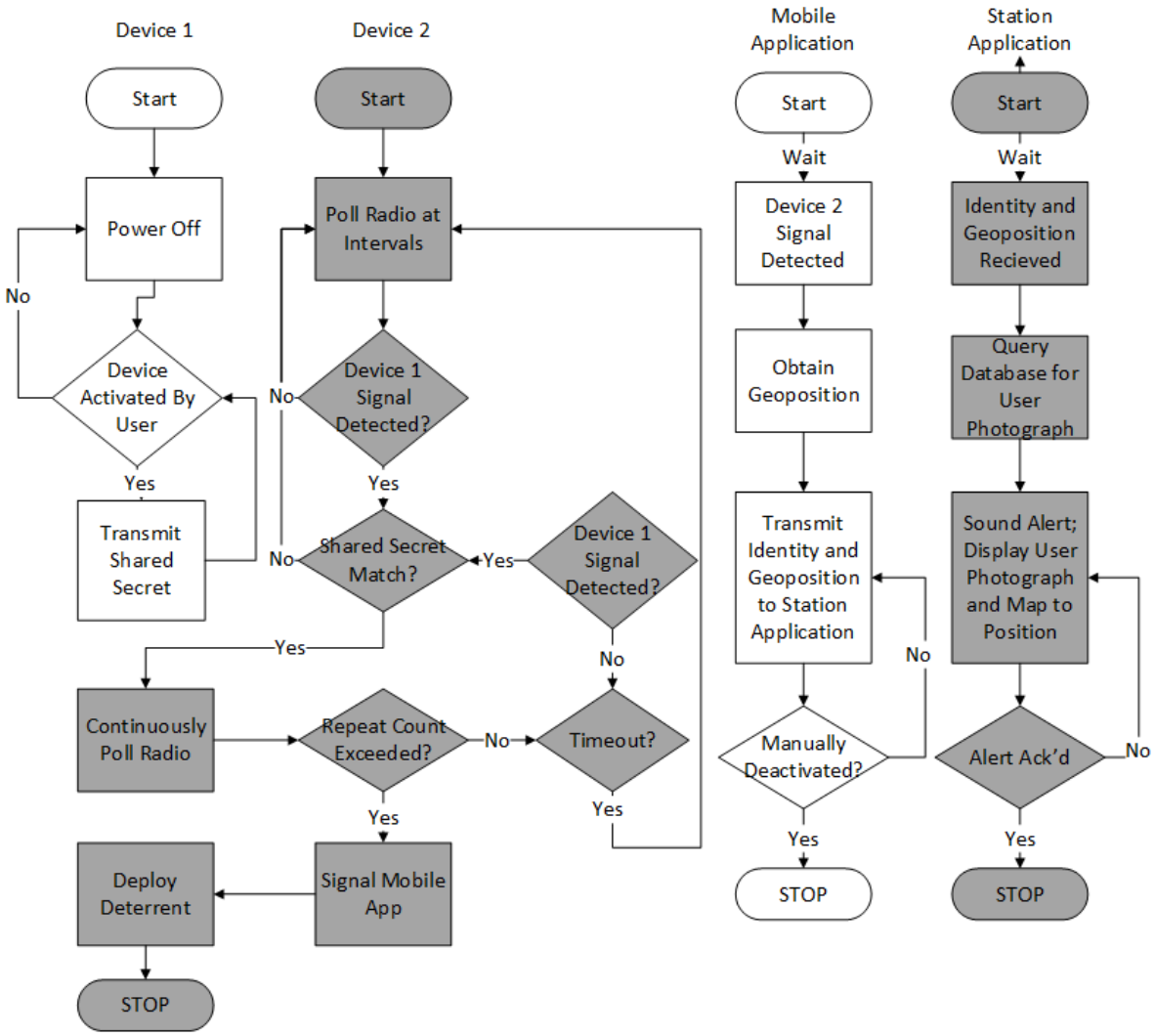

Figure 3: Logic flowchart for the devices

Timeline:

Senior Design 1: Weeks

1, 2:

Formation of Group. Gain project ideas. Initial meet with sponsors.

Weeks 3, 4:

Create initial documentation for project idea. Meet with sponsors to go over project constraints and finding out requirements for project from sponsors. Start final documentation for project idea.

Weeks 5, 6:

Meet with professor to go over feasibility. Start research for project. Meet with sponsors.

Weeks 7, 8:

Continue research for project. Start design of prototype. Meet with sponsors at their office.

Weeks 9, 10:

Finalize layout for documentation. Meet with sponsors.

Weeks 11:

Finish documentation. Final design check. Allocation of funds for purchasing of chips. Final PCB design. Prototype board construction. Meet with sponsors

Weeks 12, 13:

Revision of documentation edited by professor and sponsors. Meet with sponsors.

Weeks 14 through 16:

Finalize documentation and turn in documentation. Meet with sponsors.

Weeks 17 through 20:

Final design test of PCB. Meet with sponsors.

Senior Design 2:

Weeks 21 through 34:

PCB construction and real world test. Work on presentation for final demonstration.