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Design Specification Document

Problem Space:

In America, a gun can be relatively easy to obtain and is even required by law in some towns for every household to own a gun. Because of the accessibility of guns, they can sometimes end up in the hands of someone other than the owner. From a recent September 2016 study by the researchers at Harvard and Northeastern universities about gun ownership, between 300,000 to 600,000 guns are stolen every year. That is more than 1,600 guns stolen every day, more than one every minute. With the alarming amount of guns being stolen, the illegal weapons are more often than not then used in heinous ways. According to a 2005-2010 study, 86% of burglaries and 75% of other property crimes involved a stolen firearm.

Realizing that there is no current way to restrict the gun's usage to the sole owner, it is not shocking that less than 10% of stolen firearms are actually recovered. Like President Obama said after the 2012 attack on Sandy Hook Elementary School, "If we can develop technology that you can't unlock your phone unless you've got the right fingerprint, why can't we do it for guns?"

Our group's design is intended to restrict a gun's usage to the owner and anyone the owner deems as an authorized user. We are trying to prevent guns being stolen and misused by youths, family members, or anyone who can potentially get ahold of it and use it for bad intentions. Our group intends to design a smart gun that has two main aspects: a two step user authentication via physical fingerprint reader and a face recognition aspect, and the second aspect of a live GPS tracker. Our group believes that by implementing these features in a smart gun, the gun would only allow authorized users to actually pull the trigger, and in turn provide

Description of users:

The primary audience that our group is seeking to address is anyone who is a responsible gun owner who wants to prevent their guns from being stolen. In order to establish a relationship with these users, our group sought out acquaintances who we personally knew that owned guns. From there they were able to direct us to others who owned guns, we learned that this is called a snowball effect of user sampling. In addition we contacted Scott Preston who actually came in to talk to our class about UW Emergency Management. He was able to refer us to more specialized users that had a

greater understanding of gun usage. We then contacted them via email and started to establish relationships with other of our users. Some questions we have asked our users include: “How do you hold your gun? Are there different ways to hold a gun? Do you own a gun? How often do you check if your gun is in its place? “. Because our focus was relatively hard to observe “in the wild”, for trying to capture an individual sealing a gun is difficult to see, we conducted informal interviews and had our users demonstrate processes, such as how one would hold a gun. We believed that these questions would help our group gain think of hypothetical situations and gain a better understanding of gun usage and the responsibility that owning one comes with.

In order further reach other potential users, our group hopes to print out fliers and put them up in neighborhoods, gun selling stores, as well as asking to put some in police stations. Our group believes the best way to establish relationships with our users is actually having the opportunity to talk to gun store owners and promote the importance of our goal, so they can one day explain to the gun purchasers the importance of gun safety.

Design details and rationale:

We intended to build a smart gun and an additional mobile application. The smart gun would have two main aspects: the first being a two step user authentication and the second being a GPS locator which would be accessible on the mobile application via bluetooth. The smart gun’s two step user authentication will include a fingerprint scanner that would be situated on both sides of the gun’s grip, where the user would place his or her fingers. The second aspect to the two step user authentication focuses on a small camera positioned on the left side of the gun’s barrel, which would be directed towards the gun user’s face. Then by using both the user’s fingerprint and the face recognition technology the smart gun would deem the gun holder authorized or not. The authorized fingerprints and face standards that would be used for reference will be set up via the mobile application. We decided that our smart gun would need an internal battery in the grip that could be charged via inductive charging. Because adding a USB port in the grip of the gun would interfere with the gun’s magazine entering and exiting.

The mobile application would focus primarily on the smart gun’s gps tracking ability. The GPS tracker would be located in the gun’s grip. On the mobile application, there will be a live map and the ability to ping one’s gun, producing a sound that would help the owner locate his or her gun; think of find my iphone, but in our situation find my gun. Another aspect that the mobile application will offer is the ability to set up the smart gun’s authorized user reference list, including fingerprints and face recognition.

The rationale behind our group's design was that initially we intended to build a physical attachment that could be placed on one's existing gun. Using a physical fingerprint reader, our attachment would prevent unauthorized users from pulling the trigger. Because none of our group members actually used a gun before, let alone hold a real gun, we were a bit unclear about the gun's mechanics. But after interviewing a few actual gun users, we received feedback that if a gun was stolen with our attachment on it, there is a high possibility that the attachment could be sawed off or removed. They recommended that the features our group hoped to implement needed to be deeply engraved in our gun, thus we decided to switch to designing a smart gun.

The first design of our smart gun models a M1911 pistol, which is double action handheld gun. The first prototype included two main aspects, the two step user authentication and GPS tracker that would be located in the gun grip. We attached a small camera on along the left side of the lower frame right above the trigger guard. In addition to adding a fingerprint reader on the left side of the grip. We thought that the single fingerprint reader would be possible for ambidextrous usage. But after interviewing more users we realized that the fingerprint scanner needed to cover a larger surface as it would be more efficient for the user in practical usage. This would prevent the hassle of placing one's finger on a specific spot on the handle just to enable the gun. A larger surface area for the fingerprint scanner which covered both sides of the gun would be preferred for fingerprint enabling. In addition we learned that the M1911's grip is removable, which would defeat the process of including the fingerprint reader and GPS in the grip; like the attachment, the grips could be removed.

Realizing that the GPS technology and fingerprint reader cannot interfere with the mechanical aspects of the weapon, which include where the magazine enters the gun and the upper frame of the gun pulls back, our group drafted a final design. The final design of Identity Gun models a Glock 19, where the grip is not removable. This would provide us with the space to practically add our technological features to create Identity Gun.

User testing:

One of our user testers was David Girts, who is the Violence Prevention and Response Program Manager at UW SafeCampus. He is not a current gun owner, but has served as a police officer for over 20 years. We came to him with our first prototypes, the three gun attachments. He provided us insight on how our attachments would be unrealistic to implement on existing guns. The first reason being that the gun attachments would need to be robustly secured to the gun, because if not, they would be easily removed. The second being that the mechanical functionality would not be feasibly possible through an attachment. Mr. Girts kindly suggested that these features we were hoping to include needed to be deeply engraved in our design, in order to serve its purpose.

The second user we chose to survey was Officer Bresko, who is apart of the K-9 unit here at UWPD. He is an active gun owner and carries a concealed weapon when he is off duty. We came to him with our second prototype, the first 3D printed model of Identity Gun that resembled a M1911 pistol. He told us that having such a small fingerprint reader would be unrealistic, since the margin of error when placing one's fingerprint on the single point would be relatively high. In addition to it not being ambidextrous friendly. Officer Bresko suggested that we increase the surface area of the fingerprint scanner and have it on both sides of the gun's grip. He said that the camera position was fine, because if we placed it anywhere else on the gun it would interfere with the gun's usage.

The third user was Omer Siddiqui, Solayman's friend who has experience with guns, specifically with rifles and handguns for deer hunting. He came to him with both our paper prototypes and first 3D printed model. His initial reaction to our paper prototypes of the attachments was mainly negative. He knew that gun locks already existed, and was skeptical that technology from an attachment would be able to control the guns mechanics. There was positive results for our second prototype, where he was more inclined to the idea of a smart gun because it was more realistic to control the gun's mechanics. He said he would consider buying something like this and would highly recommend it for first time gun users.

The fourth user was Andrew Isola, Eric's friend whose family owns a gun. We came to him with the second prototype, the first 3D printed model, and the third prototype, the second 3D printed design that models a Glock 19. He was overall pleased with the GPS tracker and said that the mobile app would be viable in efficiently locating and managing one's gun. He made a reference to the find my iphone app and suggested that we include a feature in our mobile app that would allow the user to ping his or her gun, where a sound would be produced and allowed the gun to be found more easily.

Our fifth user was Keanu Dunn, Rachel's cousin who frequently carries a concealed weapon. We came to him with our second 3D printed model, the Glock 19, and he recognized that the fingerprint scanner on both sides of the grip was a good idea. He said that most gun users are able to shoot ambidextrous when needed. In addition he pointed out that there are existing attachments that can be added to Glock models along the lower frame, but he does not prefer them. But he was a bit positive about having an attachment on the side of the lower frame because it would not interfere with the sights on the top of the gun or the slide lock.

Evaluation:

From our user testing, our group realized the importance of contextual interviews. Since none of us were avid gun users, we had no prior knowledge of a gun's mechanics. When we designed our initial prototypes, we learned that none of them would be realistically effective. Only after conducting user research and having the opportunity to interview some of them, we were able to create a more reasonable design. Understanding what our users preferred by stepping into their

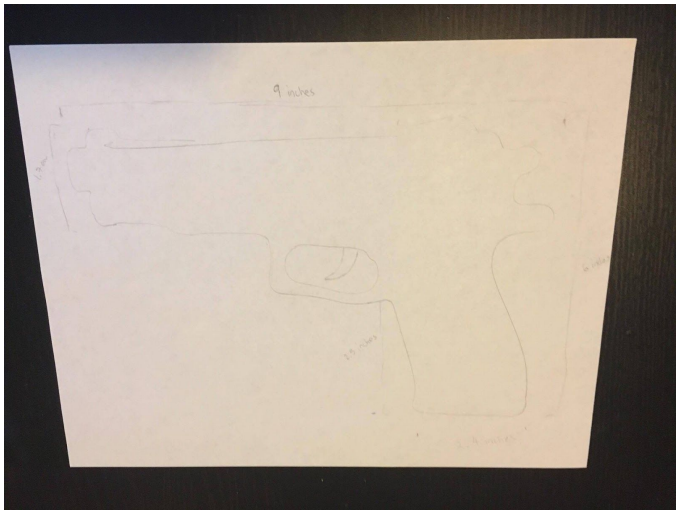
shoes allowed us to design a prototype that would not interfere with the task at hand, but could actually be of assistance to our users.

Design Process:

Gun

First Prototype:

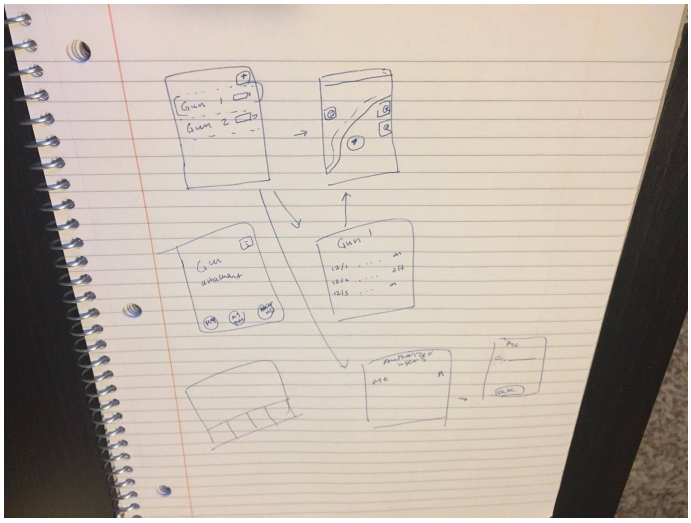
Second Prototype:



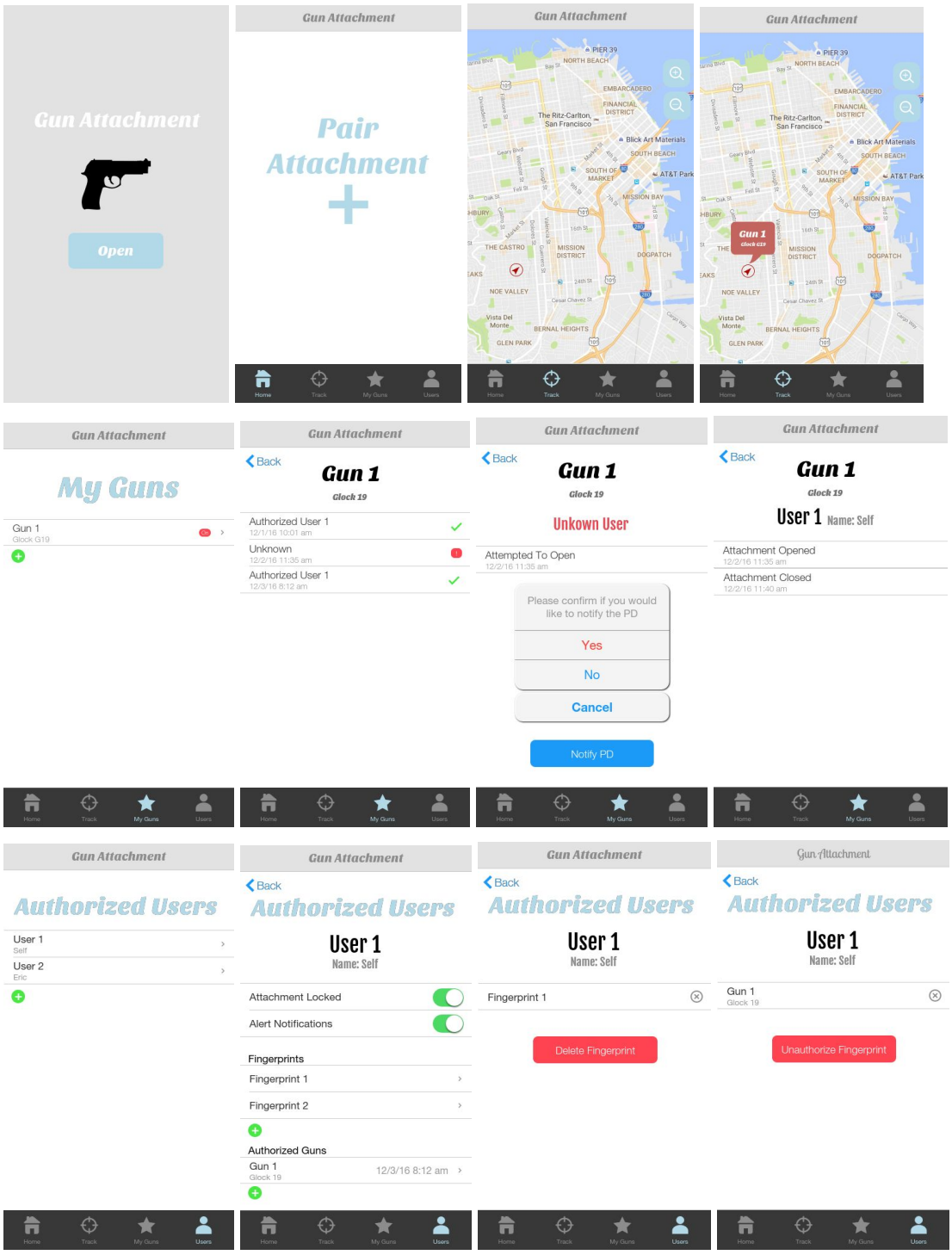
Final Prototype:

Mobile App

First Prototype:



Second Prototype: https://pr.to/WLSNRE/



Final Prototype: https://pr.to/EAVARP/