Initial Project Proposal

Year: \_2018\_ Semester: \_Spring\_ Project Name: \_\_\_\_\_\_Track-on-track\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Creation Date: \_\_\_\_October 30, 2017\_\_\_\_\_\_\_\_\_ Last Modified: Sep 18th, 2017

Team Members (#1 is Team Leader):

Member 1: \_\_\_\_\_\_\_Nick Geirland\_\_\_\_\_\_\_\_\_\_\_\_ Email: \_\_ngeirlan@purdue.edu\_\_\_\_\_\_\_

Member 2: \_\_\_\_\_\_\_Nathan McNally\_\_\_\_\_\_\_\_\_\_ Email: \_\_\_\_nmcnall@purdue.edu\_\_\_\_\_\_\_

Member 3: \_\_\_\_\_\_\_Yunsheng Li\_\_\_\_\_\_\_\_\_\_\_\_\_ Email: \_\_\_\_li1436@purdue.edu\_\_\_\_\_\_\_\_

Member 4: \_\_\_\_\_\_\_Aaron Kaiser\_\_\_\_\_\_\_\_\_\_\_\_\_ Email: \_\_\_\_kaiser20@purdue.edu\_\_\_\_\_

1.0 Description of Problem:

Backpacks, purses, and other portable containers often hold items that are important to us. The loss of a handbag with important documents or items can be devastating. Almost everyone uses some sort of bag to carry their items, and these often contain things like laptops, papers, or other valuables. According to an LA Times article, airlines have hit a record low for lost luggage, but at the same time, over 6 bags are lost per 1000 passengers costing an estimated 2.3 billion dollars [1]. Unfortunately, when a bag is lost, it is hard to find again, and the best most people can do is to retrace their steps, or check a local lost and found. There is also the possibility that these can be stolen, as they are small, portable, and easily carried. In either case, there is a need for a way to find the bag once it is lost or stolen.

2.0 Proposed Solution:

The team’s proposed solution would be to create a small device that will go into luggage, backpacks, or other containers that will allow the user to keep track of their lost or stolen property. This device will use GPS to determine where it’s location is and will be able to send the location so long as it has access to cell service. Once in range of the device, a Bluetooth module can kick in that will connect to the users phone. The user’s phone will have an app that can signal how close to the device the user is and will tell them as they get closer and farther. The device can also be signaled from the phone to emit a beep that will rise and fall in pitch as the user approaches.

3.0 ECE477 Course Requirements Satisfaction

3.1 Expected Microcontroller Responsibilities

The microcontroller will be an important part of the project. Its primary function will be to perform algorithm that determines the information to send to user’s phone which is then used to display the location of it via the phone app. Also, the microcontroller will receive information from the phone to control the bluetooth module and control the speaker used for short range tracking. The microcontroller will have to interface with the PCB in order to receive information from GPS module, and then send those commands out with cellular frequency signals.

3.2 Expected Printed Circuit Responsibilities

The primary responsibility of the PCB will be to interface the microcontroller with a GPS module a bluetooth module, a speaker and a SIM card module. The PCB will connect the information coming in via these protocols to the microcontroller. Also, the PCB will be responsible for distributing power across the board, and making sure the microcontroller and other components function properly.

4.0 Market Analysis:

Our product’s target market is anyone who owns a backpack or bag that contains valuable items. The potential customer base in West Lafayette is vast due to the amount of Purdue students. This fall’s total enrollment is over 45,000[[5]](https://www.admissions.purdue.edu/academics/enrollment.php); estimating half of this population buys one unit at $45 per unit (a competing price in the market), our market value is just over $1M. Other than marketing towards students, our product is also intended for the general adult population, especially those who travel/commute frequently and those with children who may be irresponsible for keeping track of their devices.

Another tracking product that tracks luggage, TrakDot utilizes GPS tracking but doesn’t offer close range tracking with Bluetooth like our product will. This will give us an advantage in the market. A specific example where this will be beneficial is when travelers go to pick up their luggage from the luggage belt. Using bluetooth tracking, they will be able to tell when their bag is getting closer on the belt and signal them to be more alert for looking for their bag.

Another aspect of competing products is that they focus heavily on branding which makes their devices susceptible to theft tampering. When a tracker is easily recognized as a tracker, a thief can quickly identify and remove the device to prevent any further location information transmissions. Restricting branding on our product will help reduce this issue and give us an advantage in theft protection over the competition. On the other hand, entering a market with well established brands will be difficult for our unestablished product.

5.0 Competitive Analysis:

5.1 Preliminary Patent Analysis:

5.1.1 Low power apparatus for preventing loss of cell phone and other high value items[[6]](https://www.google.com/patents/US20100283600?dq=Low+power+apparatus+for+preventing+loss+of+cell+phone&hl=en&sa=X&ved=0ahUKEwji89PRnrjKAhWFKGMKHfYyChkQ6AEIHDAA)

This patent states that a lightweight tag is put on an item to be protected and the user uses a programmable wireless appliance such as a cell phone to check if the item is within a certain range.

5.1.2 Luggage tracking method and apparatus[[7]](https://www.google.com/patents/US9439164?dq=14/227,140&hl=en&sa=X&ved=0ahUKEwirvq2u8sjXAhXI-lQKHTgHBD4Q6AEIKDAA)

A GSM device is put into the user’s luggage and the user can use a tablet or phone to check if the luggage arrives in sync with the flight. If the luggage does not arrive, the device informs the airline and the user and let them coordinate on the delivery of the luggage.

5.2 Commercial Product Analysis:

5.2.1 TrackR[[2]](https://www.thetrackr.com/)

Another competing product, TrackR, has a feature where stolen products will transmit a device’s location by using a crowd sourced network of tracking devices to transmit location data to the owner even if the tracking device is out of range of their host device. As stated before this idea is restricted by theft tampering, but is generally a well intentioned feature. This feature also falls short if a user is in lower density population as it relies on other users. In order to transmit securely it uses a unique identifier that can communicate with any phone with the TrackR app installed if within Bluetooth range and marked lost by the owner.

5.2.2 Tile[[3]](https://www.thetileapp.com/en-us/)

Tile includes a reverse tracking feature for phones. This is useful if you have a device with a tracker attached but are missing your phone. While connected to the app and within Bluetooth range, by pressing the button on the product, your phone will ring at max volume, regardless of the current volume or ringer setting. Android Wear and Apple Watch allow for the same functionality but are extremely limited by their respective host devices and have a high entry cost for such a feature. Tile uses technology patented under US 20100283600 A1. This covers a system for monitoring distance between a mobile device and small tracking device.

5.2.3 TrakDot[[4]](https://trakdot.com/en)

TrakDot is a product that most resembles our project. It is a luggage tracking system that uses GPS and mobile data to track a person’s luggage while traveling. The technology is patented under US 9439164 B2, which covers using a GSM enabled device placed in luggage that communicates with a mobile that alerts a traveler when their luggage arrives at the destination. If the luggage is lost or does not arrive, both the airline and traveler are notified. The device halts transmission of signals once in flight and reenables wireless capabilities once grounded.

5.3 Open Source Project Analysis:

5.3.1 Geogram ONE:

This project is released under the Creative Commons license version 3. This license means the code can be shared and used commercially so long as the resulting product goes under the same license. This device is very similar to ours when using the long distance tracking but it is missing out on our short distance Bluetooth finding capabilities. This is still useful for helping the user find the general location of their property but when nearby it’s no longer useful. Our product will help the user not only track and get to their items, but help them find it too.

5.3.2 GeoLink OpenTracker:

This is an open source piece of hardware with software for tracking vehicles. It is a PCB designed to be arduino-compatible and it is part of a system to manage a fleet of vehicles, and to interface this information with a server, and from there, communicate with a phone application. While the goal of this product is significantly different than ours, the tracking method seems to be similar in the sense that they both use gps to find their locations, and then they transmit that information to other devices. One major difference is that OpenTracker has no way of tracking the location of objects that are close in a 3d environment.

6.0 Sources Cited:

[1] H. Martin, “Worldwide rate of lost luggage on airlines hits record low,” Los Angeles Times, 01-May-2016. [Online]. Available: http://www.latimes.com/business/la-fi-lost-luggage-rate-20160429-story.html. [Accessed: 18-Nov-2017].

[2] “Find more. Search less.,” TrackR, 2017. [Online]. Available: https://www.thetrackr.com/. [Accessed: 18-Nov-2017].

[3] “Find Your Tile,” Find Your Keys, Wallet & Phone with Tile's App and Bluetooth Tracker Device | Tile, 2017. [Online]. Available: https://www.thetileapp.com/en-us/. [Accessed: 18-Nov-2017].

[4] “TrakDot,” Trakdot Luggage Tracker. [Online]. Available: https://trakdot.com/en. [Accessed: 18-Nov-2017].

[5] Purdue University Office of Admissions, $author.value, “Student Enrollment, Fall 2017,” Student Enrollment - Undergraduate Admissions - Purdue University, 2017. [Online]. Available: https://www.admissions.purdue.edu/academics/enrollment.php. [Accessed: 18-Nov-2017].

[6] “Patent US20100283600 - Low power apparatus for preventing loss of cell phone and other high value items,” Google Patents, 11-Nov-2010. [Online]. Available: https://www.google.com/patents/US20100283600?dq=Low%2Bpower%2Bapparatus%2Bfor%2Bpreventing%2Bloss%2Bof%2Bcell%2Bphone&hl=en&sa=X&ved=0ahUKEwji89PRnrjKAhWFKGMKHfYyChkQ6AEIHDAA. [Accessed: 18-Nov-2017].

[7] “Patent US9439164 - Luggage tracking method and apparatus,” Google Patents, 06-Aug-2016. [Online]. Available: https://www.google.com/patents/US9439164?dq=14%2F227%2C140&hl=en&sa=X&ved=0ahUKEwirvq2u8sjXAhXI-lQKHTgHBD4Q6AEIKDAA. [Accessed: 18-Nov-2017].

[8] “Assets Tracking Fleet Management,” *GEOLINK*. [Online]. Available: https://geolink.io/index.php#home. [Accessed: 18-Nov-2017].

Appendix 1: Concept Sketch





