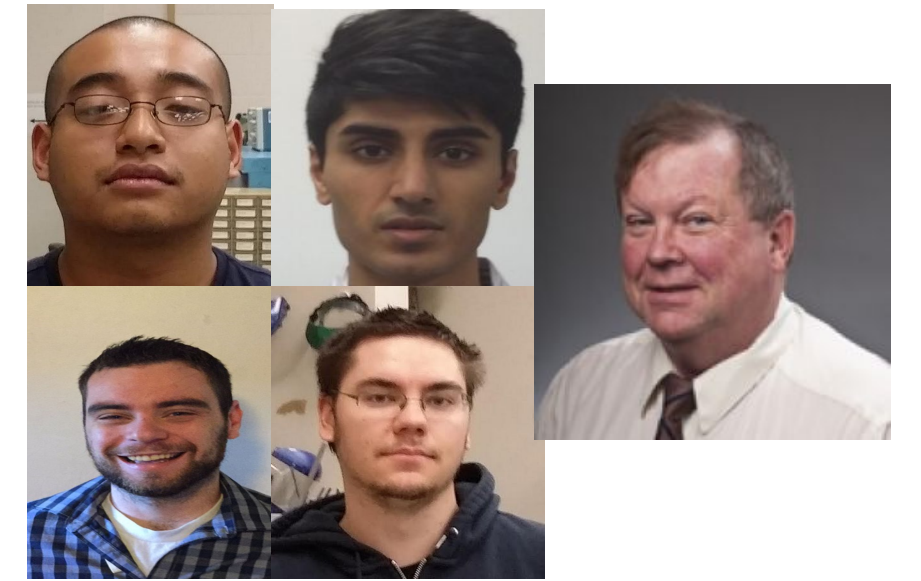




# Secure Traveler

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## Abstract

The event of someone losing an item happens every day, it can vary from simple misplacement for a short time or the item could be lost forever. This leaves negative consequences on the individual (emotional stress, lost time, money etc.) that we attempt to eliminate. Secure Traveler is an efficient, cheap and quick way to make sure that items will never be lost. By placing a Secure Traveler device on or within your belongings, you can easily locate lost items by operating a user-friendly smartphone application which makes use of Bluetooth 4.0 LE connectivity. The application will display the location of the user's devices using Google Maps through coordinates that have been uploaded and stored in Google's Firebase server, making it easy to navigate. Secure Traveler sends notifications to the smartphone, warning the user that their item has left the range of Bluetooth. Secure Traveler also can play a high pitched tone in order to help the user find their belongings even if they can't be seen.

## Results

The final weight of the device is 1.3 ounces. The size of the device is 2.36 x 1.38 x 0.79 inches. The battery to power the device is 150mAh at 3.7V and this results in a battery life of approximately 22 hours. The speaker can be heard from approximately 44.42 meters outdoors and 35.76 meters indoors. The device will remain connected to the phone for an approximate range of 36 meters. The only specifications that were not met are battery life and cost.

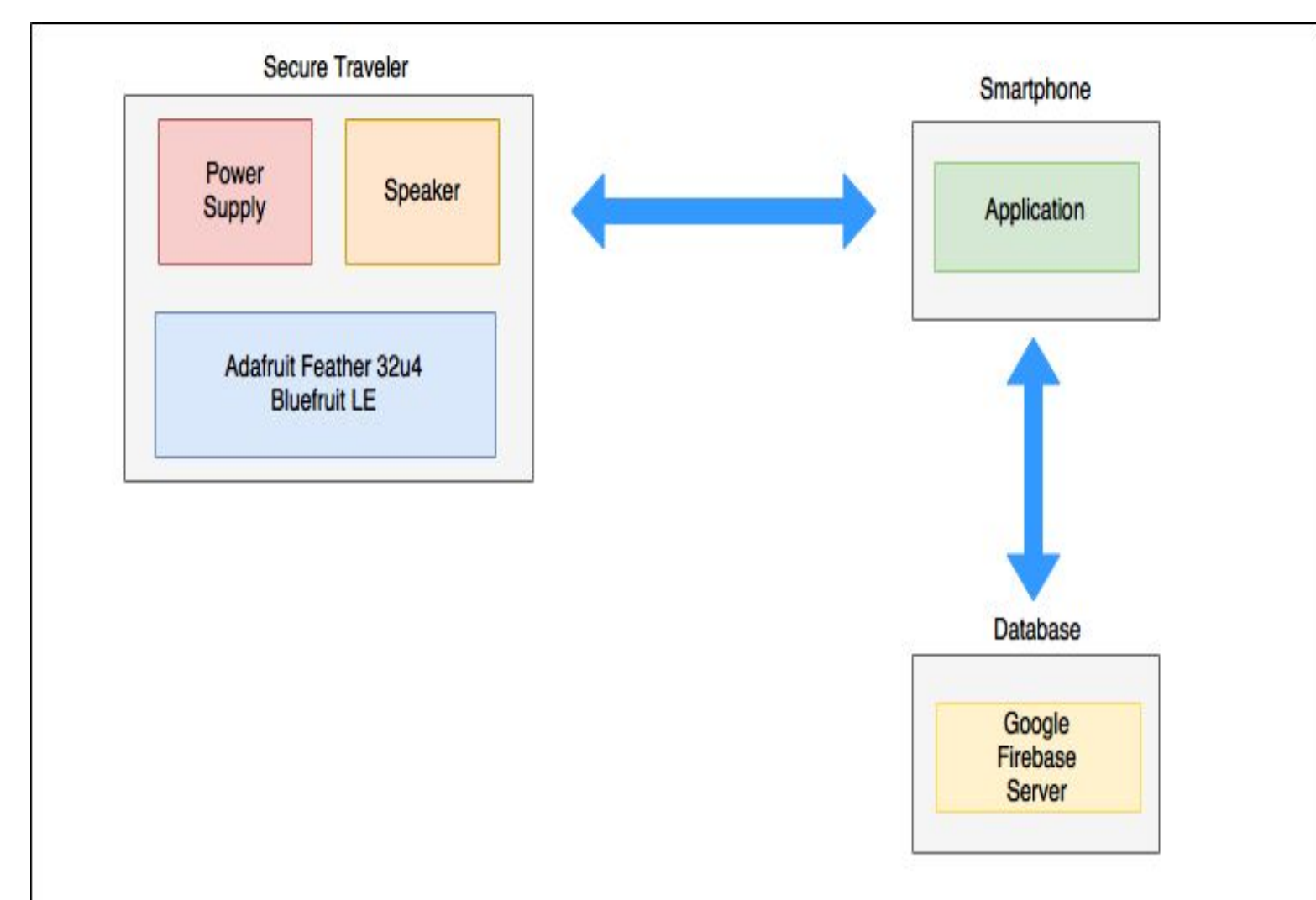
## Specifications

Requirement	Initial Projections	Final Product
Connection Range (Indoor/Outdoor)(Meters)	30 Meters Indoors 40 Meters Outdoors	Min: 20 meters, Max: 36 meters Average: 36 meters
Audio Range (Indoor/Outdoor)(Meters)	35 Meters Indoors 45 Meters Outdoors	Approx 36 meters Indoors Approx 45 meters Outdoors
Battery Life (Months)	2 Months	22 hours
Weight (Ounces)	16 ounces	1.3 ounces
Size (Cubic Inches)	6 cubic inches	2.57 cubic inches (2.36 x 1.38 x 0.79)
Server Connections	50	100
Response Time (Seconds)	1 second	Less than a second
Cost per Unit	\$25	\$44.01(1) - \$35.80(100+)

## System Overview

The system consists of the Secure Traveler device, an iOS application, and a Google Firebase Server. The application communicates with the device in order to play sound and achieve a relative proximity to its' location using the phone's coordinates. The phone coordinates are uploaded to the Google Firebase Server, as well as, the user's email address and a timestamp. The application offers a location sharing aspect, in which another user may use their location to update the location coordinates of a lost device. The application will also send a push notification if the phone loses connection with the device.

## Block Diagram



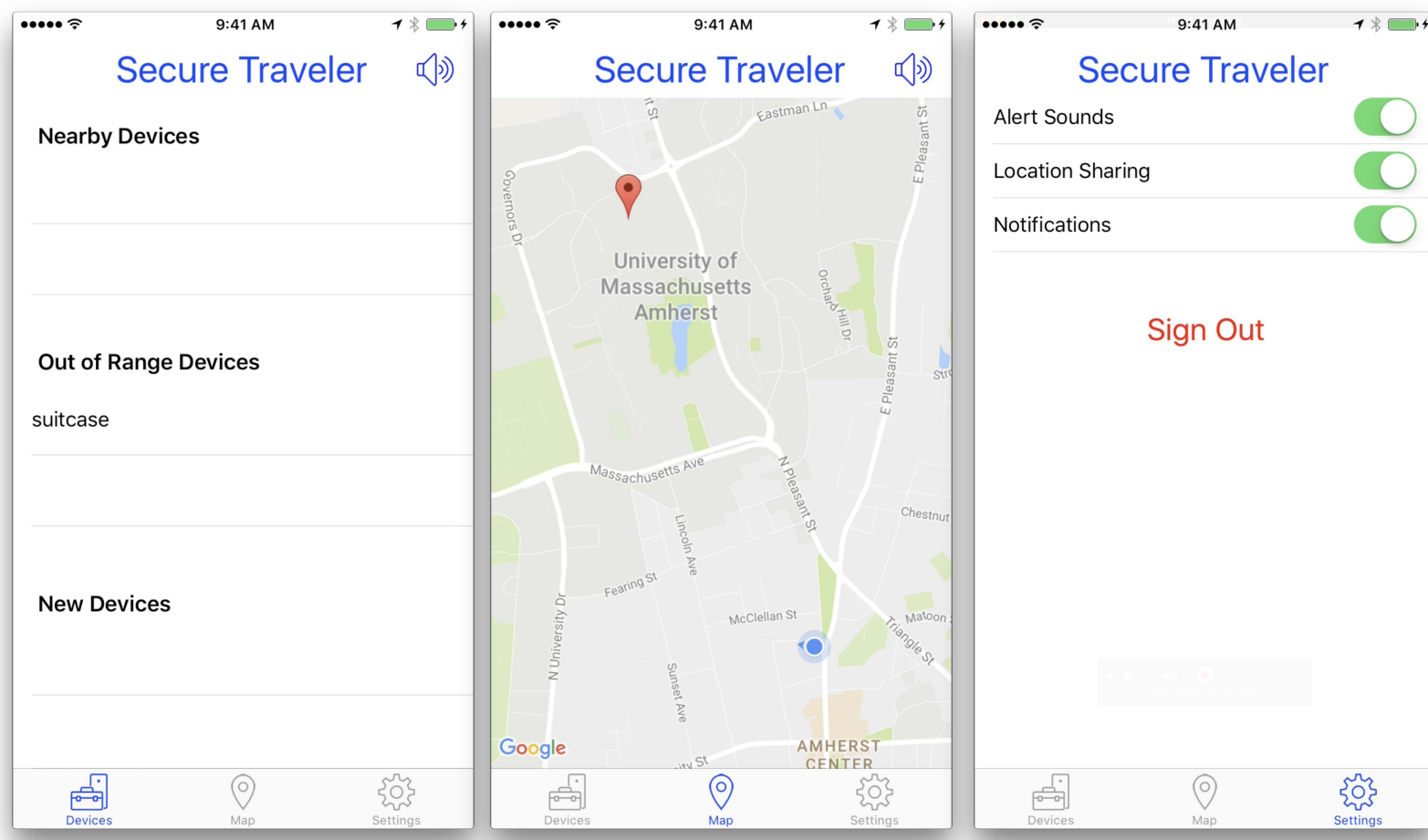
- **Secure Traveler:** Bluetooth enabled device with speaker functionality to connect with user's phone and play audio if requested
- **Application:** Connects with device and sends information to server including location data and device details such as chosen display names
- **Server:** Stores users' device location and name, and communicates with user's smartphone application if data is requested

## Acknowledgement

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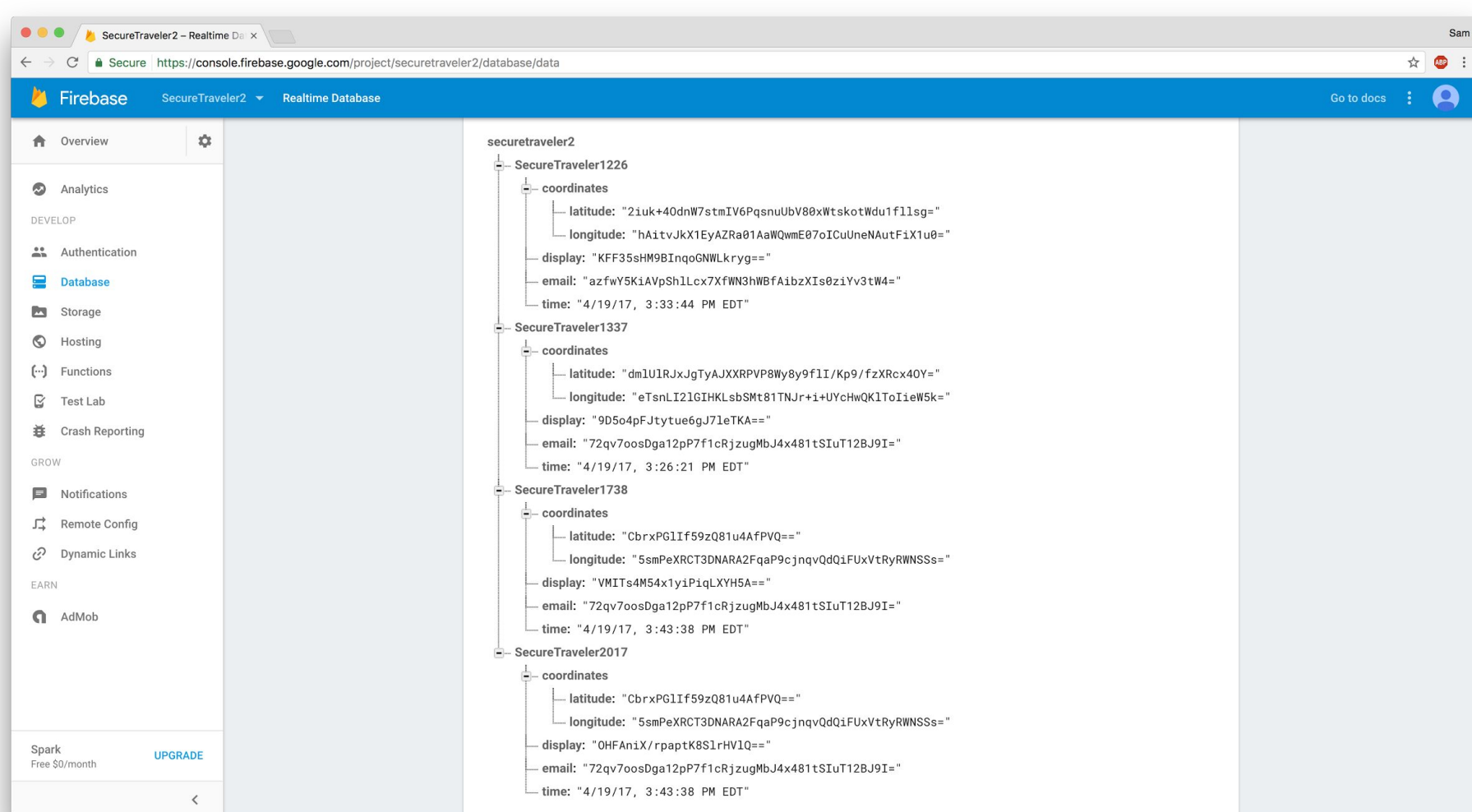
# iOS Application

The iOS application consists of three tabs: devices, map, and settings. The application uses Google Sign In and stores the user's email address as well as their registered devices' information to the Google Firebase server. The display names of the devices can be set by the user. The map tab displays the last known location of these devices. There is also the capability of playing sound on the device to help with location. The settings tab offers the capability of turning off certain aspects of the application, such as location sharing and alerts.



# Firebase Server

The server is used to store data that consists of the default name, the location coordinates, the display name, the user's email address, and the time of the device was last seen. All of the data is encrypted on the application using the Advanced Encryption Standard and a 256-bit key before being stored on the server.



# Cost

Parts	Development	Production (100+)
Adafruit Feather32u4 Bluefruit LE	\$29.95	\$23.96
TI LM386N-1 Audio Power Amplifier	Free sample	\$0.53
Lithium Ion Polymer Battery	\$5.95	\$4.76
Adafruit Mini Metal Speaker	\$1.50	\$1.20
OSH Park PCB	\$3.80	\$3.80
Hammond Manufacturing Enclosure	\$2.28	\$1.58
<b>Total</b>	<b>\$43.48</b>	<b>\$35.83</b>

# Secure Traveler Device

The Secure Traveler device uses an Adafruit Feather32u4 Bluefruit LE module to connect to the iOS application. The device is secured inside a plastic enclosure that is small and light for the user's convenience. It contains perforations for the speaker to increase audibility.

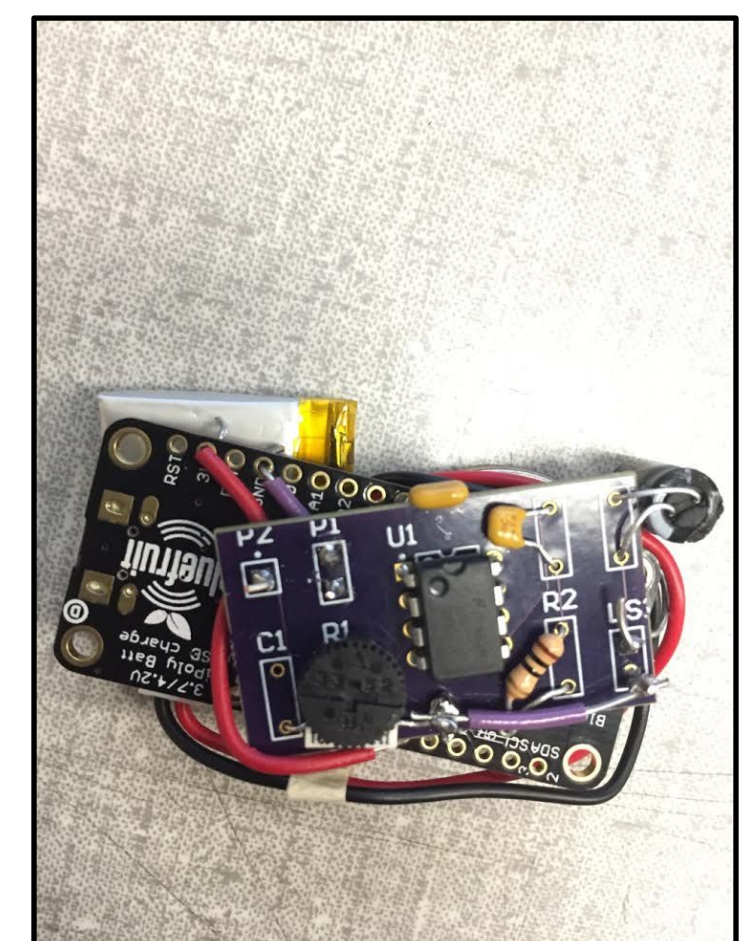


# Audio & PCB

The audio tone is produced using an 8 ohm, 0.5W Adafruit Mini Metal Speaker. The audio circuit incorporates a TI LM386N-1 Audio Power Amplifier that allows the designer to control the gain. The gain used to amplify the audio signal was set to 200 V/V. The speaker can produce an audio tone through a sound button that can be pushed by the user on the iOS application.



Front Image



Back Image

# Experiment

The capabilities of the device were tested under numerous conditions. The bluetooth connection range and speaker range were tested indoors and outdoors. The battery capacity was tested while the speaker was on until the battery died, as well as, when the speaker was off until the battery died. We also tested the error in the device's location indoors due to the limits of GPS indoors.