

SE 491-sdmay19-27

Smartphone Tracking App for Microsoft HoloLens

Week 9

11/03/18 - 11/09/18

Client: Optical Operations

Faculty Advisor: Daji Qiao

Team Members:

Ben Holmes - *Android Development*

Anthony House - *Website Development/Security*

Ryan Quigley - *Android Development*

Jose Lopez - *Website Development*

Travis Harbaugh - *Hololens Development/Android Development*

Cory Johannes - *Report Management*

Summary:

The goal this week was to create a data visualization technique using canvas elements in HTML to display movement data on a 2D plane on the user front-end. We received our bluetooth beacon that uses RSSI based signal propagation for distance estimation and have begun to start playing with that to see what all it can do. We are considering adopting the algorithm they use for our own implementations. Our team got together to identify some of the pitfalls we have been having and what we can do to improve and then finally, we have made some progress in time of arrival with a two phone, client server bluetooth setup.

Pending Issues:

Some issues that need to be worked out are, time of arrival implementations and testing for that, wifi triangulation implementation and tests, time of arrival and wifi added to the android app, further designs and data visualization for the front-end, dead reckoning optimization with 360 rotation abilities, and rethink implementations on the server. We plan to solve some of these issues both individually over Thanksgiving break, and when we meet up during our Sunday meeting times.

Past Week accomplishments

- Travis Harbaugh
 - Created an Eddystone Bluetooth Beacon by making an advertising protocol
 - Programed beacon to send the following data in the protocol:
 - 10-byte Namespace
 - Created a 16-byte UID

- Created instance ID
 - Created an advertising interval which determines the frequency in which the beacon emits the signal
 - Created Eddystone URL
 - Implemented Android application to:
 - Decode the beacon fields from the BLE advertisement
 - Estimating the distance from the cellphone to the beacon
- Ben Homes
 - Worked with Jose to create data visualization aid in Canvas. We can demonstrate our Pedestrian Dead Reckoning approach by outlining shapes on the ground, and then using data collected from our Dead Reckoning system to draw our trajectory onto Canvas.
 - Have not added anymore to the merged Android application.
 - Still working with Bluetooth and time of arrival. Trying to create a client server set up between two Bluetooth capable Android phones. I think that over short distances, using this configuration, time of arrival distance estimates can provide a greater degree of accuracy than just sound or bluetooth alone. Granted, the devices need to be close together, but with better hardware it's possible to make this work at greater distances.
- Anthony House
 - Set up a meeting with our client to do a SWOT analysis of our team
 - Identified pitfalls and other issues that we could work on and correct
 - Defined a direction with where the team needs to go
 - Did research on bluetooth and gave reasons on why we are choosing this technology and using it moving forward
- Ryan Quigley
 - Researched step length algorithms for improving current application.
 - Found and began implementing new strategy that utilizes variation of acceleration, walking frequency, and gyroscope integral value.
 - <https://ieeexplore-ieee-org.proxy.lib.iastate.edu/document/6703929/authors#authors>
- Jose Lopez
 - I worked with Ben to simulate data onto Canvas using JQuery. I parsed a JSON formatted text file to an array of objects in JS. Simulated real time tracking by calculating the time difference between each step and then waiting for that amount of time.
- Cory Johannes
 - Researched using magnetometer for recalibration/localization
 - Most articles didn't seem to consider it beyond its existence in the phone. One group used it for recalibrating phone's orientation compared to Earth. Ben doesn't seem to think we'd need to do that.
 - Brief work with JS, Jose ended up taking over that work, as he was more familiar and had time working with Ben to get it right.
 - Brief study of Bluetooth vs WiFi before learning that Ben intended to get both usable for recalibration.

- Made calculations for using beacons to triangulate location, and looked into how to improve location tracking to be more specific than North, East, South, West.

Individual Contributions:

Team Member	Contribution	Weekly Hours	Total Hours
Ben Holmes	<ul style="list-style-type: none"> ● Worked with Jose for data visualization aid in Canvas ● Continued experimenting with Bluetooth client server setup, and time of arrival distance estimation. At this point I can send data between Bluetooth Sockets, while simultaneously sending sound ● Once I add the methods for the client bluetooth device to recognize the sound frequencies, and correctly handle closing, and opening new sockets, I will be done 	10	75
Anthony House	<ul style="list-style-type: none"> ● Stated above 	7	41
Ryan Quigley	<ul style="list-style-type: none"> ● Researched improved step length estimation calculations. ● Began implementing new method. 	5	43
Jose Lopez	<ul style="list-style-type: none"> ● Worked with Ben to simulate real time steps and draw them onto canvas 	5	32
Travis Harbaugh	<ul style="list-style-type: none"> ● Set up Eddystone beacon ● Created advertising protocol by programming beacons packet ● Decoded the beacon fields from the BLE advertisement ● Estimated the distance from Bluetooth to cell phone 	10	116

Cory Johannes	<ul style="list-style-type: none"> ● Research magnetometer and bluetooth vs. WiFi, not many takeaways came of it ● Calculations for tracking location and recalibration 	7	31
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Plans for Next Week:

- Travis Harbaugh
 - Work on finish coding standards for the project plan document.
 - Work on finishing the design document.
 - Start to work on using an WiFi access point to re-calibrate the mobile device.
 - Work on timeline for the rest of the semester.
- Ben Holmes
 - I want to have a working implementation of time of arrival by next report, so before the end of November.
 - I also plan to clean up the code repo, document the Android application, and add a Readme to all the code directories I participated in.
 - If time of arrival is working, I will add its functionality to the current Android application being stored in our git repo.
 - I will then branch off and get triangulation using wifi hotspots to function.
 - After that I will add Wifi hotspot triangulation functionality to the stored Android app in our git repo.
 - Following this update is when I can begin devoting serious time to the Kalman filter, or other types of mathematical modeling.
- Anthony House
 - Define tasks for end of the year presentation.
 - Create a gantt chart for the next three weeks.
 - Create and delegate tasks to the group to continue progress.
 - Work on architecture designs.
 - Create database and prepare for data.
 - Create API for the data transfer.
- Ryan Quigley
 - Fully implement new step length estimation calculations.
- Jose Lopez
 - With on Recalibration using Bluetooth and WIFI beacons. They will communicate with the app to fix any drift that might have accumulated .
- Cory Johannes
 - Investigate WiFi access point connections and using them for recalibration (determining distance)
 - Are Android APIs available?

- Work on appendices for design doc and project plan.