SE 491-sdmay19-27

Smartphone Tracking App for Microsoft HoloLens

Week 5

09/29/18 - 10/06/08
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
Cory Johannes - *Report Management*

Summary:

- Created the basic app template we will continue to build our Android app from
- Implemented Step Tracking algorithm
- Compared and contrasted multiple step tracking algorithms in order to determine a best approach
- Created API for graphing accelerometer data on website
- Created a new, modular, well designed application for implementing step tracking related algorithms
- More thorough research in step tracking algorithms

Pending Issues:

- To deduce a method for implementing TDOA with the android OS
- To create a map of durham for representing movement on the server's interface
- Fix the weekly status reports

Past Week accomplishments

- Travis Harbaugh - HoloLens, Unity, Wrote design documentation
- Met with Optical Operations Engineer
  - Setup github repo
  - Received demo of Microsoft HoloLens
  - Discussed RethinkDB

  - Discussed WebSockets vs HTTP requests and not to use websockets because there are a lot of problems associated with the HoloLens.
  - Define the HoloLens design for our team project.
    - Use Mapbox APK to create a worksite in unity instead of design the worksite manually in unity.
    - Use longitude and latitude coordinates for Mapbox
    - Use RethinkDB as a database solution because it continuously sends you update information in Real Time without doing a pull request.
    - Use http requests to send or receive data from the database instead of web sockets
- Researched Ahmad Abableh Step Detection Algorithm
  - Use gravity sensor and acceleration to count users' steps and get the distance the user walks
  - The algorithm relies on peaks and values acceleration to determine the user strides.
- Researched Mapbox SDK
  - How to move players using x, y, z vs. longitude/latitude coordinates
  - Create custom maps in Unity
  - Instantiate new avatar objects into the jobsite using x,y,z vs Longitude/latitude coordinates
- Created new Architecture Diagram
- Created Database schema Diagram
  - Construction Worker Table
  - Accelerometer Table
  - Coordinate Table
  - Location Table
- Created HoloLens Design
  - Scripts:
- Built 3D model in unity for HoloLens
  - Installed SketchUp
  - Exported .skp to .dae and .obj
  - Added textures to .dae model
- Design Document
  - Section 1.1, 1.2, 1.3, 2.1, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6
  - 2.1.1: Concept Diagram w/ Explanation of office monitoring and construction site
  - 2.1.2: Architecture w/ Explanation of website, HoloLens, Android Application, Database
  - 2.1.3 : Mobile Application: Android OS, Android Studio IDE, Java, GPS, Accelerometer, Gyroscope & Magnetometer, Volley
  - 2.1.4: Database w/ Explanation of DB Schema
  - 2.1.5: HoloLens
  - 2.1.6: Scripts: Camera, worker/vehicle movement, particle system, animation, controller, collider scripts
  - 2.1.7: Modeling: Durham

- Ben Homes
    - Created a modular Android application, utilizing android’s best practices in MVVM architecture
    - Implemented a step tracking algorithm, as was outlined in the below research paper.
        - Abadleh, Ahmad, Eshraq Al-Hawari, and Hamad Al-Sawalqah. "Step detection algorithm for accurate distance estimation using dynamic step length." 2017 18th IEEE International Conference on Mobile Data Management (MDM). IEEE, 2017.
        - The premise of the algorithm ended up working much better for us than the algorithm itself. Will have more on that next week.
    - Continued experimenting with bluetooth and time of arrival implementations.
- Anthony House
    - Created an API endpoint for collecting data from the accelerometer. This data will be used to display a graph in real time of walking. Included security checks, validation, and everything in between.
- Ryan Quigley
    - Began testing with the pedometer sensor for a distance measurement technique.
- Jose Lopez
- Cory Johannes
    - Searching algorithms- simple/exponential moving averages, extended calman filter

---

Individual Contributions:

Team Member	Contribution	Weekly Hours	Total Hours
Ben Holmes	Created modular Android application following MVVM practices, and continued with experimentation The application can predict steps, but at this point that is all. No orientation prediction	5	30
Anthony House	Created API endpoint for collecting data from the phone	4	25
Ryan Quigley	Experimented with the android pedometer sensor	3	23
Jose Lopez	Research	2	17

Travis Harbaugh	Met with Optical Operations Engineer Researched Ahmad Adadleh Detection Algorithm Researched Mapbox SDK Create new Architecture Diagram Create Database schema Diagram Created holoLens Design Built 3D model in unity for HoloLens Design document	20	62
Cory Johannes	Research algorithms	2	15

Plans for Next Week:

- Ryan Quigley
  - Continue research stride estimation techniques. I'm primarily working with the step detection algorithm, so dynamic stride estimation is important in reducing accumulated error.
- Cory Johannes
  - Create an IOS application to test IOS sensors, and consider branching our project into that market as well.
- Travis Harbaugh
  - Work on Fixing the project plan for v2
  - Work on section 3 (testing and implementation) of the design document
  - Revise the 3D model of Durham by reducing the polygon count. Work on implemented the worksite of Durham in unity.
  - Backend needs to install RethinkDB database and create the construction worker, Accelerometer, Coordinate, and location tables.
- Anthony House
  - Create a graph on the website page to actually show the real time data collected from the phone. We don't think this will be required for the final product, but we believe it will be useful for getting started in recognizing patterns and working out initial bugs.
- Jose Lopez
  - Fix Weekly status reports 1, 2, 3

- Ben Holmes
    - Devise a method for determining a phone’s orientation and heading, using either the gyroscope, or orientation sensors. In addition, will create a 3D rendering of my phone using openGL to verify that our proposed method does not suffer from gimbal lock. I think quaternions are going to be the way to go, at least to solve the gimbal lock problem.