**Assignment 2 Report**

1. Taking input:

As stated by the assignment’s requirements, the program will take 2 types of input to determine the current location: GPS and sensors.

Since the program is expected to function outdoors, the GPS’s data will be prioritized over the sensors’. Overall:

* **Every 30 seconds**, the location provided by the GPS would be used to determine the absolute current location to save power.
* During this 30-second interval, the program would use the combination of data from the accelerometer and the magnetometer to determine instantaneous displacements from previous locations.

1. Algorithm to process data:

Since the data obtained from the accelerometer are relative to the phone’s orientation, we need to convert them into the absolute coordinate system used by Google Map’s navigation system. In order to accomplish this, I need the data from the magnetometer to facilitate matrix multiplication, namely the rotational matrix method.

**Note:** In fact, I use a code snippet from a user from StackOverFlow, [orak](https://stackoverflow.com/users/911391/orak), to perform this step because my knowledge in matrix operations is limited.

After that, the program continuously computes the instantaneous velocity, then the instantaneous displacement using 2 simple formulas:

where x: instantaneous displacement

a: instantaneous acceleration

: time between 2 accelerometer samples

Since the sampling rate is very fast - 1 sample **every 200 ms**, the instantaneous calculations are feasible.

1. Determine the next coordinate:

According to Wikipedia, one latitudinal degree is about 110.6 kilometers (110600 m) and a longitudinal degree is 111.3 kilometers (111300 m). To find the next location, we only need to use displacements on the XY-plane, dividing each by the appropriate scale and adding it to the previous latitude/longitude.

**Note:** Please enable location permission for this app so it can run on a physical device/ emulator. I succeeded to run this program on 2 different emulators on 2 windows devices but the current location could not be updated when I ran it on the Android phone you gave me.

**References:**

‌alex. (2012, July 20). *Acceleration from device’s coordinate system into absolute coordinate system*. Stack Overflow. https://stackoverflow.com/questions/11578636/acceleration-from-devices-coordinate-system-into-absolute-coordinate-system

Wikipedia Contributors. (2022, April 7). *Geographic coordinate system*. Wikipedia; Wikimedia Foundation. https://en.wikipedia.org/wiki/Geographic\_coordinate\_system

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