EE590 Ubiquitous Computing (Spring 2018)

Assignment 1: Step Counting on an Android Phone

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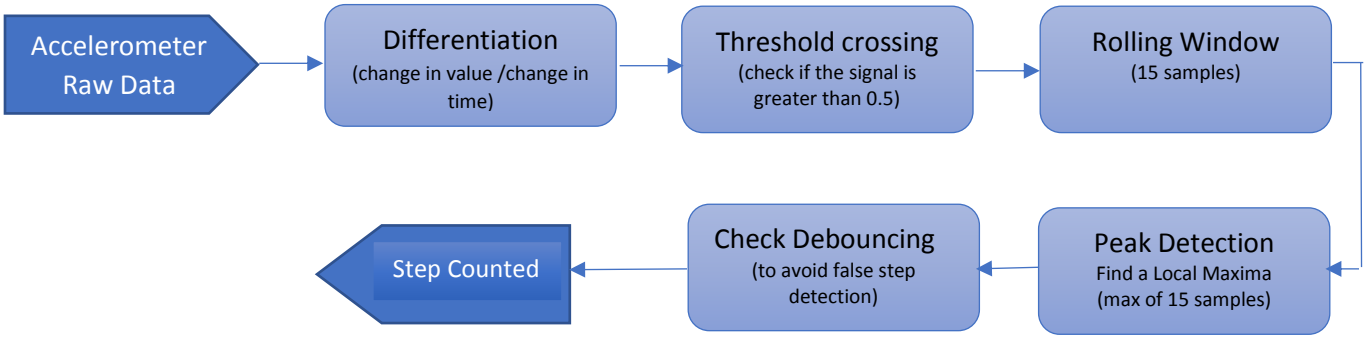
Assignment Submission: It has been uploaded as a zip file on Canvas

This assignment was to write a simple step-counting app making us familiar with Android Development. My app is built by taking the basic app provided by the professor as a skeleton.

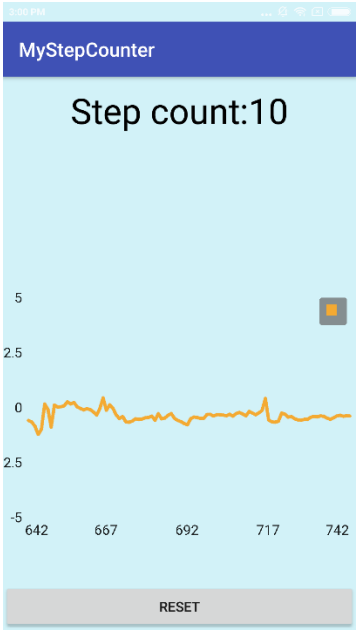
- I have mainly considered the values of x- axis as they were the most contributing towards the "walking/running" part unlike the y-axis which contributes most in "jumping/hopping" part.
- The algorithm for signal processing and figuring out a step from the signal is as below:



- A rolling window of 15 is been used to consider a set of samples and observe the signal. The number was precisely decided from the below condition:
  Number of samples to be checked = frequency of accelerometer*time taken for 1 step
  By observing, I concluded that I take about 3 steps in a second while casually walking
  So time taken for 1 step is almost 0.33s
  The frequency of accelerometer is deduced by type of delay used while considering next incoming samples. I have used `SENSOR_DELAY_GAME` which generates a 20000us delay, Hence, frequency of accelerometer is 50Hz.
  Therefore, NumberofSamplesforWindow = 0.3*50 = 15
- Differentiation : is performed to find the local maximas and to reduce the jitter effect or noise due to unintended quick movements or vibrations. The change of accelerometer data is taken over 1 change. So overall differentiated value is change in accelerometer data.
- Threshold Crossing : After testing a several times, the optimal value to consider a step was fixed at 0.3
- Peak Detection : A local maxima was found within the 15 samples and stored in the sliding window and checked if it corresponds to a real step.(signal >0.5)
- Debouncing : A debounce time is checked before counting the step to eliminate the possibility of false positive. A usual 10-15 sec of a period is seen between 2 steps.

Handling the Phone: I have tested the app by holding the phone parallel to the floor and also at some angle and I observed that it works fine in both the situations.

User interface:
The App has the App name displayed on the screen. It is followed by the Number of Steps taken and the graph of x-axis of accelerometer and the differentiated signal forming a step.
Also a reset button is provided to reset the counter to zero for ease of testing.



Code Files:
Changes have been made in:

- MainActivity.java
  Registering the sensor, Initializing the output graph, Handling the input of x-axis and differentiation
- StepCounter.java
  Specific Signal processing : Checking for threshold crossing, Peak Detection. Debouncing the signal, Counting the step
- Activity_main.xml
  A text view, A graph view and a button