

Assignment 1: Creating a Shake Detector

Total Points: 100 (+ 20 bonus) = 120 points

Aim: “Sensors are everywhere” is one of the fundamental aspects of ubiquitous computing. Smartphones have several built-in sensors. To learn about the built-in sensors in our smartphones, you will develop an Android application. The Android application will have the following features:

1. User Interface (UI) Design: You will open a new android studio project and build a basic UI with a few TextViews, EditTexts, and Buttons (more information on UI design can be found below). (10)

2. Using the SensorManager class implement the interface with SensorEventListener to continuously listen to 3-dimensional accelerometer values (3 values of acceleration ax, ay, az) in real time after the user presses the Start button. In other words, as you move the values should change in real time in the TextView until the user presses the Stop button. (40)

NOTE: The frequency of accelerometer values is very high. You might have to sample them with reasonable frequency for plotting, which is described in the later part.

3. Capture a recording of continuous 3D accelerometer time series data that includes both a few seconds of stationary (or no motion) period and a few seconds of shaking. Upload the 3D raw accelerometer time series data (e.g., .txt, .csv or .json)) to your computer and plot the amplitude of 3D accelerometer data (i.e., square root of $(ax^2 + ay^2 + az^2)$). Determine an appropriate Threshold from in the plot that can reliably classify shake from no shake. (20)

4. Finally, write the shake detector algorithm that tells you whether you shook the phone between “start” and “stop” button presses with the help of the user inputted threshold. (20)

5. Show barometer data with some additional UIs. (10)

User Interface Design:

For this assignment you need to make a User Interface (shown below) that has 4 TextViews, 1 EditText and 2 buttons. Please note that the UI shown below is just an example. You can modify the UI design, but please make sure that all the functions mentioned has been implemented.

- TextView 1 will print a string “The 3D acceleration values are”
- TextView 2 will print the 3 acceleration values along the 3 axes from the phone’s accelerometer in real time.
- TextView 3 will print a string “The Shake Detector detects”

- TextView 4 will show an output string of “shake” or “no shake” based on the output of the shake detector. We will discuss about shake detector algorithm below.
- The EditText will take a double value as input from the user. This value will be used

as the “Threshold” in the shake detection algorithm. This value will be read when the start button is pressed. Also the 3-dimensional acceleration values and the algorithm output will be displayed in TextView 2 and 4 respectively after the start button is pressed. The Stop button will stop the whole process.

Shake Detection Algorithm:

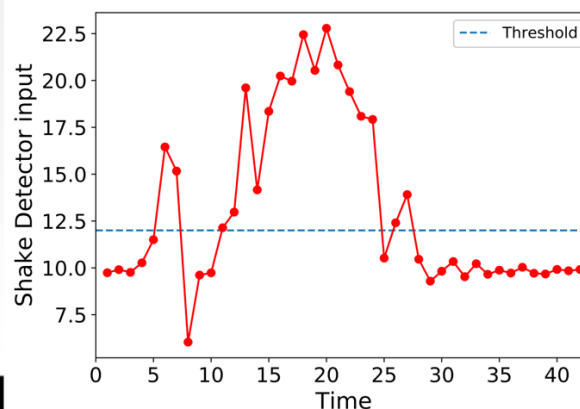
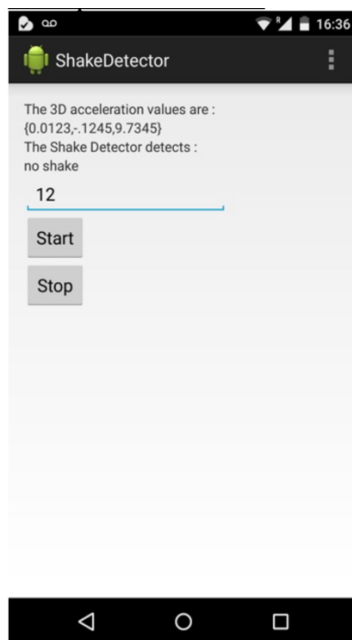
```

If( $\sqrt{ax^2 + ay^2 + az^2} < \text{Threshold}$ ){
    Display “no shake” in TextView 4
}
else{
    Display “shake” in TextView 4
}

```

where, ax, ay and az are the 3 acceleration values and sqrt is square root. Threshold is the value inputted in EditText. It usually ranges from 8 to 25.

Example UI and Plot:



Listen to Multiple Sensors (Barometer):

Most new smartphones now days have a barometer that can measure atmospheric air pressure from a certain location. This is a very important sensor, which can help us to build context aware mobile system that can track our physical activity and location. For example, higher altitude has lower atmospheric pressure. By using this simple logic we can build mobile application that can detect the floor/level number in a multistoried building.

In this part of the assignment, you have to add an additional Button and TextView. As soon as someone presses that button you have to print the air pressure value from barometer in the TextView.

BONUS (+20 bonus points):

1. Implement additional UI elements and code to allow the user to record an image. (+10)
2. Implement additional UI elements and code to allow the user to record a 5-second long audio snippet. (+10)

Deliverables:

1. Write a short paragraph in a Readme.txt mentioning if you could complete the android application. What was the most challenging part in this assignment and how did you solve it? If you could not finish the app, please explain where you got stuck. We will look at your code and give you credit for that.
2. Attach the complete project (you can zip your entire Android project) in Moodle.
3. If possible, demo your app to the instructor or the TA.