Step mentoring project documentation

❖ Project idea and analysis

Most of smart phones has many have many number of sensors one of this sensors is Linear acceleration that provide device acceleration excluding gravity in this project will use this sensor data to detect user steps during a period of time in this statuses walking, jogging, and running.

1. how this work ? the sensor return a user acceleration in three dimensions (x,y,z),the main idea is to collect a user acceleration during a period of time and if we assume that each peak in the sensor data corresponds to one step. Then if we can count the peaks, we'll be counting the steps.

Steps to find peaks

1. For each sample calculate magnitude of acceleration by this formula:
   magnitude=$\sqrt{x^2 + y^2 + z^2}$
   Where x->acceleration in x axis, y->acceleration in y axis,
   z->acceleration in z axis
2. Store magnitude of data during a period of time
3. Calculate magnitude average for all stored data.
4. calculate standard deviation to use it as threshold to find peaks using this formula:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n - 1}}$$

Where : x_i is a data point and

μ is the average of the whole stored data that calculated in step 3,

n is the number data samples

5. the find samples that greatest than the previous and the next sample, and also great than threshold, here I assume that threshold is the standard deviation that calculated in step4.
6. Finally the number of samples(peaks) from step 5 is the number of steps taken.
   This algorithm implementation

```
if (standardDeviation != 0) {
for (int i = 1; i <n-1; i++) {
   if (sensorMag[i - 1] <= sensorMag[i] && sensorMag[i] >= sensorMag[i + 1] &&
sensorMag[i] >= standardDeviation) {
      steps++;
   }
  }
} else {
  for (int i = 0; i <n-1; i++) {
     if (sensorMag[i - 1] <= sensorMag[i] && sensorMag[i] >= sensorMag[i + 1]) {
     steps++;
    }
  }
```

❖ Mobile and sensors that used

Model	OS	Sensore Information
Readmi Note 9s	**Android 12**	

❖ **Accuracy:** accuracy of program depend on the noise that sensor data include and the mobile location during movement,how person moves, example

Mobile Location	movement	Actual steps	Detected steps
Backpack	walking	6	6
hand side	walking	18	20
hand	walking	8	8
hand	jump	5	6
hand	jumping	2	4
Hand(mak mobile stable)	jumping	3	3
hand	running	10	13

❖ **Power consumption**: Lower power consumption compared to other sensors
❖ **Efficiency:** depend on noise effect to sensor
❖ **Reliability: more reliable**
❖ **Advantages**
    1. Accurate measurement of acceleration, detect movement.
    2. Lower power consumption
❖ **Disadvantages**
    1. Susceptible to external vibrations and noise, which can lead to measurement errors