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Açıklama otomatik olarak oluşturuldu

**MIDDLE EAST TECHNICAL UNIVERSITY**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**EE101 : Introduction to Electrical and Electronics Engineering  
Project III : Building Your First IoT Application: Physical Activity Monitoring System Via a Mobile Device**

**Names : Alperen Öztürk – Ömer Faruk Özmermer – Muhammed Emin Özgün  
Student IDs : 2575868** - **2516789 - 2575843**

**Introduction**

**In this project, we have designed an IoT application which is a physical activity monitoring system. Sensors which are in our mobile devices are used to track the physical activity, and data of these sensors is collected through MATLAB Mobile Application. After data collection process is finished, we have processed the data through MATLAB. This procession involves “counting steps (both with position and acceleration data”, “classification of physical activity”, and “mapping the physical activity”. In this report, we will share our results, represent them with some plots, and answer the required questions.**

**\*In this report, comments that starts with numbers are the answers to the asked questions in document, and the comments that starts with letters are our comments.**

**Data Collection / Processing and Results**

1. From which sensors can MATLAB Mobile obtain data? Briefly describe the outputs of each of those sensors.

MATLAB Mobile can obtain data from 6 sensors, and these are:

1-Microphone: It acquires Audio data, with sampling rate and recording level. Output of it is the audio recorded.

2-Acceleration: It reads the current acceleration in x, y and z coordinates, in m/s2.

3-Magnetic Field: It reads the current magnetic field in x, y and z coordinates, in microtesla.

4-Orientation: It reads the position in x, y and z coordinates in degrees, for azimuth, pitch and roll.

5-Angular Velocity: It reads the angular velocity in x, y, and z rotations in radians per second.

6- Position: It gets the data points which represent latitude (in degrees), longitude (in degrees) , speed (in m/s2) , course(in degrees relative to true north) , altitude (in meters above sea level) and horizontal accuracy ( in meters defined by a circle around the latitude and longitude. )

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  Açıklama otomatik olarak oluşturulduWe have found that the total distance traveled is 212.55 meters, and according to the position data, the number of steps is 272.
* The graph above represents the acceleration according to each axis.

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   Açıklama otomatik olarak oluşturulduCan you observe a constant bias on the data from accelerometer even while you are standing still? Estimate its value and comment on the reason behind it.

There is an approximately constant bias even in standing position. It is value is roughly 9.8549 according to our data, and the reason behind it is the gravitational force that the Earth exerts, so the bias is gravitational acceleration.

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Açıklama otomatik olarak oluşturuldu

* The graph above shows the magnitude of the acceleration, but constant effects are excluded, and each peak is represented by triangle.

1. Present the estimated number of steps during this project as a table. Note that there should be three different estimations. Compare and comment on the accuracy of these four estimations.

Estimations are not so accurate with each other. Since we estimate the number of steps with the given step length, it can vary for each person, and as the points increases in the filter, the number of steps is also increasing. We can assume that actual number of steps is between 213 and 272.

|  |  |
| --- | --- |
| Estimations | Number of Steps |
| Based on Position Data | 272 |
| Based on Acceleration Data | 213 |
| Based on Acceleration Data with Moving Avg Filter with 5 points | 124 |
| Based on Acceleration Data with Moving Avg Filter with 11 points | 152 |

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   Açıklama otomatik olarak oluşturulduComment on speed plot and accuracy of physical activity classification based on speed. How can the classification labels be extended, and what are the alternative classification methods?

In this plot, each time instant is shown with a star, and they represent the speed at that time instant. Since this plot’s classification is based on speed, each color represents the different physical activity.

Blues represent the standing position, reds represent the walking position, and yellows represent the running position. Although there are some yellow stars in the walking speed interval, the graph is pretty accurate in physical activity classification based on speed.

The classification labels can be extended to more detailed ones like slow-fast walking & running.

One alternative classification can be speed limit classification, and its intervals can be separated as Safe, Normal, Excessed, Very Dangerous.

**Conclusion**

* We have shared our results, graphs and classified them into 3 groups. At the end of the project, we have shown the route taken on the map.

5-What is the meaning of different colors on the route?

Each color means the different physical activity. Red represents the standing position, orange represents the walking position, and the yellow represents the running position. However, since walking and running speed are close to each other, in some parts of route, orange and yellow are mixed.

6-What are the possible applications of this project work in real world? What are the possible extensions/developments on the project as the next step?

This project has so many possible applications in real world. It can be used to track physical activity levels by individuals, and they can set a goal for themselves. It can also be used for cars to track the route taken, calculating the gasoline costs etc. Moreover, this project has a great potential to be developed. For example, with the help of AI, it can be personalized by learning the everyday routine of the individual. By this way, the program may create an ideal program for individuals. It can also be used to find the efficient route for a given location etc.