Health + Track Mobile Application using Accelerometer and Gyroscope

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ABSTRACT
As we live in a technology era, our cell phones became the essential part of our lives. We use and carry our cell phones wherever we go. With the several developments of the technology, many concepts can be tracked including our health and daily activities by the sensors in our mobile devices for instance accelerometer and gyroscope. In this paper we developed a mobile app by using the mobile sensors accelerometer and gyroscope to track the daily activities of a human. Our work has an extensive approach to tracking the health also by having several features such as having a food journal. For instance in this approach, if the user will select the food that he or she consumed from the food journal, he can see his total consumed calories on Health + Track’s energy section.

KEYWORDS
Health tracking, accelerometer, gyroscope

Reference format:

1 INTRODUCTION
Nowadays, many people in the society use smartphones and through the improvement of the technology, wireless sensors have been using within many devices such as mobile phones, MP3 players and so on. The motivation of the Health + Track app is to use the sensors to be in a more convenient and beneficial manner to make it user friendly. Thus, we made Health + Track app as smartphones and mobile internet usage are becoming widespread. Moreover, health apps and counting the steps has become very popular since people are more aware about health issues of 21st century. Have you ever wondered how many steps you walk in a day, 3 thousand, 5 thousand, or 10 thousand? Experts say that an average of 10 thousand to 15 thousand steps per day is beneficial to human health. On the other hand, office workers, executives, or white-collar workers, who have a heavy work tempo, have a common problem: inactivity. Inactivity is ranked 4th among the risk factors that cause death on earth according to World Health Organization data. For this reason, it is important to walk regularly and swiftly, to know how many steps we take each day. There are many ways to count our steps and one of them is pedometer. A pedometer is an electronic device that perceives the movements of the body and counts every step taken. Pedometer measures walking distance and it also records your exercise routines. There are various kinds of pedometer models in different brands. In Health+Track app there is also a live pedometer In addition to the pedometer devices, it’s more convenient to count the steps by downloading a simple app to the smartphones because usage of smartphone rate is very high. Moreover, there are many functions in these applications and it can be seen that how long, where, how many miles you walked, how many calories you burned and so on. In our application Health + Track, we used accelerometer and gyroscope sensors and integrated our app with the iOS Health app to gather information from iOS’ application to be used in our application such as step count, age, height and weight etc. To make the app more beneficial for the users, we added several features for instance calories based on the food the users consumed based on their selection from the food journal.

2 EXPERIMENTAL AND COMPUTATIONAL DETAILS

2.1 Step Count
For Health + Track project, two sensors are used: accelerometer and gyroscope. Accelerometer means that the mobile device is rotated around its position, adjusted according to the position the device has received. In simple terms, your mobile device is in a horizontal position, and the screen image is in a horizontal position. When you are in a horizontal position, the screen image is in a vertical position. Gyroscope is a sensor that works with the principle of angular momentum conservation used in direction measurement or adjustment. Gyroscope mobile devices provide more performance in gaming, and allow applications to calculate the position and orientation of the phone. With the
help of the accelerometer sensor, it is calculated whether the accelerations carry step quality. In order to be able to be step-by-step, the incoming income must be above a certain limit. If this limit is above the value, the device will recognize this as a step. Also, in this application, it is not important how the user keeps the phone, but the acceleration values received at each position will be evaluated in three dimensions, and when a higher acceleration than the limit value in the X, Y or Z-axis is detected, it will be considered as a step. To count the steps when the user is in motion, the app is integrated with the iPhone’s health application. Thus users of the Health + Track application can see their step count data, accumulated from the iPhone’s health app. Additionally, there is a live pedometer. Pedometer will function on step counting by detecting the influence of a foot with the ground (or the motion) while a step is acquired. When users will select to use the live pedometer, they can see their live results of the distance travelled, floors ascended and descended by letting the app to start accelerometer and gyroscope sensors working accordingly with iPhone’s health app.

2.2 Distance

Distance that will be travelled by users will be measured by GPS. Health + Track app users can see the total distance they travelled besides how many steps they walked, the floors climbed up and down. Distance and step count metrics will be computed independently because step length, the pace and such metrics are important to calculate the distance. The user’s travelled distance can be seen in the historic steps section of the app. The app will demonstrate user’s total distance travelled in meters for past three hours of using the app.

2.3 Calories

Calorie is an energy unit. We use it for food and food journal in Health + Track app. Calories can actually be used for anything that contains calories and energy. For example, one liter of gasoline contains 7,750,000 calories. Calorie (cal) is roughly the amount of energy required to raise a temperature of 1 gram of water by 1 degree, but when referring to the amount of calories associated with food, when a calorie is customarily referred to as 1000 calories, a kilocalorie (1 kcal = 1000 cal) is mentioned. For example, an apple that is said to contain 68 calories actually contains 68,000 calories = 68 kilocalories. In the Health + Track app, calorie units are used according to the values provided by the USDA. Health + Track users may use the journal section to select the food that they consume in a day and Health + Track will get records of calories of food to compute consumed food, which will be demonstrated in the energy session. It will be beneficial for people who consume a lot of calories in a day and who are willing to be healthy and lose weight.
2.4 Energy

In the Health+Track application, users may use the energy segment to perceive their resting burn, active burn, consumed energy and the net energy. The resting burn is the amount of calories it takes to succeed these essential functions, disregarding any physical motion, is your resting metabolic rate. You will also burn calories at rest by digesting food and this is called thermic effect of the food. The active burn is the calories you burn based on your physical activity for instance the burned calories after running 10 meters. Consumed energy will be calculated according to the user selection from the food journal. Thus, users can track their diet or eating habits. Moreover, the net energy can be seen at the bottom. And finally the net calories will be the resting burn minus consumed calories. If your net calorie is negative, you may consume more food and if it’s positive you had too much food and you shouldn’t eat more to keep track of your diet.

Figure 3: Energy section and demonstration in Health+Track app

2.5 User Profile

User profile panel is important for mostly all of the mobile applications since essential information from user is needed to provide a better service. For our Health + Track application we need user information about weight, height, gender and age to provide calorie burning suggestions based on BMI. Health+Track app will gather age, height and weight information from iPhone’s health app. Height and weight can be changed however, and age cannot be changed or typed manually if health app knows your age.

Figure 4: User profile

3 RESULTS AND DISCUSSION

3.1 Experiments

We made several experiments for the live step count and in the app by walking, running and it can be found as live pedometer. When you will press the start, it will allow your phone to start using mobile sensors such as accelerometer and gyroscope and eventually it will gather data.

Figure 5: Live Pedometer
In the gym, we tried walking and running on the treadmill to test our application. Our phone demonstrated that the distance travelled is 321.28 meters and can be seen on Figure 6.

![Image](image1.png)

**Figure 6:** Live pedometer experiment after walking and running on a treadmill.

The gathered data was accurate according to the results we accumulated from the treadmill. All in all, the data we gathered from our app and the treadmill was really beneficial and when we compared the two data, it demonstrated that our app is accurate.

### 3.2 Results

After made several experiments with our app by walking, running, climbing up and down, we accumulated several data per day and it is seen that our app works in a synchronization with iPhone’s health app very well and experiment results such as running and walking on the treadmill demonstrates our app’s accuracy. To see the actual results of the app, we provided several gathered information and it can be seen on Figure 8 and Figure 9.

![Image](image2.png)

**Figure 7:** Historic steps to demonstrate data of our experiments

![Image](image3.png)

**Figure 8:** A daily result of step count, floor climbing up and down experiment
4 CONCLUSIONS AND FUTURE WORK

In this paper we acknowledged that how we can use mobile sensors as convenient as we could such as using these sensors to track our daily activities and adding new features. We would like to improve our app according to user demands and needs throughout their comments on the mobile application stores that we will release our app. For now, we developed our app only for iOS. In future we also planning to develop our Health + Track app in Android platform and we would also like to improve our app by synchronizing it with the smart watches. This new feature can be beneficial for the users who are willing to track their health more effectively.

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