A Study on Android Based Fitness Recommendation System

In-Yong Jeong*, Jong-Won Lee**, Hoe-Kyung Jung**

* In&In Plaza, 1154, Jungbu-daero, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
E-mail: ezway@hanmail.net
** PaiChai University, Doma2-Dong, SeoGu, DaeJeon, Korea

Abstract

Recently, the recognition of food has been changed according to increase in income. In contrast, the population of obese has been growing for the lack of exercise. To solve this problem, U-Health technology has been developed. In addition, indoor/outdoor healthcare systems have been studied but, researches on fitness system for promoting muscle strength are not enough.

In this paper, we propose a Fitness recommendation system utilizing a built-in sensor of the Android mobile devices. For this purpose, a proximity sensor and an accelerometer sensor are used. A proximity sensor has a high accuracy but consumes a lot of battery, while an acceleration sensor responds more quickly, but the accuracy is low. After reducing the battery consumption of the proximity sensor, and obtaining sensor-controlled mechanism and BMI (Body Mass Index) of the user to increase the accuracy of the acceleration sensor, algorithm which recommends equipment for exercise is applied.

Key Words: BMI, Fitness System, Recommendation Algorithm, Sensor, U-Healthcare

1. Introduction

The current IT industry and the health service serves to apply a U-Healthcare IT convergence technology, thus the interest in the field of Wellness Industry is growing. Wellness Industry is IT, BT, you can use IT equipment in a new industrial complex to be checked regularly for their health services, and can use them to know their past, present, and future direction of the movement[1,2].

U-Healthcare sector according to social change is classified as significant areas of research for the Well-being. U-Healthcare system usually consists of a computer and medical equipment, it has the disadvantage ordinary people can’t easily access. Systems have been developed using the IT device to solve this problem. Among Healthcare systems using a smart phone it has been actively studied.

Sensors embedded in the mobile device and the day becomes increasingly diverse, the performance is also evolving.

When developing the Healthcare System sensors that are commonly used include accelerometer and proximity sensor, gyro sensor. In particular, proximity sensor, and the accuracy is high, but has many disadvantages on battery power, the acceleration sensor response speed is fast but the drawback is a low precision.
In this paper, adjust the speed and accuracy level event updates proximity sensor to solve the above problems and reduced battery consumption.

Also it developed a sensor control mechanism using the two kinds of sensors after the removal of the gravitational acceleration value to increase the accuracy of the acceleration sensor, by applying the recommendation algorithm to recommend an exercise device according to the BMI index proposed a fitness recommendation system.

Configuration of the paper is the research and analysis of system problems, and currently used in Chapter 2, design of development system in Chapter 3, Chapter 4 describes the implementation and review, and concludes in chapter 5.

2. Materials and Methods

Analysis of studies of the current U-Healthcare sector and analyzes the research related to the built-in sensors of mobile devices used in this paper.

2.1 U-Healthcare System

The current U-Healthcare sector can be divided into the treatment system associated with the movement and related systems. Systems used in the medical industry is using to build the computer and medical equipment, medical devices due to the high value of the public could not easily available. And the system is associated with the movement and use of smart phones and variable IT equipment. Check the quantity of exercise by sensing the user's movement and informs the amount consumed Kcal. System using a wearable heartbeat sensor checking if the change of heart rate in accordance with the user's motion and the environment to be sensibly the heart rate above a certain level to inform a dangerous situation, and the feedback to transmit data to the doctor for chronic disease receive. System using a smart TV checks the user's body fat, and shows the video over the Internet. A video related to diet or diet shown to the user, it is possible to continue to manage the changes in body fat in the graph indicates.

Healthcare systems developed so far, but they are complicated to use, the necessary equipment has many shortcomings. A system developed in this paper can be used regardless of the location of the mobile device and does not need a separate device[3-6].

2.2 Mobile Sensor

The most commonly used sensors in the U-Healthcare sector, and the like accelerometer and proximity sensor, gyro sensor. The acceleration sensor and the gyro sensor detect the movement and shaking of the mobile device.

By analyzing the user's walking distance can be checked by analyzing the gait of momentum when running as usual gait, which is built into smart mobile devices, as well as watch the
Galaxy Gear. The proximity sensor detects the approach and the contact of an object or person. Current proximity sensors embedded in the mobile device is small compared to the use case that is used in a mobile means, such as a ship or car[7,8].

3. Design

This chapter describes the design of the fitness system developed by applying the mobile sensor control mechanisms and recommendation algorithm.

3.1 Design of System

Fig. 1. The Android OS based mobile devices and sensors using a proximity sensor and accelerometer. The user was using a proximity sensor for trainers in view of the fact that both hands were full of exercise equipment collected both hands when the upper body exercise, due to the movement of the lower body workout when you do X, Y, Z axis acceleration. Metrology event management using the points generated. The Web server stores the information on the people using the mobile device with a rear interlocking system. Information as to store a unique code for recognizing the user, name, age, Id, there is a Password. It is available only for registered users and the system administrator can manage the information of the user. Windows OS-based Web server and Database was used for MySQL.
Fig. 2. When you run the application to check whether a registered user at MainActivity, and receives the user's height and weight will recommend exercise equipment in accordance with one behind the mast step calculates the BMI index.

The Choice Activity After selecting one of the lower body and upper body workout exercise moves to the Exercise List. When you select trainers Kcal shows that the sensor detects the amount consumed and the events that take place each time you use the exercise equipment.

3.2 Recommendation Algorithm

Fig. 3. Recommendation algorithm calculates the users BMI index and divided by 5. Step “normal weight”, “overweight”, “mild obesity”, “moderate obesity”, “obesity” and the like. Was classified in accordance with the movement mechanism 30 Kcal per minute is consumed ‘Level 1 ~ 3’ normal weight, the ‘Level 1’, “overweight” and “obese hardness” is ‘Level 2’, “moderate obesity” and “height the obesity” is recommended mechanism of ‘Level 3’.
4. Implements

This chapter deals with the implementation and review of control mechanisms and sensors recommendation algorithm to solve the problems of proximity sensor and accelerometer.

4.1 Sensor Control Mechanism

Proximity to resolve hardware problems in high battery consumption of the sensor was changed to the update rate and accuracy of the sensor level. Tables 1 and 2 based on the proximity sensor and the update rate to NORMAL, was able to reduce battery consumption by processing a minimum of the updated and correctly handle the event when the accuracy level to MEDIUM.

<table>
<thead>
<tr>
<th>Update Speed</th>
<th>Speed Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastest</td>
<td>1</td>
</tr>
<tr>
<td>Game</td>
<td>2</td>
</tr>
<tr>
<td>Normal</td>
<td>3</td>
</tr>
<tr>
<td>UI</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>Battery Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>1</td>
</tr>
<tr>
<td>Low</td>
<td>2</td>
</tr>
<tr>
<td>Medium</td>
<td>3</td>
</tr>
<tr>
<td>Unreliable</td>
<td>4</td>
</tr>
</tbody>
</table>

\[ F_1 = \text{Proportional Speed and Vibration Index} \]
\[ 7 : 10 = 800 : X_1 \]
\[ \text{Walk Speed} : \text{Run Speed} = \text{Threshold} : X_1 \]
\[ X_1 \approx 1142 \]

\[ F_2 = \text{Remove the Gravitational Acceleration Value} \]
\[ X_2 = 1142 - 10 = 1132 \]

\[ F_3 = \text{Round the Seat 10(In Order to reduce the Margin of Error)} \]
\[ X_3 = 1100 \]

\[ \therefore \text{Set Threshold} = X_3 \]

Fig. 4. Problems in implementing the acceleration sensor is that the accuracy is poor gravitational acceleration value is still recognized. To solve this problem by modifying the threshold value, as shown in Fig. 4, to remove the gravitational acceleration value to increase the accuracy. The average speed after setting an average speed of 5km/h when run with 3.5km/h of the experiment was to walk on the treadmill.
4.2 Web Server and Database Implement

Web servers were used to Window PC i5-4670, databases were built with MySQL. Fig. 5 provides a summary of the database of the Web server Field value. Your own numbers and name, age, Id, are stored in the Password and management.

Fig. 5. Web servers were used to Window PC i5-4670, databases were built with MySQL. Fig. 5 provides a summary of the database of the Web server Field value. Your own numbers and name, age, Id, are stored in the Password and management. User height and weight, BMI index is stored in a database, and then tells the latest weight to log in to the message. It also provides objective information by informing the people of similar weight that you own some exercise.

4.3 Implementation Screen

Fig. 6. This Fig is a List upper body workout. Upper body exercise device may have six, lower body exercise equipment are the eight. Divided according to the degree of difficulty and the Level Kcal consumption of sports equipment, user selects the desired driving mechanism.

Fig. 7. This Fig shows the amount of Kcal will inform the user consumes on average every 30 minutes of the driving mechanism to select Toast message, indicates the amount that is consumed in real time Kcal. In addition, parts of the body that develops when a motion using
the motion mechanism also stated in the text. These data indicated by the user is made possible to enhance strength of the desired site.

4.4 Review

Development system maintains accuracy while reducing the battery consumption of the proximity sensor, the acceleration sensor points to improve the gravitational acceleration value and that the continuously developed to increase the accuracy of the sensor control mechanisms. Furthermore, to overcome the problems, developed in existing hardware systems Healthcare did not address by software. Healthcare systems and wearable required by other heart rate sensors, smart TV, without the need for other IT devices available and has the advantage that the method is easy and simple to use.

5. Conclusion

Proper strength training is essential for physical health and mental health. The importance of strength training in the obese population is going to grow the modern world is growing day by day. However, the development of a fitness system that recommendation exercise equipment to a user using the sensor incorporated in the mobile device is insufficient conditions. In addition, most of U-Healthcare systems are needed medical equipment. So the public is not readily available. For a system that does not require a medical device to time and location, so it requires a wearable device and expensive monitoring equipment, the system is not subject to restrictions on the equipment the situation of the development phase.

In this paper, we develop a mechanism for controlling a proximity sensor and an acceleration sensor built into mobile devices. This was used to develop a fitness system that the user handles the event that occurs when a movement. Using the exercise equipment research and specific weight amounts to Kcal consumed during exercise to analyze and recommend effective than exercise equipment, depending on your BMI by dividing the Level
of the Index after the exercise equipment.

6. Acknowledgments

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(No. 2014R1A1A2059842)

References


*Corresponding author: Hoe-Kyung Jung, Ph.D.
Department of Computer Engineering,
Paichai University,
Doma2-Dong, SeoGu, DaeJeon, Korea
E-mail: hkjung@pcu.ac.kr

- 932 -