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Accurate Pedometer for Smartphone

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ABSTRACT

Android [1] has also integrated various sensors including gyroscope, orientation and accelerometer, so it is quite suitable to design mobile sensor applications. Pedometer is a common auxiliary device used for maintaining health and fitness. In this paper, an intelligent pedometer is developed using Android. The user's walking motion was detected via android sensor and pedometer application then analyzes the signal and provides real time feedback. The system provides three action modes: time-based mode, distance-based mode and count-based mode. All the tracking data are saved in SQLite database. For detecting the peaks from the Smartphone accelerometer sensor is used.

Keywords: - Android, pedometer, step length, sensors, Accelerometer, mobile applications.

I. INTRODUCTION

According [2] to the Canalys's *Q4 2010* global country level smart phone market report, Google's Android has become the most popular mobile platform. Android consists of a kernel based on the Linux kernel, with middleware, libraries and APIs written in C and application software running on an application framework which includes Java-compatible libraries based on Apache Harmony. Android uses the Dalvik virtual machine with just-in-time compilation to run compiled Java code. Besides, Android has a large community of developers writing applications ("apps") that extend the functionality of the devices. One of the attractive features of Android is that Android devices have multiple different types of hardware that are built in and accessible to developers. Android can use video/still cameras, touch screens, GPS, accelerometers, gyroscopes, magnetometers, proximity and pressure sensors, thermometers, etc.

The user's walking motion was detected via Android sensor. Modern medical researches highlight that pedometers support not only to physical body but mental activities of human beings to a greater extent Pedometers can be used to detect steps from vertical acceleration of the human body.

II. MODULES OF THE SYSTEM

The various modules that will be contributing to the formation of this Pedometer system includes the following:

1.Android Sensor

Smart[2] phones are becoming sensor hubs in a way, opening a rich experience for users. Android devices have multiple different types of hardware that are built in and accessible to developers. Sensors, such as a camera, accelerometer, magnetometer, orientation sensor, and proximity sensor, are available on most devices. Android abstracts the sensor implementations of each device. The Sensor class is used to describe the properties of each hardware sensor, including its type, name, manufacturer, and details on its accuracy and range. The Sensor Manager class is used to manage the sensor hardware available on Android devices.

2.Types of Sensors

a)Motion Sensors

These sensors measure acceleration forces and rotational forces along three axes. This category includes accelerometers[4], gravity sensors, gyroscopes and rotational vector sensors.

b) Position Sensors

These sensors measure the physical position of a device. This category includes orientation sensors and magnetometers.

c)Environmental Sensors

These sensors measure various environmental parameters, such as ambient air temperature and pressure, illumination, and humidity. This category includes barometers, photometers, and thermometers.

Figure 1. Android Sensors

3.Step Counter and Step Detector Sensors

The step counter and step detector sensors are very similar to each other and are used to count the steps. Both the sensors are based on a common hardware sensor that internally uses the accelerometer, but Android still treats them as logically separate sensors. Both of these sensors are highly battery optimized and consume very little power.

4.Sensors-Coordinate System

When[3] a device is held in its default orientation, the X axis is horizontal and points to the right, the Y axis is vertical and points up, and the Z axis points toward the outside of the screen face. In this system, coordinates behind the screen have negative Z values.

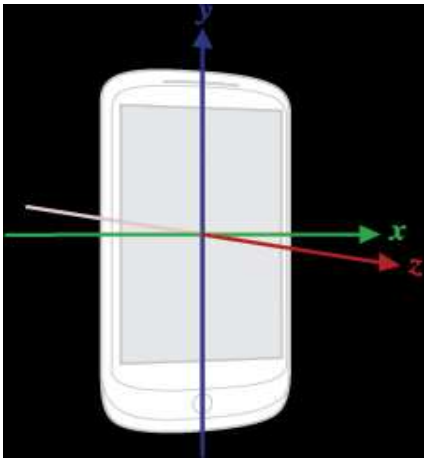

Figure 2: The coordinate system of Android

This coordinate system is used by the following sensors:

1)Acceleration 2)sensor(Accelerometer)
3)Gravity sensor
4)Gyroscope
5)Linear acceleration sensor
6)Geomagnetic field sensor

5. SQLite

SQLite, one of the built-in data persistence technologies included in the Android platform and supported by the Dalvik virtual machine, is a tiny yet powerful relational database engine created by Dr. Richard Hipp in 2000. It is arguably the most widely deployed SQL database engine in the world . A SQLite databaseis just a file. Android stores the file in the/data/data/packagename/databases directory.

III. SYSTEMS TASKS AND FUNCTIONS

a) Getting Device's acceleration & rotational attitude

The pedometer application uses acceleration sensor and orientation sensor to detect user's walking motion, and infer the walking steps. The coordinate system of the device frame is defined as: x-axis in the direction of the short side of the screen (along the menu keys) y-axis in the direction of the long side of the screen z-axis pointing out of the screen. In addition to acceleration, we also need to detect the device's orientation.

b) Action Modes

The system provides three action modes: time-based mode, distance-based mode and count-based mode.

1. Time-based :User sets up the walking time, system will notify user via Bluetooth when the exercise time is out.
2. Distance-based: User sets up the walking distance, system will notify user via Bluetooth when walking distance is achieved.
3. Count based.: User sets up the walking steps, system will notify user via Bluetooth when walking steps is achieved

c) Operation flow

The sequence diagram of the pedometer application:

1. User selects action mode and setup parameters.
2. Pedometer activity retrieves the sensors' values.
3. Pedometer activity analyzes the user's walking motion.
4. Pedometer activity checkup goal.
5. Pedometer activity sends feedback information to user.
6. Pedometer activity persists walking data in SQLite data base.
7. Pedometer activity notify user when preset goal is achieved.

IV. STEP DETECTION ALGORITHM

Step detection algorithm is use to enhance the performance of the travelled distance estimation using dynamic step length.

The proposed algorithm utilizes the acceleration values of X, Y and Z axes from accelerometer sensor, which is built in Smartphone to count steps in real-time. In our work, we assume that the mobile phone is in a static position placed in user's hand throughout the movements. The proposed algorithm determines the peaks precisely and a weight is assigned to each step based on its length.

V. RESULT

Figure 3.Application Design i.e. Count based action.

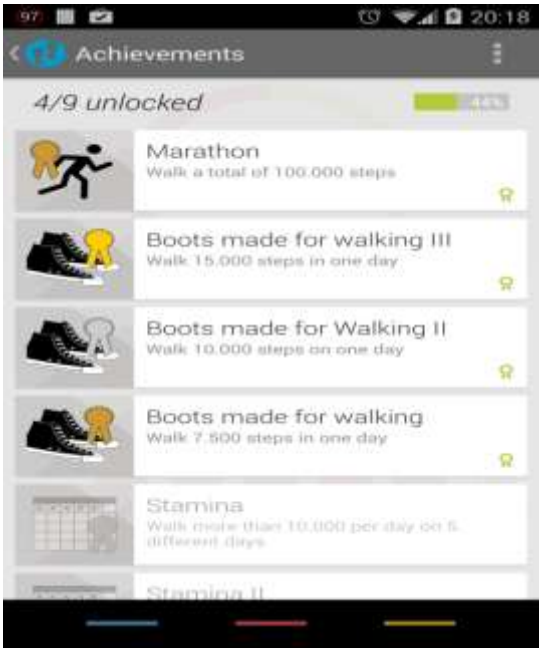

Figure 4. Application Design

Figure 5. Functins of Application i.e. Distance based action, Goal Setting.

Figure 6. Split Count i.e. Time based action.

V. FUTURE SCOPE

Android[6] is becoming sensor hubs in a way. In this study, Android is used to develop an pedometer application. User's walking motion was detect by acceleration sensor and orientation sensor. Future Strategies is as follows:

I. The tracking of foot steps can be carried out by GPS tracking in the pedometer.
II. It can be connected to Google maps for exact location data.
III. By some algorithms it may predict total energy expenditure i.e. calories .
IV. Integrate with Wi-Fi communication to provide group walking interactions.

VI. CONCLUSION

Android is becoming sensor hubs in a way. In this study, Android is used to develop an intelligent pedometer application. User's walking motion was detect by acceleration sensor and orientation sensor. Pedometer can be seen as a motivational tool for people ,which would motivate them to make more moves towards the physical Activities. Thus based on all this aspects it can be said that the intelligent pedometer goes by its name is a smart device in comparison to previous versions of pedometer. Pedometer[5] implemented in a Smartphone. From the testing conducted for different activities and different stepping speeds, the algorithm gave promising results and high step detection accuracy even at low walking speeds. The different activities is being carried to increase the use of pedometer and increase physical activity of the users. And the access of pedometer can be done from re-login and without losing previous data.

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REFERENCE

[1]Intelligent Pedometer Dhikhi .T1, Ashish Anand2, Sukirt Mohan3, Anshul Sharma4 Guide1, Student2, 3, 4 Department of CSE SRM Institute of Science and Technology, Chennai, Tamil Nadu, India..

[2]Williams & Wilkins, "ACSM's Guidelines for Exercise Testing and Prescription," 1995. Q. Ladetto, V. Gabaglio, B. Merminod, P. Terrier and Y. Schutz, "Human Walking Analysis Assisted by DGPS".

[3]N. Zhao, "Full-Featured Pedometer Design Realized with 3-Axis Digital Accelerometer".

[4]T. M. Ahola, "Pedometer for Running Activity Using Accelerometer Sensors on the Wrist".

[5]A.Z. LaCroix, S.G. Leveille, J.A. Hecht, L.C. Grothaus and E.H. Wagner "Does walking decrease the risk of cardiovascular disease hospitalization and death in older adults?," Journal of the American Geriatrics Society,vol. 44, no.2, pp.113–120, Feb., 1996.

[6]E.M. Simonsick, J.M. Guralnik, S. Volpato, J. Balfour, and L.P. Fried,"Just get out of the door! Importance of walking outside the home formaintaining mobility: Findings from the women's health and aging study,"Journal of the American Geriatrics Society, vol.53, no.2, pp.198–203,Feb.,2005.