Mobile Application for Virtual Sports Environment

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Abstract--- Recent advancement in the field of wearable sensors enables us to gather data from mobile user activities. To be fit and healthy, people have started using sports center or running in public places. In order to oversee user activities, we have developed an android application, which can be used for health monitoring where people run, walk, or jog. With this app installed in any smart mobile, various data of the user's activity can be collected using GPS. The data is then sent to the server through Wi-Fi and decisions are made and it is labeled as inactive, walking, jogging or running based on speed and acceleration. This creates a competition environment and tags like star and square are used to identify the user with the highest speed and acceleration.

Keywords--- Mobile Application, Sensor, Acceleration Sensor, Step Counting Sensor, GPS, Wi-Fi Direct.

I. Introduction

In India approximately more than 100 million people use mobile data and there is a rapid increase in the number of Indian apps in the app stores. A recent survey clearly states that an Indian has spent an average of three hours a day on their smart phones and checks their phone more than 100 times a day as shown in Table 1.

Table 1: Time Spent by People in Mobile Phones

Time Spent on Smart Phones (hrs)	% of People
> 12 hrs	13
9-11 hrs	10
6-8 hrs	25
3-5 hrs	38
1-2 hrs	16

The mobile operating system Android developed by Google is primarily designed for touch screen devices such as smartphones and tablets. The user interface of Android is based on direct manipulation using touch genstures along with a virtual keyboard for text input. The Google playstore has over one million android applications published as of july 2013.

The survey of mobile application developers show that 71% of developers create applications for android. In 2015, the survey states that 40% of app developers consider it as the target platform which is comparatively higher than Appleios. In 2014, Google I/O revealed that the monthly android users count has reached one billion. The mobile apps are developed for various applications such as daily life monitor, personal biometric signature, eler and youth care, localization and industry manufacturing assisting. In particular, some of the apps that are available in android platform on health and fitness related is listed in Table 2.

Table 2: Mobile Apps for Health and Fitness

APP NAME	PLATFORM
Charity Miles	Android, iOS
Endomondo	Android, BlackBerry, iOS, Windows
Health	iOS
Fit bit	Android, iOS
Care kit	iOS
S Health	Android

The vast increase in usage of android application motivates us to develop this Mobile Application in Android. This mobile application is helpful for those who are conscious about their fitness. In the field of monitoring health and fitness, there is a rapid increase in the use of mobile sensors, which collects user's data in the aspect of enhancing communication. Mobile app device is equipped to record the living activity. Activity recognition aims to

recognize the actions from a series of observations. The raw data is taken as input and recognizes the user's motion activity. The activities are classified based on the scenario and complexity. Based on the complexity and scenario, the activities are classified as simple, complex, living, working and health activities (Table 3).

Some of the mobile phone sensors used in various applicationsare accelerometer, ambient temperature sensor, gravity sensor, gyroscope, light sensor, linear acceleration, magnetometer, barometer, proximity sensor, humidity sensor and so on is represented in table 4.

Table 3: Activities Recognized by the Mobile App

Complexity	Simple Activity	Walking, Jogging, Standing, Lying, Sitting, Walking downstairs, Walking upstairs, Using Elevator
	Complex Activity	Travelling in Bus, Driving a vehicle, Shopping
Scenario	Living Activity	Washing hands, Watering plants, Cleaning, Ironing, Sweeping, Cooking, Eating, Clapping hands
	Working Activity	Talking in the phone, attending meeting, typing, writing
	Health Activity	Exercising, rehabilitation activities,etc.,

Table 4: Mobile Sensors and their Purpose

Mobile Sensor	Purpose
Accelerometer	To measure the acceleration force that applied to the device
Temperature	To measure the ambient room temperature
Gyroscope	To access the device's rotation in three axes
Light	To measure the illumination level
Magnetometer	To measure the geomagnetic field in three axes
Proximity	To measure the proximity of an object relative to the view screen of a device
Pedometer	To count the number of steps the user has taken
Heart rate	To know the current heart rate of a person

A composite sensor can be used to generate data by processing or fusing data from one or more physical sensors. Step detector and significant motion, game rotation vector, uncaliberated gyroscope are some of the composite sensors used in mobile for detecting various activities. The architecture diagram for this mobile application for enhancing communication through mobile devices is shown in Fig 1. The mobile application for virtual sports environment is developed in three phases which includes data collection, data processing and performance measures.

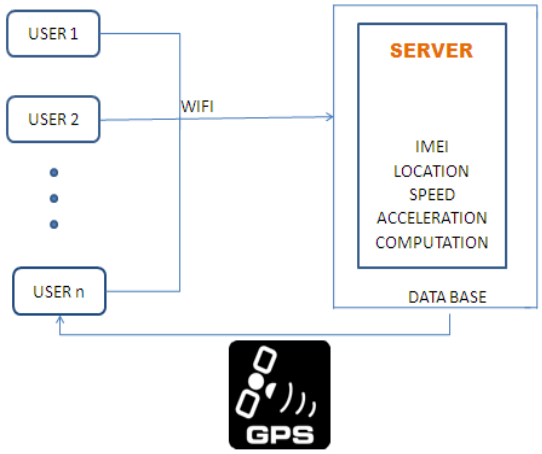
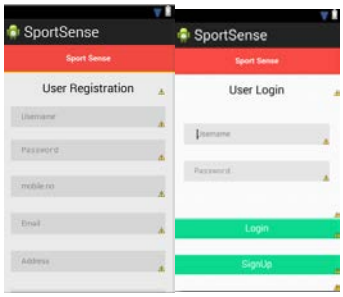


Figure 1: Architecture Diagram

II. Data Collection

The users basic information about the mobile device and other particulars related to his gender were collected during the registration phase. The sport coach acts as an administrator of this entire process, the registered users can login the application and give an access for the coach to read their location. Once the coach receives an alarming message about the active user participation for the sport, the virtual environment can be scheduled to all the requested users at a particular time. To track the user sports activities, information like movement, current position needs to be sent to the server. The essential parameters such as speed, distance, duration and acceleration is collected

through GPS via Activity Recognition system (AR). The snapshots of the user registration page and login page is shown below.



In general, AR systems utilize diverse sensors to obtain the activity related information, which are then used by machine learning techniques to infer human′s ongoing activity. According to the type of sensors used, existing AR systems can be roughly divided into two categories: 1. Video sensor based AR, which remotely observes the human activity using video sensors; 2. Physical sensor based AR (PSAR) wherein the physical sensors are attached to the body of human or objects (appliances) to infer human activity based on the location of attached sensors. PSAR is further subcategorized into Wearable sensor based AR and Object usage based AR. With these sensors, data is collected and send to the server through WiFi. The current system enables the connection set up between theclient through Wi-Fi direct.

Wifi direct technology accommodates data receiving and sending upto 100 meters. A separate device called sink device is used to connect with other devices in the network. Various parameters such as phone IMEI, number of steps, the device latitude and longitude were collected.

The collected data is then sent to the server for further processing.The sequential process involved in activity recognition is shown in the following figure 2.

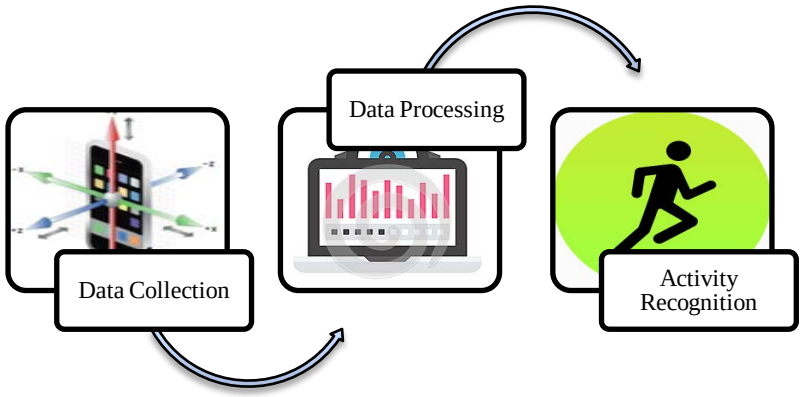
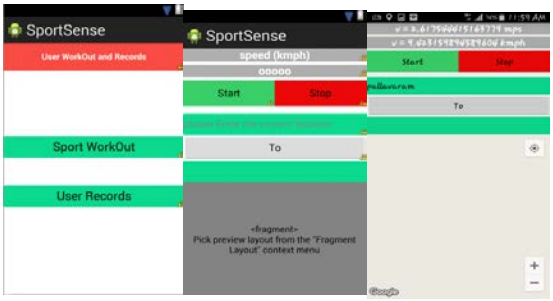


Figure 2: Activity Recognition

III. Data Processing

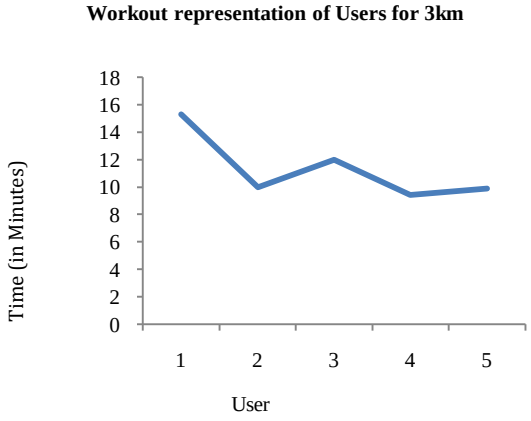
The information like IMEI number, latitude and longitude of the mobile device, the number of steps moved is stored as a separate file for each user in the server. The movement of the mobile is tracked at every ‘t’ seconds. When the user presses the “send sensor data” button in the server, data is sent. The client information like IMEI, latitude, longitude, accelerometer and velocity values are stored in the server side also. The whole activity is represented as a map and a dot in the map represents each users position. In the map, the following user activities can be viewed :acceleration, speed and actions-walking, jogging, running, cycling. The accelerometer sensor is used to measure the acceleration force that applied to the device, including force of gravity. Some of the snapshots of the application progress is represented below.



Based on the monitored activities, each user is tagged as active or inactive. Moreover the application also supports to create a competition among the user. With the processed information, the user who has highest speed and acceleration can be tagged. Hence the status of user who will be leading in these competitive environment were known to the users in the network. Here the tags such as red star and blue square were used to represent the user with the highest speed and highest acceleration respectively.

IV. Performance Measures

Processed data of the participated users in the server was accessed for finding the highest score performer is highlighted on the top in the map using latitude and longitude information. The speed of user is denoted through different color icons. A red star denotes the highest speed and blue square denotes instantaneous acceleration. The drawbacks of this type of sport sensors are : i. The period for getting the data is quite diminishing and hence data will be received morerepeatedly, ii. Battery will be depleted more quickly, iii. Battery exhaustion will be measured in exponential instead of linear form, iv. when data remains longer, energy reduction will be slower. The data collected from participated users were computed and their time taken to reach 3 km in their respective places were represented in graph1 and the snap shop of the latitude and longitude recorded is shown below.



V. Conclusion

The study of walking, running or jogging is an advent of android application. The virtual sports environment can be made possible for the remote users in different location with the use of both mobile base sensors and composite sensors based on the data required for evaluation. In this app, sensors like accelerometer, gyroscope and proximity were used for calculating the acceleration, location, speed and to assess the activities like jogging, walking, standing or idle.Theactive users with highest score were tagged with different icons for better evaluation. A non-active user's rate of standing, walking, jogging and current positions can be labeled. The duration of data collection from the sensors has a direct impact on battery consumption. Further in future, labeling can be made more precise. A detailed study is required to reduce the battery consumption of the devices participating in the virtual sports environment.

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