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PARAM: Personal Activity Recognition and Application Monitor

T. Nikhil Suresh
B.Tech Scholor
Dept. of Information Technology,
Vignana Bharathi Institute of Technology,
Aushapur, Hyderabad-501301.

G.Vivek
B.Tech Scholor
Dept. of Information Technology,
Vignana Bharathi Institute of Technology,
Aushapur, Hyderabad-501301.

J.Manikanth Reddy
B.Tech Scholor
Dept. of Information Technology,
Vignana Bharathi Institute of Technology,
Aushapur, Hyderabad-501301.

Mrs S.Bhagya Rekha
Assistant Professor,
Dept. of Information Technology,
Vignana Bharathi Institute of Technology,
Aushapur, Hyderabad-501301.

Abstract

Param is a smartphone-based application to help people ensure that they use multiple services in a single application irrespective of ages. This system tracks the day-to-day activity of a user and maintains the data in the database, which can be viewed by the user at any time. It also reminds the Elderly people to take medicines on time and maintain a healthy routine. It also monitors and tracks the usage of mobile applications of a user, like the number of times the application has been referred and the amount of time spent on it.Now-a-days there are different apps for each of the personal biometrics, elderly assistance and monitoring applications of a smartphone with lesser capabilities. Our param is to combine all these features in a single application and making it efficient for the user.While this application has now entered the mainstream, this paper provides insights into applied application activity recognition,elderly careand fitness monitoring something that commercial companies rarely share.

Keywords— ***Personal activity recognition, personal biometrics, smartphones, elderly assistance,monitoring applications, fitness.***

I.INTRODUCTION

Param, our smartphone based personal and application activity recognition technology comprises of 3 services. In this paper,these 3 services are explained according to the day to day life usage.

a) A lack of adequate physical activity is an enormous problem in our society, because physical inactivity dramatically increases the health risks for many diseases, including cardiovascular disease [2,5,8] , colon cancer [3], diabetes mellitus, hypertension, and osteoporosis. According to the World Health Organization, inactivity is responsible for approximately two million deaths per year[7], while a healthy amount of physical activity has been shown to significantly reduce the risk of all-cause mortality[1,6]. Inactivity is also associated with healthrelated societal problems like childhood obesity[4] and impacts the ability of the elderly to live independently. The good news is that according to a report from the US Surgeon General, even moderate amounts of exercise can substantially improve one's health[9]. Fitness monitoring technology based on personal biometrics can be used as an monitoring application used for tracking the fitness activity of a person. In this paper we describe Param, a smartphone-based fitness activity monitoring service, which tracks highly accurate personalized activity like jogging and running.

The fitness market currently offers many activity tracking products, such as the Fitbit [10,11], but such products require the purchase of specialized hardware and were not very popular as it is high in cost at the time our smartphone-based service was at a process of development.Some commercial fitness activity recognition apps now are available for smartphones, but these are often not very accurate, the applications are proprietary, and the data, algorithms, and results are not

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publicly released. Hence, these applications are of limited usefulness to researchers. Smartwatches[12] have recently entered the market and also support activity recognition, but these additional devices are also expensive, are far from ubiquitous, and also rely on proprietary apps.

b) India and many other countries, such as China, Japan, Korea and US, is dealing with more and more severe social problems brought by the era of aging population.In this paper we also describe the second service of Param i.e an elderly assistance service providing the details about the medicine intake details to the aged person.

Now-a-days in the world many medicine intake alerting applications are being developed,but such applications are mostly sophisticated to be used by a elder aged person.Also an additional message service is incorporated in it to alert the person regarding the intake showing the details of medicine and quantity of medicine.

c) In this modern world most of the people are addicted to their smartphones and misusing them by wasting time on particular applications which are not at all useful. This mostly happens unknowingly that they are wasting time that can be utilized for an useful purpose

The last service that is provided by our Param is application monitoring showing the details of the application and the time being used for a particular application. This will help in providing the details of time used on a particular application and people can think about the time they are using for few applications which are not at all useful.

II.SYSTEM ARCHITECTURE

Param utilizes a client-server model to perform all three services. Each of these services have similar architecture varied by small differences as servers and mobile user application is same for all 3 services provided.Each of architectures are described as follows:

The below Fig. 1 shows the major system components which are provided by the system architecture of fitness monitor service.

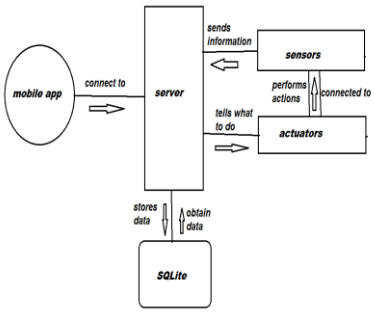

Fig. 1.Fitness monitor System Architecture

Now coming to the system components,this service comprises of few software and hardware components. At first we have the mobile application whichwill be used to display information on an android smartphone or tablet that shows the user his/her movements during the physical activity. Later on we have the server, the brain of the application, it will store the movements of the user doing the activity, information of the application and will be the base of the application.. It will tell how to react to the movements of the user. SQLite will act as the database for storing the details of the physical activity done.Next comes the hardware components sensors and actuators, Sensors will note the data of the activity done and sends the information to the server while the actuators will perform the actions that are requested by the server.

The client runs on the smartphone and transmits sensor data to the server for processing. The server performs data cleaning and preprocessing steps and then transforms the low level timeseries accelerometer sensor data into examples, where each example contains high level features that describe 10seconds of activity. The transformed data is then passed to database where the data is stored and the passed to the mobile application to show the details of the physical activity.This service identifies activities like walking, jogging, running and standing.

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The next service architecture for elderly assistance service for alerting on medicine intake is shown in Fig. 2 as below:

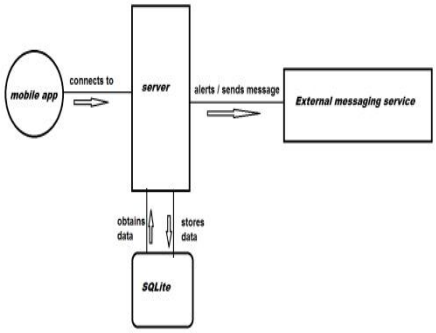

Fig. 2.Elderly assistance (pill remainder) System architecture

In this the system architecture comprises of the mobile app which will serve as the display of information and also as the input component for the details of medicine and time at which they are to be taken. The next component is the server which will process the inputs and stores them in the database. It also obtains the data from the database and alerts according to the time at which the medicine have to be taken. Finallythe last component in this service is the external messaging interface which will obtain requests from the server, based on intake time of medicine. Then it sends the message to already specified person about the details of medicine to be taken at that particular time.

Here the client initially provides the contact details of the person to whom the message has to be delivered. After providing contact details, the medicine details and time details including the amount of medicine to be taken are stored in the database.

The server then process the data and alerts the external messaging service if the time of the smartphone coincides with the time given in database for the intake of medicine. This external messaging interface will send the message as soon as it receives alert from the server to the designated contact.

The Smartphone application monitoring service system architecture is shown below Fig. 3:

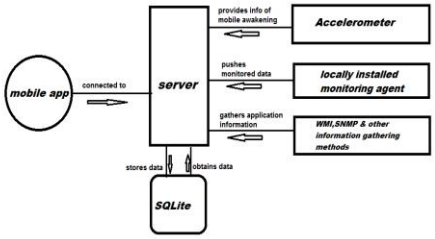

Fig. 3.Application log monitor System Architecture

In this service, we have the system components such as the mobile app, server with SQLite database,accelerometer sensor, external application monitoring agent and also few methods for application information gathering.The mobile app is connected to the server and displays the application log information.The server will preprocess the data obtained from the components and stores in database.The other components that are used in this service are accelerometer sensors, externally installed monitoring agent and also the software methods that are used in information gathering.

Here the client can track his usage of applications by using this service.The accelerometer sensors and the monitoring agent combinely provides the details of the application monitoring information and this data is pushed to the server for processing.Also other than pushing we can using polling method which uses WML,SNMP and other similar methods of gathering application information.The server process the obtained information and displays it to the client by using the mobile application.

III. LITERATURE SURVEY

Fitbit: Itis an US based company headquartered inSan Francisco, California, known for its products which are activity trackers, wireless-enabled wearable technology devices that measure data such as

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the number of steps taken, heart rate, steps climbed, and other personal metrics involved with fitness. The first of these is the *Fitbit Tracker*. Some evidence has found that the use of these devices results in less weight loss rather than other ways.[10,11]

Google Fit: It is a health-tracking platform developed by Google for the Android operating system. It is a single set of APIs that combines data from multiple apps and devices. Google Fit uses sensors in a user's activity tracker or mobile device for recording physical fitness activities (such as walking), which are measured against the user's fitness goals to provide a comprehensive view of their fitness. Confirmed partners include Nike, HTC, LG, Motorola, Runtastic and RunKeeper.Users can choose with whom their fitness data is shared with as well as delete this information at any time. Google Fitwas announced at the conference of Google I/O on 25th of june, 2014, shortly after the release of Apple's ios 8 HealthKit, which is considered as a direct competitor. This was launched to the public on 28th of October, 2014, and made available to all Android users running 4.0 and above.

My PillBox: My pillbox (Meds & Pill Reminder) [13]was designed to help for tracking and reminding your medications in a easy way.

Remembering to take your medication, especially when you're juggling a bunch of them, can be a headache. This reminder let the medicine "visually" to you, so you can enjoy to manage medicines, take it on time and safely. Also, It can track multiple person like your family, your relatives. It also has ability to let family members, caregivers and doctors monitor medication adherence through an analytics dashboard.

System Monitor: It is one of the best apps you need for monitoring system performance on Android. It manages tasks, installed packages, clean memory, helps to save battery charge of your phone and also works fast, consumes minimum of memory, low CPU usage which also saves battery power. You can also set up resizable widgets to display how your system resources are being used in real time including current CPU load and battery, memory monitor (both RAM and SD).

IV.TECHNOLOGIES IMPLEMENTED

The Param application is developed by using some technologies that can be easily used by an developer and easy to access.The technologies that are used are mentioned below:

Android: Android[14,15]is an mobile operating system developed by Google, based on the Linux kernel and designed for touchscreen mobile devices such as smartphones and tablets. Android's user interface is mainly based on direct manipulation, using touch gestures that loosely correspond to the real-world actions, such as swiping, tapping and pinching, to manipulate on-screen objects, along with a virtual keyboard for text input. In addition to these touchscreen devices, Google has further developed Android TV for televisions, Android Auto for cars, and also Android Wear for the wrist watches, each with an specialized user interface. Variants of Android are also used on notebooks, game consoles, digital cameras and other electronics.Android has the largest installed base of all operating systems (OS) of any other kind.Also Android is the best-selling OS on tablets since 2013, and on smartphones it is dominant by any metric.

Android Studio [16]: It is the official integrated development environment (IDE) for Android platform development. It was announced on 16th of may, 2013 at the Google I/O conference. Android Studio is freely available under Apache License 2.0.This was in early access preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released on June 2014. The first stable IDE was released in December 2014, starting from version 1.0. Based on Jet Brains IntelliJ IDEA software, this is designed specifically for Android development. It is available for downloading on Windows, Mac OS X and Linux, and also replaced Eclipse Android Development

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Tools (ADT) as Google's primary IDE for native Android application development. New features are expected to be rolling out with each release of Android Studio. The following are the features that are provided in the current stable version:

- A Gradle based build support.
- Android specific refactoring .
- Lint tools used to catch performance, usability, version compatibility and other problems.
- ProGuard integration and app-signing capabilities.
- An rich layout editor that allows users to drag-and-drop UI components and option to preview layouts on multiple screen configurations.
- Support to build Android Wear apps

SQLite [17,18]: It is a relational database management system that is contained in a C programming library. In contrast to other database management systems, SQLite is not a client–server database engine. Rather, it was embedded into the end program. SQLite is ACID compliant and implements most of the SQL standard, using a dynamically and weakly typed SQL syntax that doesn't guarantee the domain integrity. It is a popular choice as embedded database software for local or client storage in the application softwares such as web browsers. It is the most widely deployed database engine, as it is used today by most of the widespread browsers, operating systems, and embedded systems (such as mobile phones). This has bindings to many programming languages.

Features of SQLite

- SQLite implements most of the SQL-92 standard but it lacks some of the features. For example, it partially provides triggers and it can't write to views (however it provides INSTEAD OF triggers that provide similar functionality). While it provides complex queries and it still has limited ALTER TABLE function, as it cannot modify or delete columns.
- Also SQLite uses an unusual type system for SQL-compatible DBMS; instead of assigning the type to a column as in most SQL database systems, types are assigned to the individual values; in language terms it is dynamically typed. Moreover, it is weakly typed in some of the ways that Perl is and one can insert a string into an integer column (although SQLite will try to convert string to an integer primarly, if the column's preferred type is an integer). This will add flexibility to columns, especially when bound to a dynamically typed scripting language. However, this technique is not portable to other SQL products. A common criticism is that SQLite's type system lacks the data integrity mechanism that is provided by statically typed columns in other products. The SQLite website describes an "strict affinity" mode, but this has not yet been added. However, it can be implemented with constraints like CHECK(typeof(x)='integer').

V.CONCLUSION AND FUTURE WORK

This paper describes a deployed smartphone-based activity and application monitoring application called Param, which provides the user with an accurate assessment of their activities and allows them to monitor the impact of any behavioural changes including the application usage monitoring. Smartphones are ubiquitous and becoming more and more sophisticated. This has been changing the landscape of people's daily life and has opened the doors for many interesting data mining applications. Human activity recognition is a core building block behind these applications. It takes the raw sensors' reading as inputs and predicts a user's motion activity. This paper presents a comprehensivesurvey of the recent advances in activity recognition with smartphones sensors. We introduce the basic concepts of activity recognition (such as sensors, activity types, etc)The activity recognition based on smartphone sensors leads to many possible future research directions. Besides the applications mentioned, an even further sophisticated way could be equipping

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smartphones with intelligent applications to replace the traditional devices such as remote control, traffic controlling, and tracking devices.

Param's first sevice of tracking the fitness activity can be extended in future.This can be achieved by adding few more additional skills in addition to the walking and jogging like cycling, swimming, workouts ,exercise and many more.At present we strived to achieve the walking and jogging distance and time used for this physical activity.

The second service,an medicine reminder in elderly assistance sector is achieved and additional feature of reminding the aged person by a message service. This service is further most can be extended in future by not only reminding the medicine intake but also to remind the personal activities and it can also be extended to the people who can't do their activities time to time like normal people.

The final service in our Param is the application monitoring service.In this we developed a service to show the time and no of times an application is being used and also to show the data of the application regarding its size and version details. In future an attempt can be made to extend this service by increasing the details that are shown to user and there is a chance to include the alert option if an application is used for a much longer time which may decrease the wastage of time for an unuseful application.

We faced many challenges while developing and deploying this tool, and learned several lessons. One key lesson that we learned was that some people, mainly elders rarely carry their phone in their pocket. This impacts the utility of our service. This could be addressed by making the Param more flexible, so that the application can be dynamically recognize all the activites either regarding fitness or inside the smartphone. Much of this work began, and was deployed, before fitness trackers became popular and before smartphone-based activity recognition entered the mainstream. Some of the features, such as medicine reminder, were demonstrated to be very effective, while such capabilities are still not standard. Our research group is now focused on the future enhancement of Param to extend its services in personal biometrics and also in indoor localization which will help in further growth of the ease of using smartphone for day to day activities..

Finally, we conclude this paper stating that the modern world require these kind of applications which reduces the complexities in day to day life of a person and we have been successful to an extent to reach that purpose and will strive to reach our future goal.

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