Personal Tracking using Static Trajectory Locations

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Abstract. The growth in number and capacity of smart devices such as GPS enabled smart phones and PDAs present an unparalleled opportunity for mobile healthcare applications. In this paper we propose a novel approach for monitoring movement related activities of a patient. An application is developed to monitor and control movement of patient according to his/her practitioner's prescription. The implementation and evaluation of health monitoring service is briefly described in this paper.

Keywords: Personal Tracking; Healthcare using trajectory data; static trajectory locations tracking

1. Introduction

GPS is commendable technology to find location related activities. Presently a huge number of devices are enabled with this technology and getting more common with rapid speed. Currently more of these technologies are used for advancement of overall society and mankind. Like how to control traffic in better way, finding peak and low rush hours and movement behavior of people of a particular area.

A recent study used trajectory information of people for finding people attractive areas and their related movement patterns, which can lead to instructive insight to transport management, urban planning and location-based services (LBS).They considered taxi as important mode of transport and acquired road traffic condition, travel patterns, average speed estimation and attractive places where people often visit [1]. In [2] trajectory mining is used for mining ship spatial trajectory and an Automatically Identification System (AIS) is developed as a result of this study in which GPS enabled technology is used for finding the paths of ships [2].The basic purpose of this study was self-navigation and collision avoidance but it can be extended for better marine traffic management and distribution.

Our approach in this paper is incorporating trajectory mining techniques to a person's direct life and particularly its usage in healthcare domain is targeted in this paper. A GPS based smart phone application is developed which is used for monitoring daily life routine by finding trajectory locations visited by a patient. Further these patterns are compared with the patterns prescribed by physician of patient and recommendations for better carrying out prescribed schedule are presented to patient.

In broader prospect it can be used for finding traffic routines of people of particular area thus can be used for better traffic management and can also explore opportunities for business people to target people's interested things, which can be discovered by scrutinizing this data.

This paper is organized as follows. In 2nd section related work is discussed. Architecture and modules of developed health care application is explained in 3rd section. Result and conclusion work is exploited in section 4 and 5 respectively and references are given in section 6.

2. Related Work

Recently, innovations in GPS enabled smart phones technologies and low-cost internet availability has tiled the way for development vital movement related services.

Reviewing recent works in mobile healthcare reveal that most of these projects [5-8] have mainly focused on using, enhancing or combining existing technologies and context-aware projects mostly dealing with a limited scope (i.e. not applicable to other context-aware scenarios). In [3] A Context-Aware system based on Personal tracking is developed which is a motivating concept to map the trajectory of a mobile user, adding contextual information related to each user position. In our study this approach is modified and used for building health care mobile application.

3. Architecture of Health Care System

Human health is considerably interrelated with his/her routine life activities. Thus by controlling these activities one can maintain good health easily. Health care service developed in this paper is responsible of tracking and monitoring of movement patterns of a patient according to the practitioner's instruction.

Our application assumed that patient moves with his GPS empowered smart phone device and internet is available at all of significant locations.

Figure 1 presents the architecture of our service. As it is indicated in figure that service is divided into 3 parts, including 2 smart phone application interfaces one for patient and the other for practitioner and a cloud based database server for processing and storage of data.

Movement of patient is recorded by his smart phone application service. For each trajectory location of patient following parameters are recorded: Patient's credentials, Geo co-ordinates (longitude and latitude of position), and Geo tags (Geographical identification), Total time spent, Clock time and sequence number of this place.

Patient's position status is checked after small interval of time and co-ordinates are recorded when he/she is at static position. Then to get some information from these statistics, co-ordinates are mapped to their geographical identification using Google API.

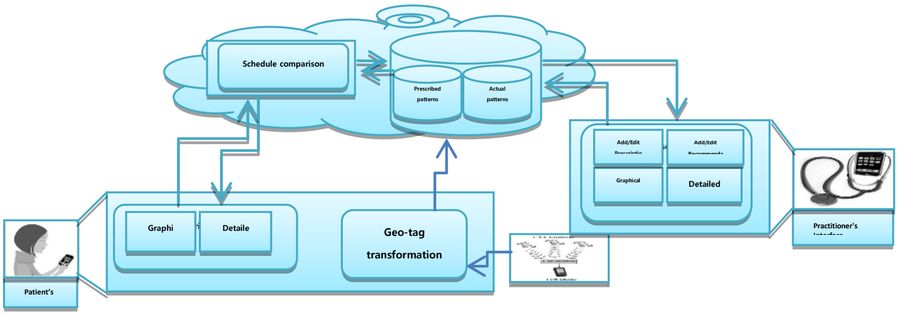

Fig 1: Architecture of Healthcare System

Storage and comparison of trajectory patterns is reasonably high computation task. So for better performing the centralized data server is introduced. Entire data of patient is stored and processed on this server and both physician and patient access this database but only physician is allowed to make changes. This is built in MySQL and web service for accessing it is developed in .Net. Practitioner's service allows him/her to view and modify prescription for patients.

4. Results

Developed system is composed of two types of services and result showing views. Each of them is described below in detail.

4.1 Smart Phone Service for Patient

All the activities related data of patient is recorded using this smartphone application and then it is sent to remote cloud data server. This service uses GPS receiver for recording coordinates of user and Google API for conversion of coordinate to geo code (fig. 2) Credentials of patient (fig. 3) and semantic tags are also added by this service.

Fig. 2 Geo identification Fig.3 Patient Credentials Fig.4.Schedule ComparisonFig.5 Detailed Comparison

4.2 Smart Service for Practitioner

This service is for practitioner to assist in monitoring the patients and also to modify (add/edit) their prescribed schedule for a particular patient. Same GUI patterns comparison and detailed patterns comparison results as exposed to patient are shown to physician. This view has almost same functionality as discussed above but the difference is that practitioner is allowed to update complete schedule for their patients like which places they should visit during their daily routine. Same like patient's application view, all the data added by doctor is sent to and accessed by remote centralized server using web service.

Comparison results of patient's daily life trajectory patterns with prescribed schedule are shown to both patient and practitioner. There are two result showing views.

4.3 GUI patterns comparison

In this view patterns of selected days are shown in graphical form to give a quick view. These patterns are shown in order in which it is followed by patient. Using this view patient can also track missing of some recommended place from his/her routine schedule. Order of visiting places also holds quite importance as going to sports club in evening time after office makes more sense than doing some exercise after dinner as shown in fig 4.

Using this view one can easily relate his/her trajectory pattern order with prescribed one.

4.4 Detailed patterns Comparison

This view is for detailed comparison of trajectory patterns. Schedule of selected days are shown in form of table and all the parameters of selected day i.e. semantic tag, Time spent, Date, and Order of visiting places are shown for comparison. Using this view patient can easily monitor his/her current state i.e. missing of some sport activity or lunch can easily be outlined by this view. Snap shot of this view is shown in figure 5.

5. Conclusion and future work

In this paper we proposed and validated a general tactic for using trajectory data in health care domain. System developed in this paper shows how trajectory patterns of a person can bring perfection in health life and it also discovers a new direction for practitioners to monitor their patients in better and more accurate way.

Our future work includes analysis of data to predict behavior of patient and provide some useful suggestions for upcoming activity. This will help patient to follow prescription and he will be suggested before doing some activity e.g. food suggestion during lunch time and some particular exercise recommendation during his sports time etc.

Also by applying frequent mining techniques on trajectory locations data can provide us significant results for understanding effect of patient's activities on his/her life. After attainment of this knowledge prescription can be updated accordingly.

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