Android Based Mobile Phones
Regulating Our Health Issues

Ankita Singh
ME Indira College of Engineering and Management - Pune

Abstract: An android based mobile data acquisition [DAQ] solution have been enriched which collects personalized health information of the end-user, store analyze and visualize it on the smart device and is sent to the datacenter for further processing. This device is capable to collect information from a large set of different wireless (Bluetooth and Wi-Fi) and wired (USB) sensors. Living lab facility has successfully tested this developed system. Both the end users and care givers are benefited by the sensor data acquisition on the personal mobile device by providing better and more efficient monitoring of health and also facilitating prevention. The paper goes about defining the internal architecture of the software solution and its main functionalities.

1. Introduction

The growing population of industrialized countries also increases the health care costs. Most of the problems that primarily centralized healthcare systems have can be solved by the transparently embedded remote health care. Now-a-days, a large number of enabling technologies are available to measure the patient’s physiological signals remotely. The remote patient monitoring solutions are already available such as the android based My Fitness Companion.

i. It is capable to support the listed therapy fields: fitness, diabetes, asthma, obesity, hypertension, CHD, etc.

ii. It provides medical guidance, emergency alarm functionality and collects personal health information e.g.: Microsoft health vault

iii. It helps in the care of elderly persons [e.g. neurodegenerative diseases, stroke etc.], and it also provides online web interface to manage [process and share]health information

iv. It is specialized both on android based [mobile hub] portable remote monitoring applications, and normal PC based [home hub]remote monitoring solutions

This paper depicts the way we have built up our remote patient monitoring environment with the help of client side software and the dr. health portal. As the time passed this software environment has been used to do patient’s location event monitoring, remote diabetes and hypertension monitoring in our living lab.

The direct endeavor of the AALAMSRK project through the co-operation of commercial companies, universities and other non-profit organizations was to develop an integrated, standardized dementia and health monitoring system supported by innovative, modern measurement and info-communication technologies. The integration of medical expertise and developing assisted living patterns [ALPs], the realized system offers personalized monitoring and prevention of elderly people, in particular for those who suffer from stroke, neurological diseases such as dementia or depression.

Figure 1. Remote health monitoring infrastructure

2. Motivation

The general project aim was to improve the quality and cost effectiveness of healthcare services by developing service models, methods, tools, products and services. The research and development of a full scale remote tele monitoring system that monitors both activity levels and vital signs such as blood pressure, blood sugar level and heart rate, alerting caregivers about potential health problems or emergency situations.

The below listed points are the four evitable service pillars which builds remote patient monitoring:

- Data acquisition services
  DAQ services collect physiological information of a person’s condition from deployed sensor infrastructure or from the person directly.
• Store/ forward and visualize services
  These provide services to store, process and visualize locally the captured physiological information of a person’s device and to forward these information using ICT towards the central data collector node for further data processing, storing, visualization.

• Activity recognition service
  It deals with recognition of psychophysical performance of patients or elderly people for effective therapy intervention (quantitative and qualitative measurement of body movement)

• Lifestyle guidance services
  Lifestyle guidance, therapy adjustment, early warning personalized health care and rehabilitation are enabled by the feedback from medical experts/physician.

3. Living Lab

The patient’s home medical assistance and lifestyle guidance services are the main novelties of the AALAMSRK project. It also succors new potential opportunities to capture insight medical knowledge with its effective non-stop health monitoring methods. This monitoring is done by our clinical trial-ready, standardized distributed monitoring and testing environments (so called living labs). These labs are succoring all the R & D tasks of the medical, engineering and business (marketing) work packages and also gives evaluation and test environment for new hypotheses and results.

The well-established living lab environments are located in three regions with Hungary (capital city, middle size city and rural area) and hence the types of patient’s environment are totally distinct. During test periods, all thanks to the living labs studies we have learned a lot about the different environment necessities, and revealed many aspects of various problems which were concerned with the sustainability, usability of our health monitoring and emergency management solution.

4. Comparison among the Two: Fixed (Home Hub) & Portable (Mobile Hub) Monitoring Devices

It was the PC based home hub to be developed first during the AALAMSRK project. It supports Linux and is able to run both on proprietary solutions (like Intel health guide) and on out-of-the-box commodity PCs optionally equipped with touch screen. Later on an android based mobile hub solution [which enables additional usage scenarios due to its different characteristics] was developed besides the home hub solution.

The mobile hub is full of many attractive features such as cheaper price, location awareness, inbuilt touch screen, etc. On the other hand, it has significant shortcomings as compared to full PC hardware (limited CPU power, memory, storage size and external interface connection support, etc.). Mobile hub targets different functionalities as compared to the home hub solution [due to compact screen size and fewer hardware interfaces], and it can be extended with the help of additional features such as mobility, location awareness, and compact size.

Both home hub and mobile hub are capable enough to run on different other hardware configurations. The home hub was successfully tested on a large set of (Linux installed and touch screen equipped) PCs. In accordance with the carried out tests, the mobile hub software is capable to run almost all Bluetooth enabled and android 1.2+ based smart phone. If both the solutions are working non-stop 24x7 the PC based home hub consumes far more power than mobile based mobile hub. And the study says that the usage of the PC based home hub solution requires significant amount of electricity, and this increased electricity costs can become a limiting factor at the number of potential users.

5. Actual Sensor Set of Our Health Monitoring System

These sensors can provide digital fingerprint of the patient /person’s psychophysical status and performance which are categorized on the basis of their data collection techniques: active or passive type sensors. Both the sensors are used in order to collect detailed and accurate information about the patient remotely about:

i. Blood glucose/sugar level
ii. Actual pulse and oxygenation level
iii. ECG signals
iv. Blood pressure
v. Movement within the house with all mounted sensors
vi. Medication , with sensors of medicament dispenser
vii. Eating habits, with sensors placed on the refrigerator
viii. Actigraph (patient’s activity) which is a watch like sensor on the patient’s wrist.
ix. Actimetry sensor can measure non-invasively rest/activity cycles, gross motor activity.
x. Weight
xi. Environmental information, about room temperature, humidity etc.

6. Features of Basic Mobile Hub Software

i. Health status visualization
ii. Support of multi-language [English, German, Italian and Hungarian]
iii. Silent sensor DAQ mode [automatic data collection] via Bluetooth
iv. Health status visualization (with statistics and data mining facility) at the data center.
v. Manual DAQ mode (optionally GUI initiated sensor data collection) only via Bluetooth.
vi. Limited data compression and encryption during data transmission towards the data center.
vii. Automatic sensor data pre-evaluation at the mobile hub.
viii. Full featured location aware mobile emergency alarm.
ix. Real-time sensor data forwarding to the central data collector server.
x. Store and forward mode to enable offline data collection.

The two software mobile and home hub is designed to be appropriate for different skilled users. Both user interfaces are highly configurable to support elderly persons (high contrast, huge characters, simple UI). In order to make touch screen usage easy the home hub a large GUI was designed with huge buttons and characters.

On the basis of the results of the test that was received from the living lab experiments: due to small touch screen, on the mobile hub multiple separated GUI have been developed for the differently skilled elderly persons. To overcome this problem, two user skill sets have been identified which can categorize the hardware / software utilization ability level of the patient:

i. GUI for elderly people without any IT knowledge
ii. GUI for normal and expert end users

7. Additional Software Functionalities Linked with Mobile Hub

i. Location and sudden event monitoring service
ii. In case of a sudden panic situation, an alarm can also be activated manually [by the patient] or automatically [e.g. by the accelerometer] with the mobile device. The moment an alarm is initiated the central dispatcher is able to acquire local information immediately.
iii. Diary services Mobile hub enables to do correlation analysis of stored data series besides pure data collection. These are intended to notify user in pre-defined appointments about data collection needs, which enables us to track data in certain periods.

8. Conclusion

Both the fixed and portable solutions have been tested for almost four years in the living lab environment. Besides monitoring of patient, we have to monitor not only remotely the person’s status but also some mobile hardware and software specific parameters are required. Studies prove that both PC and android based DAQ solutions are capable enough to provide seamless remote monitoring of elderly persons that too not only at home but also with mobile hub abroad.

9. Acknowledgements

European Union has succored a lot in the completion of the project. This is helpful in development of assisted living patterns and integration into decision promotes the quality of life with the help of the results from the AALAMSRK project. We would also like to thank for their financial support.

10. References