SMART PHONE BASED CRITICAL CARE FOR PATIENTS WITH CHRONIC HEART FAILURE

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Abstract— A system to monitor the physical activity of patients with chronic heart failure (CHF) with the available sensors like Accelerometer and GPS using a smart phone is proposed. The proposed workflow for tele-monitoring consists of several stages. Patient’s physical activity and vital signs data are being collected via a smart phone and reported to a central server. The central server in turn analysis available to the medical team. The medical team assesses the health status of the patient based on the processed data and intervenes if necessary. To address the need for tracking the health status of individuals with CHF, a tele-monitoring system that would deliver real-time information on patient’s overall activity levels via Energy Expenditure (EE) estimate, self-reported vital signs (heart rate, blood pressure, and weight), and relevant cardiovascular symptoms (fatigue, activity, dizziness, shortness of breath, etc). The changes in these symptoms represent markers that can predict early worsening of the CHF condition. It is important to note that this pilot study is an observational study that aims at drawing lessons learned from deploying a continuous tele-monitoring system for patients with heart failure in the real world.

Keywords—Chronic Heart Failure (CHF), GPS, Accelerometer, Tele-Monitoring

1. INTRODUCTION

Internet of Things (IOT) is becoming an increasingly growing topic of conversation both in workplace and outside of it. It’s a concept that not only has the potential to impact how we live but also how we work. It is the inter-networking of physical devices, vehicles (also referred to as “connected devices” and “smart devices”), buildings, and other items- embedded with electronics, software, sensors, actuators, and other network connectivity that enable these objects to collect and exchange data. So, with the help of this we introduce a real time system to tele-monitor patients diagnosed with Chronic Heart Failure.

2. EXISTING SYSTEM

- HIGH re-hospitalization rates among patients with chronic heart-failure (CHF) and other chronic life-threatening conditions represent a significant cost to current health care system.
- No such system exists currently for monitoring CHF.
- Patients should be monitored at every regular interval of time but that is not possible with the existing system.
- Hospitals should be responsible incase the patients are readmitted for the same reason.
- In case, suddenly the patients seem to be critical the doctors cannot be altered.
- Present system relies mostly on the data fed by the patients or their attendants.

3. DISADVANTAGES OF EXISTING SYSTEM

- Economic burden is high.
- Patients are being readmitted approximately within six months of discharge.
- Many research systems have been deployed in a limited environment.

4. SYSTEM REQUIREMENTS

A. TECHNOLOGIES USED

- Android
- J2EE (JSP, Servlet)
- Web Services (JAX-RS), JSON.
- JavaScript, Ajax, HTML, CSS, jquery

B. SOFTWARE REQUIREMENTS

- Windows XP/7
- JDK 1.6
- J2EE
- Tomcat 6.0
- MySQL

C. HARDWARE REQUIREMENTS

- Hard Disk : 250GB and Above
- RAM : 4GB and Above
- Processor : P IV and Above

5. PROPOSED SYSTEM

i. The implementation of a tele-monitoring system based on a smart phone that collects continuous estimates of EE in real-time, daily self-reported vital signs and cardiovascular symptoms, b) performs data analysis, and c) provides alerts to the medical staff.
ii. Lessons learned from the deployment of the system to patients with CHF in their everyday environment.
iii. Observations of the medical intervention in the context of the collected data. Such observations can be used to
iv. Acceptability of the continuous tele-monitoring and data sharing with various stakeholders.

v. Analysis of the battery performance over the course of several weeks of continuous monitoring

6. ADVANTAGES OF PROPOSED SYSTEM

- Rehospitalization rate is reduced.
- Accelerometer is used to estimate the minute by minute Energy Expenditure (EE).
- GPS is used to track the outdoor activities of patients.
- Automatic analysis of data alerts the medical team if a significant change is detected.
- Smart phone is better than many of the wearable devices because it is ubiquitous and convenient.

Basic application version like GINGERBREAD (2.3) and above can be used in client (patient side). Telemonitoring is very interactive because it gets patient’s response.

7. BLOCK DIAGRAM

[Diagram showing the block diagram of the proposed system]

8. MODULES

1) Accelerometer Sensor Module
2) GPS Tracking Module
3) Medical Data Analysis

1) ACCELEROMETER SENSOR MODULE

Most Android-powered devices have built-in sensors that measure motion, orientation, and various environmental conditions. These sensors are capable of providing raw data with high precision and accuracy, and are useful if you want to monitor three-dimensional device movement or positioning, or you want to monitor changes in the ambient environment near a device. For example, Accelerometer Sensor measures the acceleration force in m/s² that is applied to a device on all three physical axes (x, y, and z). So patient’s activity can be measured minute-by-minute and energy expenditure (EE) estimated from accelerometers.

2) GPS TRACKING MODULE

Running is one of the few good ways to burn those extra calories, lighten up your mood and strengthen your core muscles. Not so long ago, you had to hook up special peripheral devices to track your pace, distance and heartbeat, but you can now measure all of these and do a lot more at your fingertips, right from your Android smartphone. Based on the GPS values we tracked relative user location to track outdoors activity and measure walking or running distance.

3) MEDICAL DATA ANALYSIS:

The Patient profile creation is used to add the patient information to a server and then add the respective kit id. The server maintains the patient information and updates the status of a patient. The smart phone is used to sense the patient’s energy estimation.

The web application represents a single-page summary for the patients. It also provides access links to all key platform applications such as treatment plan, BG patterns, and other applications. For the patient, it summarizes the health profile through monitoring patient’s vitals and trends of bio-data, pediatric summary and medical summary.

9. CONCLUSION

With the increasing prevalence of tele-monitoring, there is an emerging need to automate the data analysis and provide effective feedback to patients. This can be achieved by modeling behavior in order to continuously assess rehospitalization risk levels based on the underlying analysis. Such models are in particular necessary when the number of monitored patients becomes large, since manual data analytics becomes impractical or even unfeasible. Furthermore, since tele-monitoring can involve self-reported data, estimating the level of objectiveness and including the corresponding confidence levels into the models are important points to consider. And the input is the patients response to the questions regarding their health like symptoms, weight, fatigue which may be biased.

Battery optimization is one factor which is achieved here which is a big change in smart phones.

REFERENCES


