mHealthcare Wellness Monitoring Infrastructure Using Physiological Signals through Smart Phone: A Review

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*Abstract:-***This paper describes personalized heart monitoring system using smart phones. Wireless sensors and smart phones are used to monitor the wellbeing of heart patients. The smart phone analyses in real-time the ECG signals and determines whether the person needs any emergency treatment. Depending on the situation the smart phone can automatically give alert message to caretakers or call the ambulance. It is also give advice for first aid treatment. In this study, a proposed framework was deployed for health monitoring and wellness.**

Keywords: **Smartphones, Mobile Health, WSN, Mobile phone sensing, Body sensor network, ECG.**

I. INTRODUCTION

Signal processing algorithms/models are inherently compute intensive to extract non-measurable physiological parameters (e.g., heart rate variability, vascular stiffness, peripheral resistance, pulse transfer time) from these vital signs in order to gain valuable knowledge about the psychophysio logical condition [1].

Tiny sensors are being designed to gather information on bodily conditions such as temperature, heart rate, blood pressure, blood and urine chemical levels, breathing rate and volume, activity levels, and almost any other physiological characteristic that provides information that can be used to diagnose health problems [2].

The worldwide challenge in healthcare system is to provide high quality service, easy accessibility and low cost service. These challenges damages the existing healthcare systems therefore it is necessity to develop better, smarter, cost effective and healthcare systems to provide quality healthcare services at runtime. With this a large number of people, especially the elder people needed healthcare services, healthcare resources and quality with limited financial resources. Now days people are more health conscious so better healthcare services is on the rise, so everyone is demanding for better healthcare services that can be provided through ubiquitous healthcare systems [3].

Mobile health (mHealth) represents the use of mobile wireless communication devices to improve health outcomes, healthcare services, and health research. M-Health monitoring systems typically integrate wearable physiological sensors, personal devices like smartphones. They allow an individual to closely monitor changes in his or her vital signs and provide feedback to help maintain an optimal health and wellness status [4].

Smartphones and tablets have spread rapidly in developed and developing nations, and this represents a major opportunity to transform the manner in which medical care is delivered. Smartphones and tablets systems will save money, improve access, and provide higher levels of quality. [5]

Mobile Health Care is the integration of mobile computing and health monitoring. It is the application of mobile computing technologies for improving communication among patients, physicians, and other health care workers.

II. RELATED WORK

This Section discusses various projects and investigations done by different research groups to realize mhealth and wellness in some recent healthcare related systems.

Combine mobile health technology with ubiquitous computing for monitoring the wellness of high risk patients. The smart phone analyses real-time the ECG signals and determines whether the person needs any kind of treatment.

Convergences of smart biosensors, smartphones, and cloud computing services have enabled the development and proliferation of affordable mHealth monitoring systems capable of continuous health and wellness monitoring. UAH originally developed two mHealth applications: sTUG and mWheelness. sTUG quantifies and automates a standard Timed-Upand- Go (TUG) test used to assess mobility of individuals. The following parameters that quantify individual phases of the iTUG: (a) the total duration of the TUG, (b) the total duration of the sit-to-stand transition, and (c) the total duration of the stand-to-sit transition. In addition, we extract parameters that further quantify body movements during sit-to-stand and stand-to-sit transitions, including the duration of sub phases, maximum angular velocities, and upper trunk angles. These parameters are recorded on the smartphone and optionally uploaded to the mHealth server. The application stops monitoring automatically once it detects the end of the stand-to-sit transition [4].

A novel, combinatorial model for interpreting and analyzing an electrocardiogram (ECG) is presented. QRS peak detection model is applied. This is verified with an online algorithm, which is time efficient [9].

In this research work, most of the techniques are used in electrocardiogram for biometric recognition. In particular, classify the methodologies based on the classification and features schemes. Lastly, a comparative analysis of the performance of a few of the ECG biometric systems is presented, using house database.[10]

Using a systematic wavelet transform algorithm, this real time multi functional integrated ECG signal-processing scheme can understand multiple QRS detection, heart beat rate prediction and classification, noise suppression, and clean ECG reconstruction.

The proposed ECG signal processing system is implemented with CMOS technology by utilizing the novel low-cost hardware architecture. This ECG signal processor chip achieves low area and power consumptions. This framework is highly suitable for wearable applications of heart monitoring patients [11].

To identify the emotional states of human body using ECG signals, which could revolutionize applications in education, medicine, safety, entertainment etc. A solution based on empirical mode decomposition (EMD) is proposed for detection of emotion patterns on ECG dynamically. Classification features are based on the local oscillation and instantaneous frequency within every mode [12].

III. METHOD

Health monitoring systems is use either in-built sensors of smart phones, or a combination of biosensors and smart phone sensors for collecting information about persons health like blood pressure, pulse, Electrocardiogram (ECG), Electroencephalogram (EEG) etc, depending upon the system requirements.

Wearable health monitoring system allows an individual to closely monitor changes in patient vital signs and provide feedback for maintaining an optimal health status.

Mobile health (mHealth) sensing uses medical sensors to collect data about the patients.

Data stream mining has attracted more research attention from the data mining community. Data streams are huge, fast and real-time extraction of Knowledge structure.

Availability, affordability, and excellent performance make smartphones an ideal platform for mHealth applications. The Zephyr BioHarness 3 and Hidalgo Equivital 2 physiological monitors, capable of recording RR intervals and raw ECG signals, are a good choice for applications where accuracy and resolution are prime requirements [4].

Home Health Care

There are four major aspects of home health care are as follows

i. Preventative health care programs
ii. Physiological monitoring
iii. Functional monitoring
iv. Assessment of quality of life

Preventive healthcare

It consists of actions taken for disease prevention, to avoid the disease treatment. All healthy peoples should visit their health care provider or physician from time to time, to avoid the emergency.

Physiologic Monitoring

By using the various parameters monitoring system, measure and show the waveforms and numerical data dependent on their configuration.

Functional Monitoring

It looks the functionality offered by a individual application or by a distributed system. The purpose of functional monitoring is to evaluate the performance and availability of system.

The Assessment of Quality of life

It designed to measure health-related quality of life, and the descriptive system for a multi-attribute utility instrument. It measures 5 scopes: illness, social relationships, independent living, psychological wellbeing and physical senses.

Comprehensive Data Sets and Information Fusion

The interpretation of ambulatory electrocardiogram (ECG) data can be enhanced by data provided simultaneously by accelerometer sensor: The ECG signal is expected to be strongly affected by physical disturbances due to activities such as running. Using the accelerometer information can therefore improve the interpretation of the raw ECG data and thereby reduce the probability of incorrect clinical interpretation that would lead to false alarms. What makes fusion challenging in practice is the fact that not all measurements can be made at the same spatial and temporal resolution [13].

Accelerometer Sensor and Geo-Location Facilities:

The main application of accelerometers for healthcare purposes is to track a person's physical activity level. It is important as it allows reducing the risk of having many chronic diseases. There are specially designed accelerometer-based devices that measure activity level as a number of steps performed by the person. Such devices are called pedometers.

The main reason to use mobile phones in healthcare domain is to improve quality and availability of the healthcare services, because very many people in the world already have a mobile phone.

Evaluating Assessment

mHealth technologies support new methods for collecting biological, behavioural, or environmental data and the outcomes of interventions. These include sensors that monitor phenomena with higher precision, improved sampling frequency, fewer missing data, greater convenience, and in some cases, lower cost than traditional measures. Algorithms derived from sensor data and selfreports allow inferences about physiologic, psychological, emotional, and environmental state, such as mobile sensor systems for psychological stress or smoking [13].

Data Processing and Analytics

High data density requires data processing methods not commonly used in health research. Machine-learning methods that make classification decisions based on features from the data can be applied to segments of data to draw inferences about individuals such as type of physical activity, level of stress, or intensity of pain. Having accurate analytics for high-frequency data collected in mHealth applications is critical for both assessment and intervention purposes [13].

Sensors

From each sensor data is collected and processed in the smart phone for diagnosis of patient [14].

Camera Sensor:

The mobile phone camera sensor can be used to provide useful information about a patient images and videos that applies in such applications as remote doctor consultation. The more significant example of using mobile device camera in healthcare services is the teledermatology, where the patient skin images are used by the doctor to make a diagnosis.

Emergency procedure

The smart phone can automatically give alert message to the ambulance and caretaker when a high risk patient is detected.

An application shows the alarm and a notifying message to the user when emergency occurs. The application can give emergency call automatically.

This paper described a personalized health monitoring system using a smart phone and wireless (wearable) sensors. If the patient is in danger, automatically an ambulance will be call. In normal situations, system monitors and records the sensor data for additional patient health record which is used for further analysis by a specialist. This reduces the time; communication costs, medical staff workload, and motivates the patient's self-care [14].

IV. CONCLUSION/ FUTURE SCOPE

This paper describes personalized heart monitoring using smart phones. Wireless sensors and smart phones are used to monitor the wellbeing of ECG patients. The smart phone analyses real-time the ECG signals and determines whether the person needs any emergency help. As per the situation smart phone can automatically give alert message to pre assigned caretaker or call the ambulance.

Creative use of mHealth can reduce the cost of health care and improves wellness. These applications are developed in a variety of domains, but thorough research is needed for examining the challenges of utilizing mobile technologies to improve health outcomes. Research is still needed to measure when, where, and for whom mHealth devices, systems and apps are efficient [13].

V. REFERENCES

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