Human Healthcare Monitoring Using WearableSensors and BigDataAnalytics

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Abstract — A wireless sensor networks(WSN) in healthcare monitoring is used for prevention of diseases. Wearable sensor consist of sensor with low power constraints and low cost which is used to measure temperature, pressure and to monitor activities. The sensed data in wireless sensor networks is transmitted to mobile apps through the interface. The sensed data is transmitted to the database server where constrained hidden markov model(CHMM) to generate a medical report by comparing it with a precalculated value .The medical report enables the user to lead a healthy life.

Index terms — Wireless sensor networks(WSN), Constrained Hidden Markov Model(CHMM),medical report , low cost.

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1 INTRODUCTION

Health is very important for a person to lead a wealthy life. People live in different climatic conditions in different parts of the world. Medicines of various kinds is used to cure different diseases such as antibiotics, ayurvedic which have different impact on human beings.

Wireless sensor networks in healthcare is used in different kinds of applications. Life expectancy increases with advancement in technologies and chronic diseases are increasing dramatically. Digital healthcare lead to direct contact between clinician and patient and records their data in electronic healthcare records. Large collection of data lead to collision where authorization, authentication and integrity for reliability.

Wearable sensors do not cause toil in life in the form of money, pain or time. It can make predictions about the health of human beings. Preliminary measures can be taken by using sensors which measures cycological features of human beings. Personification of mobile phone offers healthcare services quickly, cheaply and effectively.

Mobile health monitoring system may alert the patients by analyzing the sensed data through cloud based platform to generate a healthcare report. The level of the individuals who has ability to understand the services and basic health information to make health decisions. Healthcare providers are used to collect the sensed data in the networks should be specified to respective consumer. The data is structured since each sensor measures same factor using various measuring units. The data are received from different devices and places in various research fields. All the data will be repeatedly with interoperability and integrity for analyses using algorithms.[2]

Constrained hidden markov model is partially based on markov decision process. It is used to analyze dynamic system where changes in hidden state can cause variations in output. The constraints of transition parameters of hidden markov model are analyzed to evolve a structured parameter. Mapping input vectors of arbitrary dimension N onto a discrete map with one or two dimension vector which provides low cost in terms of memory and computation time. [10]

2 LITERATURE REVIEW

System which is effective in remote monitoring of the patient and full management of the medical resources like assigning duties to the doctors, nurses etc. In this paper design a low cost patient monitoring devices that can measure the pulse rate of the patients and transmit this data to the low cost tablet pc and generate an alert message, if there is any critical condition. It can store the data in local database and if the network services are available, then the data automatically send to the central server.[8]

The design and development of a wearable ubiquitous healthcare monitoring system using integrated sensors. In this paper healthcare system was design based on wireless sensor network for wide coverage with minimum battery power to support radio frequency transmission. The physiological data to be transmitted in wireless sensor network using IEEE 802.15.4 from on-body wearable sensor devices to a base station which is connected to a server PC

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finally that data can be displayed and stored in the server PC continuously.[16]

In this paper microcontroller based continuous non invasive cuff less blood pressure measurement system with an alarm circuit for health care monitoring system. Accuracy of the system is found in acceptance range by comparing the results with the existing conventional systems. If the BP reading, heart rate or body temperature exceeds the standard range for any patient, the system is able to notify using an alarming circuit. the whole system is controlled by microcontroller ATMEGA8L. The overall system is reliable, accurate, portable, trust worthy, user friendly and cost effective.[3]

The physiological data must not be lost in wired communications, but a wireless communication such as zigbee can lose a data. So, this paper proposed the reliable data transmission not to lose a physiological data in zigbee based health monitoring system. Generally one user's health monitoring system has a few zigbee devices nearby, the communication should be accepted between only one user's devices. So the access control should be implemented because there is a lot of a zigbee device nearby. [10]

An effective, feasible and reliable wireless sensor system based on zigbee technology, which is mainly support structural health monitoring such as buildings, bridges, roads. There are some few problems occurred in existing system such as instability, power consumption and not having enough bandwidths in the wireless system. In order to avoid the existing problem, they introduced the wireless sensor networks based on zigbee technology. Compared to conventional wireless personal area network (WPANS), such as Bluetooth, RFID, Zigbee has many advantages, such as low-power consumption, long data rate and reliable.[18]

3. PROPOSED SYSTEM FOR HEALTHCARE MONITORING

Wearable sensors will be used by users anywhere whether in home or street can obtain their health information .The wearable sensor senses observation about their temperature, heart beat and activities .The observations are transferred through interface such as Bluetooth Low energy(BLE) to mobile apps.The mobile apps acts as interface through where the information is stored and retrieved .The values is transferred to the database server where it is processed through Contrained Hidden Markov Model(CHMM) to generate a report about individuals health.

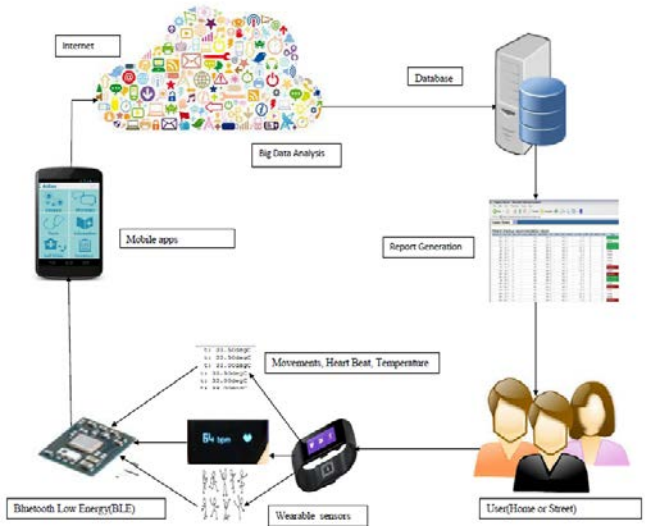

Fig 1: System Architecture

A . Wearable device:

The wearable device consist of tinyduino processor board consist of Atmel Atmega328P microcontroller with 14 digital input/output pins and 6 analog inputs pins with 8MHz ceramic resonator. The accelerometer tinysheild consist of inbuilt temperature sensor and pulse sensor amped which is used to measure activities, temperature and heart beat.Tiny shield protoboard 1 is used to translate the signal from tinyduino which is connected to header using mounting screws in which the pins are spaced 2mm apart. The mounting crews is used to connet the tinyduino, sensors for transmitting the signal to the respective pins. Tinyduino is powered by either using VBATT or 5V using universal serial bus(USB) tinyshield by connecting to the system.

Fig 2: TinyDuino Microcontroller

Tinyshield accelerometer consist of BMA 250 3 axis accelerometer which can sense tilt, motion ,vibration and shock to monitor the activities of human beings can be processed at 1.8V with inbuilt temperature sensor .The holes are spaced 0.1" for power, ground and I^2C to connect two signals from tinyshield microcontroller to connected system.

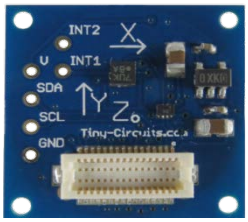

Fig 3:TinyShield accelerometer

Protoboards are used to collect all the signals from the sensors and confined to single point to be transmitted to mobile apps usig interface.The signals are spaced 0.1" with 0.1" header which is default.

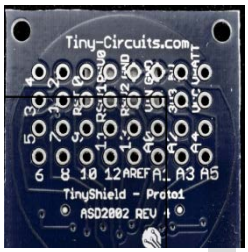

Fig 4: Tinyshield protoboard with spacing 0.1"

Pulse sensor is a heart rate sensor which is used by atheletes, students,artist to easily integrate live heart rate data in this work.It consist of open source monitoring app to graph pulse in real time.

Fig 5: Front end and backend of pulse sensor

The bluetooth low energy (BLE-Version 4) acts as an interface for android or ios devices which operate on low power sensors on high voltage with bluegiga BLE 112 module for a wireless communication of 10 meters with a power supply of 3-5V.

Fig 6: Tiny shield bluetooth low energy

B. Mobile apps

The wide use of mobile phones made the users to benefit from mobile apps in absence of doctors or at remote places where people in need medical facilities. It is used to provide health information for patients or doctors fastly and efficiently. Patients benefit from as they provide models as which part of body is suffering from which disease and how user will benefit after treatment and answer their question visually.The mobile apps consist of login form for respective patient to hold individual records. The readings are navigated to the next page to temperature, activities, pressure pages.

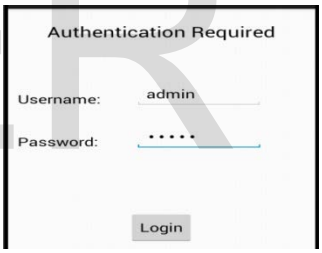

Fig 7 :Login Form

Mobile apps consist of login form for individual user to provide authentication and integrity. The readings are transferred to respective page for displaying to the user. The wide use of mobile phone enabled to develop mobile apps for users to understand the need of active life by regular exercise to healthy fit life in their old age. The daily health conditions such as pressure, temperature and monitor activities by subjecting own home system in proposed system. Wireless transmission of data and sensors to collect data to generate medical report by analyzing the data stored in the database server.

Fig 8:The measured observations are transmitted to the respective page to generate report

D. Report Generation

The observations from wearable sensors are transmitted by interface through the wireless sensor networks to mobile apps. The values are retrieved from the mobile apps and transmitted to database server where big data analysis is performed using Constrained Hidden Markov Model(CHMM) to generate a report. It is compared the precalculated value to provide information about individuals health.

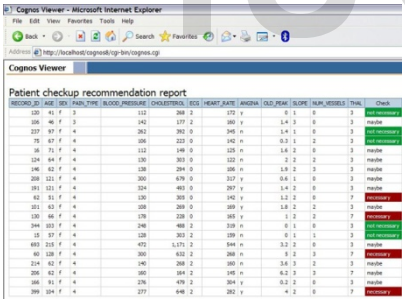

Fig 11 :Report Generation

4 CONCLUSION

In this paper, wireless healthcare monitoring system is proposed for users. The proposed healthcare monitoring system consist of sensors to monitor the health of patients .The monitored health status is communicated to nearest smartphone and is transmitted to database server where report is generated to the patients. The wearable device we have constructed process at low cost and low power with Bluetooth low energy is acting as interface.

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