

A Real-Time wearable Health Monitoring System by using sensor based smart:A Systematic Literature Review

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Abstract- *A real time heart monitoring system is develop to reduce the cost , application, data security and validation. The system give an interface between the doctor and the patients for two-way communications. The main purpose of this paper is to give facilitate the remote cardiac patients in getting latest healthcare services which might not be possible due to low doctor-to-patient ratio situation.*

Keywords—*Health Monitoring System, Wi-Fi Model, Sensor, Tele-healthcare.*

I. INTRODUCTION

Now days tele-healthcare services are very useful. Tele-healthcare system use by wireless and wearable sensor technologies. Tele-healthcare is personalized healthcare delivered from distance and transfer the data to the professional, they provide feedback to the patient. New smart technologies play a key role in healthcare and wellness availing to the improvement of healthcare concepts [1]. In this research paper, a real-time health monitoring system is exhibited by using sensor based smart solution. This system is for two way communication between the doctor and the patient. These systems can comprise various types of small physiological sensors, transmission modules and processing capabilities, and can thus facilitate low-cost wearable sensible solutions for continuous all-day and any-place health, mental and activity status monitoring. Smart wearable sensors are effective and reliable for preventative methods in many different bevel of medicine such as, cardiopulmonary, vascular, endocrine, neurological function and rehabilitation medicine [3]. To gain a truly health smart home, a number of challenges still exist in many perspective of the development procedure.

II. RESEARCH CONTEXT

In research community marked a lot of attention because of wearable health monitoring system . Alternative in Tele-healthcare are the system which are extending the capabilities of physiological monitoring devices between doctors and patients [4].These devices are mobilized into routine care intense and long diseases then provides more reliability of these devices. A real time wearable health Monitoring devices allow monitoring the vital parameters such as Heartbeat rate, blood pressure or decision personalized triggered alerts. Cardiac diseases ,diabetes ,blood pressure

are take care of the patients by tele-healthcare [2]. These devices contain an assortment of different sensors which can be used to monitor variables and transmit data either to a personal device[2].The information on patient which found by the real time health monitor sent to the patients smartphone, computer or other devices. Sensors which are used in the devices allow patients to self monitor also provide a dashboard for healthcare[5].

These sensors are manage easily and flexible for patient. Health monitoring wearable system can measure the heart beat by using LED and LDR and a microcontroller sensor. To measure blood pressure we can use sphygmomanometer sensor. By using this sensor can easily measure the blood pressure and heartbeat rate and give feedback to the patient about the health condition. Smart wearable sensors are effective and reliable for preventative methods in many different facets of medicine[2].These sensor devices are processing and decision support such as actuators , wireless communication networks, data capture technology for of wearable devices and sensors[1].By this monitoring devices patient get benefit they receive their health condition at anywhere. This devices provides the ability for a patient to better understand their healthcare by integrating complement models that combine subjective symptoms with objective criteria.

III. METHODOLOGY

For collecting all the information we used Research papers and journals and also used Google for searching . It knows as Heart Rate Monitoring .A method for monitoring heart rate of the heart using a wearable system. Most HRM devices use a design where the signal is acquired from the subject and a filtering function is applied to remove the high order harmonics and noise from the signal [5] . After a period heart rate receives from heart beat signals and stores the data to a database[4]. It can be determine an idle heart rate of the monitoring body. This idle heart rate is compared with the stored data. This system can detect the heart rate after a certain period and send signal to the users[4] . The sensor based unit is designed as : 1) it must be portable and must easier to carry 2) user friendly interface and also easy to use 3) it must collect all the heart rate of the monitoring body and

must send to the database [4]. The sensor tries to serve the client.

Working Procedure: The basic heartbeat sensor consists of a light emitting diode and a detector like a light detecting resistor. A variation in the flow of blood causes by the heart beat pulses. Blood observes some of light, the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in form of electrical signal and is proportional to the heart beat rate. Relating to the tissue, the signal is actually a DC signal. The digital pulses are given to a microcontroller for calculating the heart beat rate.

IV. RESEARCH QUESTION

RQ1: What is the Activity Conceptualization in A Real time wearable health monitoring system?

Ans: The context-aware health monitoring applications which are exhibited to evaluate and detect human behavior need a clear description of the nature of human activities. Physical human behavior's can be distinguished by either actions or activities. Actions and activities are used interchangeably to denote human behavior with different complexity levels. On the one hand, an action usually refers to a simple event that is executed by a single person and typically lasting for a short time. For instance, opening a door, moving dishes, turn on light, etc. On the other hand, an activity usually refers to a more complex behavior consisting of a sequence of actions that are performed either by a single or multiple persons who are interacting with each other in a constrained manner. Activities last longer than actions and can be seen from three different perspectives: a sequence of actions, interleaved activities or concurrent activities

RQ2: How Movement Tracking and Fall Detection can be used in health monitoring system?

Ans: In health monitoring systems robust and immediate fall detection is important in facilitating appropriate services and medical support. Mobility and accidental falls are common causes of serious damage that can lead to the loss of life so the main aim of such projects is to provide alerts to caregivers in the event of a fall, and to enable remote monitoring to facilitate rapid intervention in emergency situations. Mainly, movement and fall detection systems target ambulatory activities, including dynamic, stationary and transitional activities, as well as location tracking and accidental falls. These systems use PSN and MD sensors and devices for data acquirement, the devices in this class of monitoring can be divided into three categories: wearable-based, ambient-based and camera based, see section Wearable detection approaches use sensors, such as accelerometers and gyroscopes, to detect and location, measure motion, and posture by measuring acceleration and orientation. The camera and vision detection approach, implemented in video tracking systems, relies on video data processing such as inactivity, shape and 3D motion for movement and fall detection.

RQ3: What is the principle of Heartbeat Sensor?

Ans: The heartbeat sensor is based on the principle of photo phlethysmography [6]. The change in volume of blood through any organ of the body which causes a change, this change can measure by sensor. the timing of the pulses is more important where heart pulse rate is to be monitored. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent *to the heart beat pulses* [6].

RQ4: Why Fingertrip Sensor is important?

Ans: It is a easy system for people. They can easily or without any outside pain they come to know about heart **rate**. A resistor to make a current flow and values of resistors are chosen so that they produce the maximum amount of light as an output [5]. The resistor is placed in series with the resistor to reduce the current drawn by the detection system.

RQ5: How HRM can be used in real time monitoring ?

Ans: The proposed system is an web-based human Heart Rate Monitoring system (HRM) which is implemented on an embedded system with Arduino and ear-clip heart rate sensor. The server side system ran the web server and database and the sensor data read from the sensor using Arduino code. This section describes the implementation of web-based human heart rate monitoring system, and demonstrates the performance of the proposed system and determine the idle heart rate for the monitoring body and make an alert in an abnormal situation. The environment of the experiment how the sensor and Arduino board connected with the body [4].

RQ 6: What are the major aim of the paper?

Ans: The major aim of the paper can be summarized as following:

1. To obtain the real-time medical information about a patient via IoT.
2. Processing and classification of information gathered about the patient.
3. To interpret and predict any disease or disorder in preliminary stage itself using the data mining techniques that will also provide the approach advantageous for decision making.[9][8]
4. To provide Internet of Things based healthcare solutions.

RQ 7: How IoT can be used in real time monitoring and displaying all the parameters?

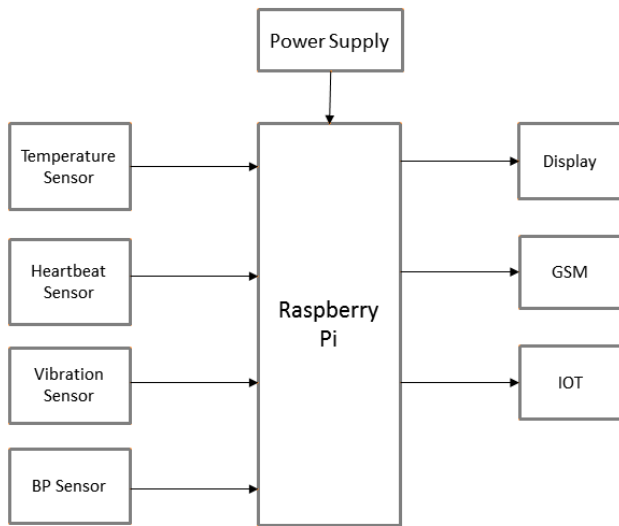


Figure 1. System Architecture

The various Components to be used in system are :

A. Raspberry Pi: The Raspberry Pi is a bank card size microcontroller with the features of a small pc and is extremely popular for development purposes because it offers the entire Linux server and peripheral device connectivity on a single chip and is very cost-effective.[7]

*B. Temperature Sensor :*For measuring the temperature LM35 sensor has been used which is an IC sensor used to measure the temperature with the help of the analog output proportional to the temperature.[8]

*C. Heartbeat Sensor :*The heart rate is measured using a pair of LED and LDR and a microcontroller and it works on the fundamentals of optoelectronics. The infrared radiation is emitted by IR led and the infrared light is reflected by the surface. The intensity of radiation generated electron-hole pair which in turn produces leakage current. This current thus generated is sent through a resistor to obtain the proportional voltage. Thus, the greater is the intensity of the incident ray, the larger value of voltage flowing across resistor will be obtained.[7][8]

*D. Vibration Sensor :*The vibration sensor used in here senses the shaking of the surrounding and hence we use it here to monitor whether the patient is shivering so that proper aid can be given.

*E. BP Sensor :*For measuring the blood pressure, we have used here a manual blood pressure monitor instead of a digital one as it is cheaper.[9]It is commonly known as a sphygmomanometer and the kit consists of an arm cuff, a squeeze bulb to inflate the cuff, stethoscope and a sensor to read the pressure. Blood pressure is measure using an air pressure sensor. The readings are in the form of electrical signals. These readings are also converted to digital form to be read by the Raspberry Pi.

V. RESULT

The result of Smart Health Monitoring system is of extreme use to patients and doctors as well. The patient can check their health status anytime from the comfort of their homes and visit hospitals only when they really need to.[7] This can be done by using our system whose result are brought online and can be seen from anywhere around the world. Since it is a prototype model, our system shows the almost real time values of various health parameters and emulates how the same can be implemented in the real world. The doctors can also use the log of the patient body condition to study and determine the effect of medicine or other such things.

The smart prediction module predicts the disease that the patient is suffering from by asking them for various symptoms they may have and the options are based on the previous symptom. The final conclusion is made after at least 3-4 symptoms are identified. The result is most accurate if more and more symptoms are identified.

VI. RESEARCH AND DEVELOPMENT IN WHMS

In this section, several types of wearable health-monitoring systems are discussed. Since during the last 10 years there have been numerous research efforts and products that can be classified as WHMS, in this review, we attempt to categorize .

- 1) based on whether they are commercial products or research prototypes;[7]
- 2) based on their hardware configuration, e.g., BAN-based, smart textile-based, microcontroller, or custom hardware-based, etc. Research efforts will be examined first, followed by a review on commercially available systems.

VII. EVALUATION

In this section, we attempt to evaluate the most and “prevailing” systems from the ones discussed in the previous sections. The choice of the systems to be evaluated was based upon the following:[7]

- 1) Their ability to measure multiple parameters;
- 2) The amount and the detail level of their provided documentation;
- 3) The frequency of their citation by other projects;
- 4) The extent to which they utilize state-of-the-art hardware Technologies;
- 5) The incorporation of intelligent algorithms for feature extraction

Literature reviews: Literature reviews were performed at the beginning of this thesis work. We reviewed the literature for smart wearable sensors(SWS) and development of that technology. More than five journal publications are currently under review and three conference papers are under correction phase.[7][8]

Technology reviews: Various technology devices such as Apple watch series 2 or Samsung galaxy gear, Fitbit Charge 3 etc. smart wearable devices were reviewed. The main concern was to propose a unique and better smart health monitoring device than the existing ones.[8]

VIII. VALIDATION

Health monitoring systems in smart environments have produced rapidly to become a viable alternative to traditional healthcare solutions. The aim of Health monitoring systems to provide timely e-health services to individuals wishing to maintain their independence also reduced the cost. In this way, any interaction with healthcare institutions elderly people can avoid, for as long as possible, which in turn minimize pressure on the health system. currently, health monitoring systems has attracted considerable attention in research payable g to the development of new technologies. Similar to medicinal training, health monitoring systems is used for diagnosis; the conduct of preventive or post-curative medicinal checking and monitoring and therapeutic procedures ; the prescription of medications and the provision of services.

The information is stored on a cloud server database and can be displayed through an online website or mobile application by authorized personnel only. This module comprises of the hardware components of the system that makes it IoT enabled and is used to record the health parameters of the patient using various sensors. Here, Raspberry pi acts as a central server to which all the sensors are connected through the GPIO pins or using MCP3008 analog-to-digital convertor if their output is in the analog form as raspberry pi works only on digital signals. The pi reads the real-time values and updates them to my SQL DB which is then used to display them on the web interface.

IX. CONCLUSION

In this study a real-time heart monitoring system for heart patients located in remote areas has been proposed. The developed system is comprised of wearable sensors, Android handheld device, and web interface. The developed system would inform the doctor in case of emergency through alarms; however, delay in alarms might occur due to weak signals of 3G networks in some remote areas. Though the delayed alarming time is still within the golden period of time it should be considered in future research. As wireless technology is emerging day by day, the use of latest wireless technology may overcome these issues which ultimately increases the applicability and usefulness of the proposed remote monitoring system. Furthermore, false alarms can be generated due to the battery issues of sensors and smartphone. The research can be extended to overcome these battery and false alarm limitations.

X. REFERENCE

- [1]https://www.researchgate.net/publication/287148196_A_RealTime_Health_Monitoring_System_for_Remote_Cardiac_Patients_Using_Smartphone_and_Wearable_Sensors
- [2] S. Sareen, S.K Sood, S.K Gupta, IoT-based cloud framework to control Ebola virus outbreak. J. Ambient. Intel. Humanized Comput.**9**., 1–18 (2016).
- [3]<https://www.scirp.org/Journal/PaperInformation.aspx?PaperID=66790>
- [4].https://www.researchgate.net/publication/222103486_Microcontroller_based_Heart_Rate_Monitor_using_Fingertip_Sensors
- [5].<https://www.elprocus.com/heartbeat-sensor-working-application/>
- [6] <https://hal.archives-ouvertes.fr/hal-01715576/document>
- [7] <https://www.researchgate.net/publication/224610780>
- [8] <http://www.archpublichealth.com/content/72/1/28>
- [9] <http://www.ripublication.com>

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