Health Status of the Human Monitored through Wearable Device

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Abstract

Health is not valued till sickness comes, this is the factor by which we humans have developed technology to sustain our self from any unknown ailments. Machinery plays a vital role in aiding us maintaining our health. Technology has developed drastically where small wearable devices are captivating enough to monitor our health. Thus, IOT and healthcare is about to become more human friendlier in the near future. When health becomes a fear factor at some crucial moment calling for rescue is the question to be answered. Our work deals with summarization of how wearable device helpful in monitoring human activities and also gives report about various challenges in existing solution.

Keywords— fall detection, heart beat rate monitoring, Human health monitoring, wearable sensors.

I. INTRODUCTION

Change as empowerment is been delivered to numerous industries by Internet of Things (IOT). Under healthcare, patients and providers are benefited by IOT as an emerging trend. The latest development of IOT are wearable devices with aid of software applications help in keeping tabs on an individual health and also helps in capturing health data in order to evaluate the future condition.

Wearable sensor plays a major role in this smart world which is widely used to monitor people activities and behavior, in-turn it leads to safe and peaceful living environment. This ensures the wearable technology to revolutionize our life in the social interaction aspects. Based on these benefits many wearable bands attract the human and creates a huge impact in global market. In recent times, there has been wide use of wearable sensors especially in medical field for the prospect of monitoring the health status of the human. Sensors would be sustainly record signals correspond with your key physiological parameters and relay the resulting data to a database linked with your health records.

People are unaware about their internal organic functions even if they have any abnormality; they keep on ignoring it which leads to severe health issue. With today's technological development all these type of health issues can be easily identified through wearable sensors.[5] In the field of fitness and sports the wearable devices plays the major role to keep track of their activities and keep on motivating to push up to achieve their goals. Factors used to recognize any illness in human physiology are manually checked by:

1. By feeling the forehead or the neck of the person.
2. By examining the person's skin whether it is flush or red.
3. Fatigue gives away the person condition which is accompanied by lethargy.
4. Body pain.
5. Dehydration of water in body etc.,[8]

Yet, these above symptoms are internally co-related with variation with heart beat which is obviously featured with the flow of pulses. Thus, doctors learn the art of reading the pulses by which they determine the condition of the person. So, the wearable devices are centered around the concept of reading pulses and have been characterized to display the stature of the one who is wearing it.

Android applications and web application could be used to aid the wearable devices. This is for easy interaction with device in case of without touching it. These applications are used to record data from wearable device and even configuration of the device is possible.[5]

II. SENSOR FOR HUMAN ACTIVITY MONITORING

This section deals with a review of few sensors which are commonly used for monitoring different human activities. Sensors will measure the physiological parameters of human accurately and reliably over long duration. The rapid development of nano technologies has enabled the rise of various kinds of smart sensors to sense and estimate data more effectively and rapid, with lower energy consumption and less processing resources. Body temperature is one of the physiological parameters measured by wearable sensor for human activity monitoring. The variation in temperature measured on the skin will helps to measure internal humidity of the person and can be used to detect various health condition. The another important measuring physiological parameter of human is heart rate. Heart rate is a precisely regulated variable, which plays critical role in health and disease of human. There are many methods available to measure heart rate of the person; Photoplethysomography (PPG) is the new trending methodology for monitoring human

heart rate. PPG is a technical term which emits light into the skin and measuring the amount of light that is scattered by blood flow. That's a simple way, but PPG is based on the fact that light entering the body will migrate in an estimated manner as the blood flow dynamics change, such as with changes in blood pulse rates (heart rate).[9]

The movement of the human can be monitored by accelerometer sensor. Accelerometer has been used in various studies and particularly to monitor movement of human for example to measure metabolic rate of human, physical activity levels, balance and detect falls.[7] A single triaxial accelerometer can provide object's acceleration in three directions which include the impact of gravity. A coordinate will be built when the accelerometer is fixed on human's body.

Wearable ElectroCardiogram (ECG) sensors are also used to detect cardiovascular disease, especially for people with chronic heart problems. The ECG signal grants very useful information about the function of the heart beats, which are used in diagnosis of cardiac disease.[10] The above sensors are helpful in monitoring the human activities in various prospects. There may be any other sensor employed depending on special requirements or critical needs. It is proven that potential experiment on wearable device will diagnose the abnormalities such as congestive heart failure, the prevention of chronic condition such as diabetes, dizziness etc.

III. EXISTING SCENERIO IN FALL DETECTION AND HEART RATE MONITORING

Occurrence of fall can be intentional or unintentional. Intentional falls occur mostly to the young ones by means of accident and unintentional falls occur to aged people due to weakness or dizziness. These falls could have serious consequences if the injured ones aren't taken for medical attention within a short period of time. According to statistics the consequence is not totally caused by fall alone but due to the delay in assistance and medical treatment. In order to reduce consequence of fall, the time taken between the fall and medical assistance must be minimum.

Automatic fall detection become an urgent need in both home and hospital environment. The fall can be detected using the motion and pose of the person. In almost all the fall detection can be done using sensor and classifier is inevitable. IMU (Inertial Measurement Unit) is composed of accelerometer and gyroscope, which is widely used in INS (Inertial navigation system). When mounted to the body of subject, IMU can obtain acceleration and position of the person with high accuracy rate.[1] Since position of the body can be detected with gyroscope sensor. 1-axis gyros can detect three stages of process in human such as collapse, impact and inactivity. The another sensor for monitoring axis view position of human accelerometer sensor. The 3-axis accelerometer sensor will provides acceleration of the human motion in co-axial manner such

the three different axis from the human position can be monitored. Using the gyroscope and accelerometer the complete movement of the human can be monitored easily. So far the accelerometer reading only can be viewed in the sensor device but the alert message when the human fell down is not approached till today.

The another physiological parameter monitoring is human heart beat rate. Heart rate decreases are highly threating which is one of the main causes for sudden death. The cost for detecting and treating cardiovascular disease is very high, during which monitoring and accessing the heart rate states from diagnosing every cardiac cycle is important and essential. Electrocardiogram sensor devices have attracted great research attention in monitoring human heart rate. The sensor can record and diagnoses abnormal cardiac arrhythmias.[10] So far the person met with cardiac arrest can be only hospitalized by their neighbors or relatives and there is no providence of automatic alert message through wearable device.

IV. CHALLENGES IN WEARABLE DEVICE

The research and scientific communities are working hard to design and develop smart wearable devices to be used for continuous monitoring of different human activities for 24x7. The physical impact of a sensor operation needs to be taken into consideration and can be addressed by appropriate design of multiple sensor components such as processor, radio and optimization of data algorithm. While the sensors are placed on the body, the risk of thermal injury to tissue may also be can be considered and can be reduced by limiting the frequency range. Moreover, data transmission may suffer from deep fading and packet loss due to the dynamic on body channel induced by surrounding and movement of human. The most important requirements for an effective software framework, enabling efficient signal-processing application had been reported. A health monitoring system consisting of wearable sensor such as ElectroCardiogram, temperature, skin humidity, accelerometer and smartphone based network has been reported to provide tele medical services. The big challenge of the work is to have comfortable wearable sensor system which can be wear by person without feeling any discomfort.

V. REVIEW ON EXISTING WORK

According to Subhas Chandra Mukhopadhyay[1] the health care system is going through a transformation where continuous monitoring of health status of a patient is possible even without Hospitalization. This can be achieved using the Wearable sensors that available in the market. Major issues faced are the Energy Harvesting in the Wearable Sensors. Available of different types of sensor that leads to difficulty In choosing the better one. High Cost of the Sensors. Several challenges faced on design, development, yarn, implementation and utilization and monitoring. Cost in utilization of the Cloud source.

According to the Narendra Kumar et al[2], People are facing many physical, physiological, psychological problems. And they have no time to visit the doctors again and again. In order to provide a solution the author suggest the usage of Wireless Sensor Network(WSN) and Intelligent Personal Digital Assistant (IPDA). A separate Server is used for the monitoring of the Healthcare. BAN

pulse. Here he uses the (Photophlethysmography) PPG and Arduino Developer Board. No electrical method is followed so there will be no accuracy in the data produced.

According to Yashasavi YadaV and Manasa S Gowda[4] Many people among us lose their life to heart attack because of their diet, age, less physical activity and many other factor. And the literature survey of him says that most of the heart attacks are 5 to 6 times more common during the hours of one to five. The leading cause of death worldwide is heart attack.

is a Emerging Technology, Signal & Path Performance Usability and Communication Challenge.

According to the Bandana Mallick and Ajit Kumar Patro[3] Heart rate is very vital health parameter that is directly related to the soundness of the human cardiovascular system. It can be measured either by the ECG waveform or by sensing the According to Jay Chen et al [5] unintentional falls are common cause of severe injury in the elderly population. By introducing small, non-invasive sensor motes in conjunction with a wireless network. The usage of accelerometer sensor plays a major role in detecting the acceleration of human body. The gyroscope sensor appropriate value with reference to the significance of every motion of the body. The purpose of alerting mechanism for fall gives a opportunity to save one's .

TABLE I
Summary on Research work for health monitoring

TOPIC	PROPOSED BY	FEATURES	DRAWBACKS
Wearable sensors for human activity monitoring	Subhas Chandra Mukhopadhyay 2015[1]	Detailed study in various wearable sensors and implementation technology	Challenges faced during wearable device only focused and not in wearable network creation.
Wearable sensors remote healthcare monitoring system	Narendra Kumar et al 2012[2]	Periodic analyse of patient is monitored remotely by doctor in medical center	No emergency alert is given to doctor; only the monitoring process is available.
Heart rate monitoring system using finger tip through Arduino and processing software	Bandana Mallick and Ajit Kumar Patro 2016[3]	Complete monitoring of human heart beat rate with photoplethy-somography (PPG) methodology.	Only the human heart beat is monitored and does not focus on other physiological parameters.
Heart rate monitoring and heart attack detection using wearable device	Yashasavi Yadav and Manasa S Gowda 2016[4]	An alert message can be send to emergency contact persons.	No storage of the data collected from sensor and doesn't used for further reference
Health monitoring and management using Internet-Of-Things(IOT)sensing with cloud based processing: Opportunities and challenges	Moeen Hassanalieragh et al 2015[5]	Detailed review report about the wireless body area network and visualisation of every data from our human body.	Doesn't concern with major review report about transmission of data from one device to another.
Wearable sensor for reliable fall detection	Jay chen et al 2005[6]	Detailed review in the study of analysing fall of the person and visualising variation in the motion of data.	Only focused on detection of fall rate and not concerned with other parts of the body parameter.
Embedded Based Patient Monitoring System with First Aid Tracker	Naveen Kumar.J and Sankararaman.T.C 2016	An alert system is embedded with health monitoring system and provision of alert message when the patient is in abnormal condition.	The alert message was send through GSM module and storage of data is not provided for future analytics.

VI. CONCLUSION

According to the study made in this article, the wearable device will gives an opportunity to monitor the health status of the human with low-cost and in efficient way. It is found that researchers are bewildered with the ability of what the wearable device can perform in this smart world. We have found that newer way alert mechanism can be created for human to give information about their abnormalities to their care givers.

REFERENCES

[1] Subhas Chandra Mukhopadhyay "Wearable sensors for human activity monitoring", *ieee sensors journal,vol.15,no.3,march 2015.*

[2] Narendra Kumar, et al "Wearable Sensor for Remote Healthcare Monitoring System ", *International Journal of Engineering Trends and Technology ,2012.*

[3] Bandana Mallick, Ajit Kumar Patro "Heart rate monitoring system using finger tip through arduino and processing software", *International Journal of Science, Engineering and Technical research ,January 2016.*

[4] YashasaviYadav, et al "Heart rate monitoring and heart attack detection using wearable device " , *International Journal of Technical research and applications,(May-June) 2016.*

[5] MoeenHassanalieragh, et al "Health Monitoring and Management Using Internet-of-Things(IOT) sensing with Cloud-based Processing: Opportunities and Challenges" , *IEEE International Conference on Services Computing ,2015.*

[6] Jay Chen∗, Karric Kwong, et al. "Wearable Sensors for Reliable Fall Detection" *IEEE Engineering in Medicine and Biology 27th Annual Conference Shanghai, China, September-2005*

[7] Naveen Kumar and Sankararaman "Embedded based patient monitoring system with first aid tracker" *International journal of innovative research in science, engineering and technology, March 2016.*

[8] http://www.analog.com/en/analog-dialogue/articles/detecting-falls-3-axis-digital-accelerometer.html

[9] http://www.wikihow.com/Check-a-Fever-Without-a-Thermometer

[10] http://valencell.com/blog/2015/10/optical-heart-rate-monitoring-what-you-need-to-know
https://www.cooking-hacks.com/electrocardiogram-sensor-ecg-ehealth-medical

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