

**REVIEW ARTICLE****A literature Survey: Health-care Monitoring System**P. Pradeep<sup>1</sup>, M. Arogia Victor Paul<sup>2</sup>, Arbind Kumar Gupta<sup>3</sup>, S. Venkatesan<sup>4</sup>*Department of CSE, Dayananda Sagar College of Engineering, Bengaluru, Karnataka, India***Received : 15/02/2018; Revised : 28/03/2018; Accepted : 11/04/2018****ABSTRACT**

The current scenario of designing wearable biosensor systems and their advance biosensors for an effective health-care monitoring system has a lot of attention in the scientific community, which makes worth for the industry aspects during the recent years. In addition, this advanced health-care system focuses on high quality and very much low cost, also which is to be reliable and secured. Health care is been a big issue due to lack of availability of expert doctor's and the current trend to focus on the existing issues. In this paper, it briefs the information about the telemetric and Holter electrocardiograph (ECG) Warehouse (THEW) technology benefits, which has the scientific community which scopes about to advance in the field of ECG and cardiac safety. In addition, here, it focuses on Virtus Middleware used in the health-care solutions. The main advantages are as low power consumption by the sensors and an early warning system which is very helpful in general wards in the hospitals for alerting the patients from serious health defective conditions. Here, this literature review gives an idea regarding the immediate feedback which is been provided to the patient and the caretaker, through a concept of wireless sensor patient monitoring system. This gives more advantage of storing the sensors' patient data in cloud and analysis of data from the cloud, which also alerts to the patients and caretaker through Short Message Service.

**Key words:** Cloud storage, electrocardiograph, internet of things, pulse sensor, security, temperature sensor

**INTRODUCTION**

Wearable sensors for health-care monitoring is achieved, a lot of attention toward the industrial markets, where these advanced sensors have also made a remark in health-care monitoring systems. Here, smart and connected health care is an important one among the factors that focus in internet of things (IoT). This survey speaks about the information about the data transmission, cloud storage, security, messaging alerts, and the immediate feedback given by the different authors. In this survey, it specifies about the THEW technology for cardiac monitoring and improvement of reliable electrocardiograph (ECG) that has been collected. In these, Virtus is a middleware in the application layer for wireless sensors. In addition, there will be an early warning system (EWS) for effective patient monitoring in the hospital. Investigation of this information that

is gathered from the patients gives general idea of information mining.

**MOTIVATION**

India is the largest population country. The growth here increases day to day, and the basic need for people is food and health care. Health care is mainly needed for elderly people who cannot afford more money for health-care checkups in their day-to-day lives.

**Objectives**

A number of technologies can reduce overall costs for the preventing or managing the illnesses. It includes devices that constantly monitor health, devices that auto-administer therapies, or devices that track real-time health data when a patient self-administers a therapy. Nowadays there exist a strong network connectivity and internet services that interlink the smart devices to maintain. These devices are now increasingly

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used and integrated with telemedicine and telehealth through the IoT.

## LITERATURE SURVEY

Pantelopoulos and Bourbakis<sup>[1]</sup> give information about the current existing research and development of wireless biosensors system for effective health-care monitoring. This system consists of wireless sensors using ZigBee wireless technology and ultra-low power technology. This system also supports wireless communication for wireless body area network (WBANs), in which it adapts the individual physiological conditions using artificial neural network. It also uses certain ranges in between 2360 and 2400 MHz band for medical BAN services to avoid interferences from wireless technologies, where these wearable systems must be reliable, multifunctional, and easy to use for the patients monitoring. It must be applicable for real-time usage.

Milenkovi *et al.*<sup>[2]</sup> spoke about the closely monitoring of health-care system, in providing feedback and alert medical person to maintain optimal health-care monitoring. This system makes the integration of physical sensors, embedded microcontrollers, and radio interfaces on a single chip called as wearable wireless body/personal area network. In addition, it is very cheaper in cost and portable to carry. It also provides an immediate feedback to the user about the health status and updates the medical records in the system. The system supports continuous health monitoring and provides benefits to patient. Where, there is an improvement needed on quality of service (QoS) for a wireless communication, reliability of sensors, security, and standardization of interfaces and interoperability.

Kumar *et al.*<sup>[3]</sup> spoke about the very wide usage of wireless sensor network for remote monitoring of patients, storage of data in cloud environment, and also the patient data are taken, where it is transferred through a wireless network without any interrupt. So that we can monitor the accumulated data from the patient using some smart applications with a comparison to the existing information in the system. Alert Short Message Service is sent to the doctor and to the patient caretaker. To provide the security and privacy to patient data and mobile computing, there is a need for health-care services with high quality and low cost that includes data

analysis and cloud computing.

Nithin *et al.*<sup>[4]</sup> spoke about the sensors that will record not only the current day's data but also the previous days. Data provided by the sensors are longitudinally rich and helpful to the doctor to give precautions. WBAN consists of wearable sensors, which measures various physiological parameters. Sensor transmits the gathered data to a gateway server through Bluetooth connection. Gateway server stores data into remote server for later retrieval by clinics through internet. Real time continues monitoring from anywhere in the world. It can be extended by adding database management and cloud storage. Doctors can access the data of the patient.

Chou *et al.*<sup>[5]</sup> spoke that there is a need for sufficient energy required for the data collection by a wireless sensor network. The existing adaptive compressive sensing algorithms obtain a very good data, but these cannot be added to the WSN. So, that the methods like information collection framework and adaptive projection vectors are used for iteratively compute projections that also maximize the ratio of the information that gains to the energy required to get the information to realize the energy efficiency in absolutely collecting the information in WSN.

Couderc<sup>[6]</sup> speaks about the ECG current signals and the resources available to the scientific community, in which the Telemetric and Holter ECG Warehouse (THEW) is an initiative that developed to the scientific community to the advance in which it assures about the field of ECG and cardiac safety. Furthermore, in this, an initiative has grown rapidly, and the organization using data warehouse concepts is growing continuously. So that the improvement is needed in ECG technology for cardiac safety.

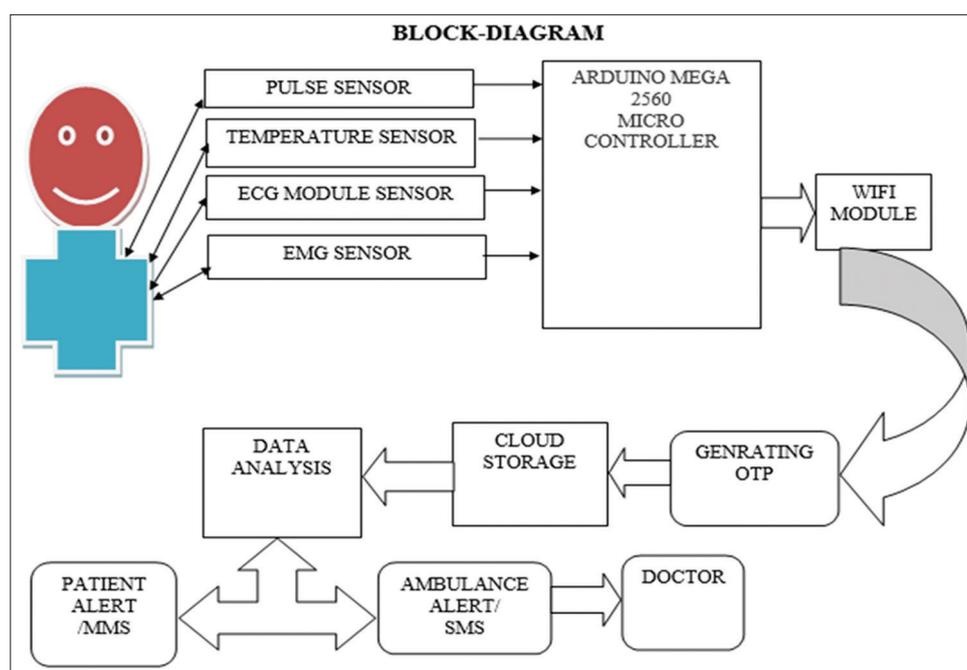
Bazzani *et al.*<sup>[7]</sup> gave information about the IoT technology in which it continuously monitors the patient's activity independently in remote monitoring. In addition, a patient activates from home and can be handled using an IoT paradigm. Here, the concept is of IoT, which is linked with the architecture layer that is a middleware. VIRTUS is an event-driven middleware, which tells about the IoT paradigms in e-health.

Kocabas *et al.*<sup>[8]</sup> said that the digital health is the next big revolution when the internet was invented. Here, remote data are widely spread in the system, where system consists of two super layers named

**Table 1:** Comparative analysis of technology in healthcare monitoring system

Author	Years	Technology	Existing problem	Proposed system
Pantelopoulos and Bourbakis	January 2010	1. ZigBee wireless 2. Ultra low power technology	1. Biosensors system for effective health-care monitoring 2. Wireless communication for WBANs	1. Reliable 2. Multifunctional 3. Ease to use
Milenkovi <i>et al.</i>	2006	1. Embedded microcontrollers 2. Radio interfaces	1. Providing feedback 2. Alert medical	1. QoS
Kumar <i>et al.</i>	January 2014	1. Cloud environment	1. Comparing with lookup table 2. SMS	1. Security 2. Privacy
Nithin <i>et al.</i>	October 2014	1. Bluetooth	1. Record not only the current day's data but also the previous day's	1. Database management 2. Cloud storage
Chou <i>et al.</i>	October 2009	1. Sufficient energy required for the data collection by a wireless sensor network	1. Adaptive compressive sensing algorithm	1. Heuristics algorithm
Couderc	2010	1. ECG-related technology	1. THEW	1. Improvement needed in ECG technology for cardiac safety
Bazzani <i>et al.</i>	June 2012	1. Bluetooth 2. ZigBee wireless	1. IoT paradigm 2. Virtus	1. Focusing more on advantages of Virtus
Kocabas <i>et al.</i>	October 2013	1. Cloud storage 2. Radio communication	1. Two super layers named the front end and the back end 2. Front end acts as an interface between the patient and the system. Also, back end acts as interface between the system and the doctor	1. Privacy 2. Security 3. Analytics
Page <i>et al.</i>	2015	1. ZigBee 2. Cloud	1. Continuous monitoring 2. Feedback 3. Automatic alarm	1. Database 2. Automatic updates from the live data itself
Mao <i>et al.</i>	April 2014	1. Data mining	1. EWS 2. Novel data mining framework	1. Bucketing technique

EWS: Early warning system, SMS: Short Message Service, QoS: Quality of service, WBAN: Wireless body area network, THEW: Telemetric and Holter ECG Warehouse, IoT: Internet of things

**Figure 1:** Shows block diagram of patient healthcare monitoring system

the front end and the back end. Here, front end acts as an interface between the patient and the system. Furthermore, back end acts as an interface between the system and the doctor. Here, privacy and the security part have been included, in which

it also identifies business opportunity in arising from the system during sharing and analytics. Page *et al.*<sup>[9]</sup> said that there is no proper method to predict the cardiovascular diseases chronic heart failure; therefore, there is a need for comprehensive

monitoring system, which is required for effective clinical diagnostics. In addition, this system allows continuous monitoring of the patient in which it gives feedback by an automatic alarm for patient's long-term status report. This system is very helpful for patients with high risk of life, like an ECG monitoring, and also in this, a novel virtualization mechanism allows the doctor to monitor the real-time multiple patients. Thus, it requires a need to implement sending the data to a proper database and should have an automatic updates from the live data itself.

Mao *et al.*<sup>[10]</sup> briefed about the EWS in which it is designed to identify the signs of clinical deterioration and to provide an early warning for serious clinical events. Thus, novel data mining framework is used for analyzing typical medical data. From the novel data mining, here, we can make early prediction and prevention based on data from the system so that it is very helpful for General Hospital Wards. In addition, these predictive systems are been developed for patients for early predictions. So, that these lead to the introduction of bucketing technique which is used for capturing vital signals changes in the system.

## PROPOSED SYSTEM

Here in Figure 1, the specific biosensors are been associated with the patient body. Along with this, all the above shown biosensors gather the information, while the program for every sensor is incorporated in the system for the support and keeping in mind that the code is running, and the information is gathered. In addition, by utilizing Raspberry pi microcontroller, all sensors are associated here, using an in-built Wi-Fi Module, so that the information exchange to the nearby server using Tomcat version 7, along with Advanced Encryption Standard (AES), has been used for encryption and decryption of the information in which it is utilized for security purpose. Hence, data analytics will come into picture which depends on the information that put away in cloud (Sqlyog) for everyday usage, with graphical representation. Here, message alarms are sent to the doctor and patient guardian on emergency. The doctor is given with one kind of client ID and password for authentication along with the patient so that the doctor can verify the information and treatment can be given to the patient.

Here, we discuss usage of IoT in government and private sector:

Apple: Apps and devices were introduced to take care of health during our daily work, for example, apple watch that tells about accelerometer and heart rate of the body. Health apps also give information about the performance of the body.

Navy health: Developed a breastfeeding pump that operates by the use of hydraulic suction without using a regular electric vacuum pump. The pump is cheaper compared to the existing one.

Sunshine: User information is taken from the usage of smartphone and crowdsource. Sunshine offers users to make the best decision of life compared to the world. It also monitors user sentiment throughout the day to identify stressors.

Orbita: It has been integrated with major smart home technologies such as Amazon Echo and Google home. They help to enhance lives of chronic care recipients and care provider.

Orbita solutions will integrate with wearables, home health monitors, and smart home technologies to provide health awareness.

Vision for internet of things health-care status by some technology firms.

## CONCLUSION

This survey briefs about the concept of biosensors for an effective health-care monitoring system. THEW technology is a focus for the improvement in cardiac and ECG monitoring. In addition to this survey, there is a need of security aspects, message alertness, and simulation for performance calculations.

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