

# A Survey on IoT Cloud based Contactless Health Monitoring System

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**Abstract** - A Contactless Health Monitoring System can ensure better well-being of patients and condition of life especially in remote areas where there is no healthcare system. In this project, the vital signs of health like body temperature, pulse rate, oxygen level and ECG are measured using the sensors like MLX90614, MAX30100 and AD8232 the measured data is sent over to the IOT cloud to get recorded history of the patient. An android app is also designed to display the current parameter values which would be installed in the Doctor's phone monitoring from a remote place. We tried to propose a model which is non-invasive in nature and can monitor the patient in remote area through sensor connected networks. The principle aim of this model is to provide healthcare facilities in Hospitals, Malls, Schools, Offices, and Commercial & Residential Areas etc. which can be used as a self-service.

**Key Words:** ESP32 Microcontroller, remote health monitoring, IOT, oximetry, heart rate, temperature, ECG

## 1. INTRODUCTION

In the ever-increasing world population, people are suffering from chronic diseases at a high rate. The main reason behind this is daily usage of tobacco, alcohol consumption, over stress, no physical activity etc. According to the world health organization (WHO), millions of people die due to increased cholesterol levels, overweight, high etc. The person who is affected by chronic disease must handle his life properly with at most care and should be treated and monitored by a doctor all the time. The important parameters for the chronic diseases are the heart rate, body temperature, amount of oxygen in the blood etc. The patient monitoring system allows doctors to supervise many patients at a time.

The heart rate indicates the soundness of the heart. Heart rate for adult males on an average is 70bpm and for adult females on an average is 75bpm. With the help of these values, the heart condition can be tracked. The body temperature tells the body condition. The normal human body temperature is  $98.6^{\circ}\text{F} \pm 0.7^{\circ}\text{F}$ . Any variation in the values of body temperature can risk improper human health.

The amount of oxygen in the blood is calculated by the Spo2 sensor which is a very vital parameter for human health. The normal oxygen levels in the blood varies

between 75 to 100mm of mercury.

There may be no procurement on check those parameters the point when they exchange will home. What's more consequently there is an opportunity that the ailment might come back once more. Patient-Health's information (high-temperature, Cardiac frequency, position) will be every now and again measured and transmitted through net-server. Time about sending (say each 3 min) could a chance to be situated. Checking individual takes in tolerant particular edge. Approximately the standard body-temperature of a tolerant is  $37^{\circ}\text{C}$  while lone persnickety senses hot In as much body temperature is  $37.0^{\circ}\text{C}$ . By utilizing a averaging technobabble In An moderately long time, eyewitness could take these thresholds for patients. Utilizing same provision previously, doctor's advanced mobile phone, specialist might perspective as much patient's wellbeing status. At any of the parameter dives past the edge esteem he will get a caution notice.

The amount of oxygen below 60mm of Hg is considered as low. It is also an important parameter for human health. The regular monitoring of these vital parameters is very important for better health and great health. For the measurement of these vital parameters, an automated system must be designed for continuous monitoring.

## 2. LITERATURE SURVEY

In paper [1], "IOT Based Emergency Health Monitoring System" Author Md. Raseduzzaman Rumen, Khan Russian Johan, Amit Bara, Md. Jamil Ronin, Balladur Rahman, in this decade, IOT based system place the key role in medical appliances. For that reason, many researchers are trying to develop numerous IOT based medical appliances. Some the researcher work is given below; a researcher implemented a patient monitor system, which aim is to gather data for clinical research and academic studies. PHS will enable faster and safer preventive care, lower overall cost, improved patient centered practice and enhanced sustainability. In this paper researchers implemented a system, which is monitoring the body parameter such as pulse rate, ECG.

ARM7LPC 2138 processor is used as a main interface and the data displayed by using graphical user interface. If any of the parameter goes to normal range then a notification sends to the mobile via SMS. In this work, an electronic device is described which monitors the elderly people's health in their own home.

In paper [2], "IOT based Real Time Health Monitoring" authors Vain Yuri, D.C. Shebang There are many approaches for measuring the vital parameters for health monitoring. Alexis Bell et al. developed a prototype for a wireless patient monitoring system. This system was measuring oxygen concentration in blood, pulse and temperature by interfacing with sensors. The drawback of the design was thermistor positioning, the blood oxygen concentration was not calibrated; the hardware requirement was more and lead to the high cost of the prototype. Sager R Patel et al. designed patient monitoring using wireless technology. It used sensors for measuring the vital signs of patients. The drawback was the readings were not proper and showing glitches while showing the output. So hail Shaikh et al. designed a system for monitoring patients using IOT. The main target was just the data transmission from patients to the doctors. The drawback was the non-inclusion of MAC protocols for still efficient data transmission. T K Ramesh et al. developed a wireless network protocol for monitoring the patients. The comparison of wireless network protocols is done. The drawback was the communication in rural areas was not efficient. Dr. Breath Kumar G J proposed a design for monitoring the patient's vegetative state using cloud computing and IOT. It shows to the family members the patient condition remotely. The main drawback is it's applicable for patients only in a vegetative state. Susan M et al proposed a design.

In paper [3], "IOT Based Remote Patient Health Monitoring System" authors Ghulam Gauss Wars, Kantian Hans, and Sunil Kumar Khatri Door ET. Al checked up blood pressure of a person with the help of Keep in Touch connected to Android based Smart Phone through a Near Field Communication. It is based on inductive and magnetic coupling. Upon getting the readings from Keep in Touch all the data is transferred on the smart phone. Since the data is in closed loop so the data is transferred to a secure website and with the help of this website anyone can monitor the readings of blood pressure level. Jun aid Mohammed ET. Al evaluated the Electrocardiogram of the person and monitored the readings anywhere around the globe using IOIO- OTG Microcontroller. An Android application was developed for displaying the readings of Electrocardiogram reading monitoring. IOIO-On the Go microcontroller is able to transfer the data to the android device using a universal serial bus connection, Bluetooth connection or a near field communication.

Mohammed S. Jesses ET. Al is based on the monitoring of the temperature of human body using a Raspberry-pi motherboard that is connected to a cloud based system.

In paper [4], "An IOT based Patient Health Monitoring System" authors D. Shiva Rama Krishnan, Subhash Chand Gupta, Tanupriya Choudhury A no. of assessments on the theme of Wireless-Sensors methods were done before as projects reports or, as research papers on IOT based Patient Health Monitoring System. The First System which the researchers made patient health-monitoring system using Atmega-8 microcontroller with Wireless Body part Sensing-Network (WBPSN). In this work, the sensors which are utilized here are Temperature sensor, Bpm sensor, Heart beat sensor. These sensors are put on human body which are screens the wellbeing condition without irritating the day by day timetable of the patient and Wellbeing observing framework comprises of sensors, microcontroller, Lcd show and GSM modem to transmit or get wellbeing related information to or from the specialist. Thus, at doctor's facility same GSM modem is utilized. It takes small amount of time to tell the patients and their loved ones about the results and delivers the report directly with no interruption. The second one uses similar technique to monitor the parameters. Monitored parameters are sent by utilizing RF-ID peruser, Bluetoothv2, GsM and Umts remote innovation. Information gets transmitted as the bundles. This framework stores past information. The third one is similar to the First system but it instead it uses Atmega-328 micro-controller and the wifi module is employed to transmit the data to the doctor and the loved ones of the patient. WI- Fi module 8662i is employed which uses its Cip- Mux Fetch and upload mechanism.

In paper [5], "Study of Health Monitoring System" authors Megha Chavan, Prajakta Pardeshi, S.A. Khoje, Manasvi Patil This paper reviews advances in smart health monitoring system with their application especially in medical field. Study of wireless, remote and mobile health care systems emphasize effectiveness of system in hospital as well as home environment. Many researchers developed online or web-based monitoring systems which plays crucial role to monitor patient by different approaches producing high quality data and accuracy.

Most monitoring system major vital signs and send it to remote station like local server, PC/Laptop for further processing. Different communication protocols like Zig bee, Wi-Fi, Bluetooth are used in smart health monitoring. Various health monitoring platform are validated by different experimental study and clinical trial. By validation procedure, one can easily understand accuracy, flexibility, precision rate etc. of various systems in depth. During last few decades, advancement in health care system growing rapidly. Smart health monitoring plays crucial role in hospitals, residential and outdoor settings by different communication technologies like global positioning system (GPS), radio frequency identification (RFID).

Increment in health care technology concern with medical data quality, security, stability and accuracy of system.

In paper [6], "Development of Smart Healthcare Monitoring System in IoT Environment," authors Md. Milon Islam · Ashikur Rahaman · Md. Rashedul Islam . Healthcare monitoring system in hospitals and many other health centers has experienced significant growth, and portable healthcare monitoring systems with emerging technologies are becoming of great concern to many countries worldwide nowadays. The advent of Internet of Things (IoT) technologies facilitates the progress of healthcare from face-to-face consulting to telemedicine. This paper proposes a smart healthcare system in IoT environment that can monitor a patient's basic health signs as well as the room condition where the patients are now in real-time. In this system, five sensors are used to capture the data from hospital environment named heart beat sensor, body temperature sensor, room temperature sensor, CO sensor, and CO2 sensor. The error percentage of the developed scheme is within a certain limit .

In paper [7], "Remote patient monitoring: a comprehensive study," authors Lakmini P. Malasinghe · Naeem Ramzan · Keshav Dahal . Healthcare is a field that is rapidly developing in technology and services. A recent development in this area is remote monitoring of patients which has many advantages in a fast aging world population with increasing health complications. With relatively simple applications to monitor patients inside hospital rooms, the technology has developed to the extent that the patient can be allowed normal daily activities at home while still being monitored with the use of modern communication and sensor technologies. Sensors for monitoring essential vital signs such as electrocardiogram reading, heart rate, respiration rate, blood pressure, temperature, blood glucose levels and neural system activity are available today. Range of remote healthcare varies from monitoring chronically ill patients, elders, premature children to victims of accidents. These new technologies can monitor patients based on the illness or based on the situation. The technology varies from sensors attached to body to ambient sensors attached to the environment and new breakthroughs show contactless monitoring which requires only the patient to be present within a few meters from the sensor. Fall detection systems and applications to monitor chronic ill patients have already become familiar to many. This study provides a review of the recent advances in remote healthcare and monitoring in both with-contact and contactless methods. With the review, the authors discuss some issues .

In paper [8], "Contactless Patient Monitoring for General Wards," authors Tolga P. NAZIYOK1 , Atinkut A. ZELEKE and Rainer RÖHRIG . Even in general wards often occur sudden, serious life-threatening situations, e.g. 18% of patients develop post-surgery complications . State of the art to forecast critical situations is to measure the

early warning score (EWS) or to monitor the vital signs of patients . This requires personal resources for measuring the EWS. On the other hand a monitor connected to each patient is needed. Currently this needs sensors on every patient, which is a source of failures and false alarms. An alternative solution might be technologies for non-contact monitoring like ballistocardiography (BCG), radar or thermography based technologies . The purpose of this review is to assess the state of the art of potential techniques for contactless patient monitoring in general wards and the challenge of monitoring rooms from any direction and with long distances between the sensors and the humans. The Search was performed on MEDLINE. The Inclusion criteria were studies with technologies to receive cardio and respiratory signals from humans without contact. To maximize recall and precision, three categories of search terms was built: The first describes the technology used, second what kind of data was collected and the third included terms that described a contactless system computer scientist and a public health informatician performed an independent assessment of the relevance of the papers in three stages.

### 3. DISCUSSION

Internet of Things (IOT) can be defined as when "Things start to think". Here things in IOT can be any physical object or entity which has unique identifiers (UIDs). It is a system of interconnected devices (with UIDs) have the ability to sense, accumulate and transfer data over a network with less or without human intervention and can be utilize remotely. In healthcare sector IOT plays an important role as it is reliable, flexible and affordable system, it offers an optimizing technology to acquire the leading healthcare services and can meliorate the current medical services. There are many vital signs for measurement of health parameter, out of which measurement of body temperature is used to determine that person is having fever or not.

As the body temperature varies with the variation in the temperature of environment i.e., in dawn the temperature happened to be lowest while highest in the afternoon. 37 °C or 98.7 °F is considered as the normal body temperature of a person. As we know the about the temperature variation, both the variation of environment and body need to be measured. Similarly, the pulse rate of a person plays an important role in the cardiovascular process. Pulse rate expressed in beats per minute (BPM) measured by beats of heart in per minute. About 72bpm – 100bpm is taken as normal, if it either exceed or decrease then prevention is needed. BPM depends on how a person is working i.e., if a person is exercising then the heart rate increases.

The fitness of a person is decided by the rate at which pulse rate comes to normal point. Along with this oxygen level as well as ECG is monitored which provides more insights of persons health condition. With India being the second most populous country in the world, medically

challenged people increasing steadily rural population are affected most because of the lack of medical practitioners. India has a vast healthcare system and this system is divided into two sectors: public and private but there are many differences in the level of healthcare of rural and urban area resources, as well as also in the public and private healthcare facilities. With rapid increase in population, is getting very challenging for health division of India to provide a proper and well-ordered healthcare for the rural area and remote population. Even 75% of the healthcare infrastructure are in urban areas where only 27% of the population is living. The remaining 73% of the country's population is lacking proper primary healthcare facilities. A well-equipped health monitoring system is most publicly applicable to professionalize the health maintenance in necessitous population of the country. E-healthcare is an appropriate way to provide medical care to the remote area users with cheap and easily overcome the problem of unavailability of doctors in isolated areas.

#### 4. CONCLUSION

In this project, we have proposed an IOT based model for remote patient health monitoring. With the help of sensors, the proposed system is able to track the basic vitals like temperature, heart rate, oxygen level and electrocardiogram readings of patients at home or remote site. The doctor can remotely monitor the live status of the patient from anyplace with the only constraint that there should be internet connectivity as to receive the live updates about the patient. The proposed model is extremely useful for the society and would supplement the existing solutions for health monitoring.

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