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**“REVIEW ON REMOTE HEALTHCARE MONITORING SYSTEM FOR HYPERTENSIVE  
PATIENT USING IOT”**

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**ABSTRACT:** *Day by Day world's population as well as chronic and health problems would be increases and needs to develop efficient and good healthcare system for maintaining the healthy life of people. Number of users allows connecting the various resources like sensors and collecting the real time data for processing. In this paper we proposed the healthcare model named as K-Healthcare based on 4 layers such as sensor layer, network layer, Internet layer and services layer. Each layers of model are coordinate to each other successively and provide the platform for accessing the patient health information on mobile phones. Especially for the old age hearth problem patient needs continuous monitoring but 24 \* 7 continuous monitoring is difficult because such system leads to high cost. In this review paper we will propose low cost and easy to use remote healthcare monitoring system for hypertensive patients based on IOT. A bio-signal sensor and a microcontroller are the major components of the system. The data has been collected using the sensor technology and are transmitted to an intelligent server. The IOT system is able to monitor the location of the patient. The proposed system consists of a body sensor network that is used to measure and collect Physiological data of patient. In case of emergency situation the caretaker and doctor are intimated through short message service for providing adequate help.*

**Keywords:** Internet of Thing, Sensors, Remote Healthcare Monitoring System, K-Healthcare

## **1. INTRODUCTION**

The medical health problem is a big challenge that is facing the today's world. An old age person who is suffering from heart problem or any other chronic diseases and is at home for long period and continuous monitoring of such patient is a tedious job. Solution for this situation is to use sensor technology in which patient can be monitor continuously without admitting to hospital. The sensor technology is a new approach used in medical field for monitoring the patient continuously and analyzes the patient's condition in real time. Wearable sensors collect the patient data like ECG, Blood pressure, temperature, and send continuously to remote location using the wireless technology based on Internet of Thing (IOT). Internet of Thing has good impact on reducing the cost of healthcare and improving the treatment of patient. This type of technology helps to track the patient's health information effectively and take immediate action. IOT provides tremendous changes in the daily activities of person and also provides the alert mechanism i.e. send sms to family members or caretaker of patient. In this paper we developed a model for continuous monitoring the patients from remote areas using the various IOT sensors tools.

Following are the some health care challenges presented that inspired to this research work.

In India, sometime in rural as well as urban areas the patients are died because of lack of healthcare resources like medical instruments and most of time doctors are not

available in hospital and also unavailability of health monitoring devices. There are quantities of the healthcare framework was designed which gives remote medicinal services benefits however there have some restriction, for example, exorbitant, absence of patient information security and profoundly computational and communication overhead [1]. The quantity of people matured at 60 years and over on the world arrived at 910 million in 2015, and it is anticipated to develop to 1.5 billion out of 2030 and about 2.5 billion of every 2050. It is determined that the 65+ is the largest age group and the normal age will be roughly 51-55 in numerous nations in Asian Countries in 2050 [2]. Secondly that increases the various chronic diseases like heart failure, arrhythmia, blood pressure, diabetes etc. Third challenges are to increases the cost of medical services [3].

## **2. LITERATURE REVIEW**

Here different paper are studied based on the approaches by different researchers,

A. J. Jara, et. al. (2013), designed system for remote monitoring based on IOT using YOAPY protocol, integration of different systems like hospital information system, services provider system, Context Management Framework, Knowledge Base Systems and Environment Integration Platform. This architecture uses RFID, wireless personal devices, embedded systems, Monere and Movital hardware, 6LoWPAN, HDP.

X. Boyi, et. al. (2014), proposed a semantic data model to store and accesses the IOT data. The proposed system, called UDA-IOT, highlights how it is used in emergency medical services. They implement the DSS (decision support system) to solve the emergency problems.

R. Tabish, et. al. (2014) developed 6LowPAN-based ubiquitous healthcare system called U-healthcare which performs the health monitoring in both indoor and outdoor conditions. The system uses a live streaming platform for reading of remote monitoring sensors of ECG and temperature. The designed system can store the sensed data at remote server and use free Cloud service like Ubuntu One. The system uses different devices and technologies like router, PC, IPv6, Serial Line Internet Protocol (SLIP), 3G/4G, Microcontroller MSP430 and CC2420, Tiny OS and Contiki Open source operating system, ISR, and Wi-Fi. The system is capable to online streaming when the internet speed is good, also in emergency conditions.

D. Susitraet. al. (2017) designed a model for monitoring the driver's health continuously. This system checks heart rate, temperature, blood pressure of driver using the various sensors like alcoholic sensor etc. and also check the status of driver whether driver is sleeping or not.

R. N. Kirtanaet. al. (2017) proposed the low cost heart rate monitoring system based on IOT using the Zigbee

protocol. The system used pulse sensor for measuring the heart rate of patient. If abnormal condition is detected then alert sms is send to caretaker or doctors mobile phone.

Daniel Ruiz-Fernandez ID et. al. (2017) propose a model dependent on Business Process Management worldview, all together of innovations, procedures and IT standards which increment the advantages of this system. To accomplish the proposed designed; the clinical procedure of the hypertension is broke down with the goal of distinguishing shortcomings and improving the procedure. When the procedure is examined, framework that joins medical devices and ecological sensors, along with a data framework, has been created. To check this paradigm, web frameworks associated with healthcare monitoring and sensors and versatile mobile application have been actualized.

Sunil L. Rahaneet. al. (2015) designed the healthcare system for monitoring the patient's continuously using GSM and microcontroller based on the wireless sensor network. The system check the patient's temperature, blood pressure, heart beats etc. Various sensors placed on patient's body for collect the body signals and send to the base station or remote location of hospital. If system detects the abnormal activity of patients then send the alert sms to the doctor or his relatives on mobile phones.

**Table 1: Comparative Summary of Healthcare Monitoring System**

Author	Publication Year	Monitoring Devices	Hardware/Software and Technology	Application	Cost
A. J. Jara et. al. [1]	2013	Mobile	Movital, portable Sensors, IOT, RFID and IPv6, ubiquitous computing	ECG analysis	Costly
X. Boyi, et. al. [2]	2014	Mobile	IOT, Mobile Cloud Computing	Medical Industrial Application	Costly
R. Tabish, et. al. [3]	2014	Remote PC	6LowPAN enabled edge router, temperature and ECG Sensors, IOT, IPV6, 3G or 4G connectivity, Cloud computing	Temperature and ECG	Costly
D. Susitra et. al. [4]	2017	LCD Screen and Buzzer	LED, LDR, sensors, GSM, GPS,	Heart Rate, temperature, Blood Pressure, Drowsiness, Alcohol detection	Cost- effective
R. N. Kirtana et. al. [5]	2017	Web Page	Pulse sensor, Arduino Uno, Java, MySql, Zigbee, MQTT, IOT	Measure Heart Rate	Cost- effective
Daniel Ruiz-Fernandez ID et. al. [6]	2017	Mobile App	Smart sensors, Cloud Computing	Blood Pressure, Temperature	Costly
Sunil L. Rahane et. al. [7]	2015	PC	Sensors, microcontroller, GSM modem, WSN, GPS, Web server	Blood Pressure, Temperature, ECG, and Respiration Rate	Cost Effective
Amna Abdullah, et. al. [8]	2015	PC, Smartphones	Arduino, Sensors, ZigBee, ECG Electrodes, Cloud,	Temperature, Heart Rate, Sugar Level in blood, ECG analysis, Blood Pressure	Cost Effective
M. N. Hindia et. al. [9]	2016	Mobile App	Sensors, LTE-Femto Networks, IOT	Temperature, Heart Rate, Sugar Level in blood, ECG analysis, Blood Pressure	Costly

### 3. IOT IN MEDICAL SYSTEM

Internet of Things has major advantages in medical system used for analysis, diagnosis and effective treatment.

**3.1 IOT FOR PATIENT:** IOT devices like Temperature sensor, blood pressure sensor, heart rate monitoring sensors, glucometer etc. is ease to use for monitoring patients. IOT collects the patient real-time data using sensors and send this data to remote hospital for analysis or diagnosing the patients. IOT provide the amazing platform for patient to enable the fast tracking health condition.

**3.2 IOT FOR DOCTORS:** Doctors can monitor patient's health condition more effectively. They can follow patient's adherence to treatment method or any requirement for any medical emergency. IoT empowers the medical healthcare services experts to be progressively attentive and communicate with the patients effectively. Information gathered from IoT gadgets can assist doctors with recognizing the best possible treatment for patients and arrive at the normal results.

**3.3 IOT FOR HOSPITAL:** IoT enabled devices uses the sensors and keep to track the medical equipment location. The spread of diseases is a significant worry for patients in hospitals. IoT empowered cleanliness observing gadgets help in keeping patients from getting contaminated. IoT gadgets additionally help in resource the executives like drug store stock control, and natural observing, for example, checking cooler temperature, and moistness and temperature control.

### 4. SYSTEM ARCHITECTURE

The proposed medical system is used to automatically monitoring the health status of patient based on the Internet of Things. Proposed system used blood pressure sensor, Temperature sensor and pulse oxy-meter sensor for monitoring the patient health continuously [12]. If any abnormal situation arise then system send the patient data to IOT cloud server and server send the alert notification to doctor or caretaker. A bio-signal sensor and a microcontroller are the major components of the system. System is useful for old age person who needs to monitor regularly. The Proposed Architecture consists of following components.

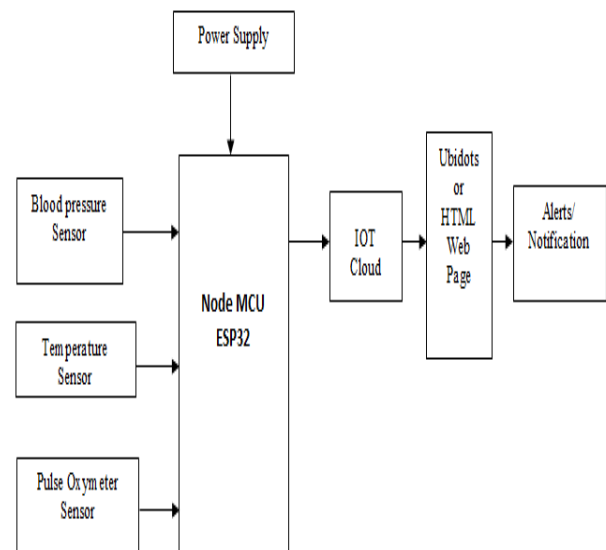
- IOT Enabled Devices i.e. Sensors, Microcontroller Unit
- Desktop PC
- IOT Cloud Server

**4.1 IOT ENABLED DEVICES:** IOT enabled devices is a collection of hardware with different sensors that sends information from one location to another location over internet. In our system used Blood pressure sensors, temperature sensor, and pulse oxy-meter sensor. All these devices are connected to the microcontroller ESP 32 unit

and microcontroller unit connected to the IOT cloud server. Sensors collect the signal from patients and send to microcontroller unit. Microcontroller unit convert these analog signal into the digital signals and send to IOT cloud server.

**4.2 DESKTOP PC:** It is used as a graphical user interface application for monitoring the patient using the internet. The Desktop PC connected to the cloud server and accesses the patient data from server. In case of Emergency; desktop PC send alert message or notification to the caretaker or doctor. The Desktop PC shows the various statistical analysis of patient report like Blood pressure, temperature and pulse etc.

**4.3 IOT CLOUD SERVER:** We will proposed system in which the various sensors is interface with controller ESP 32. We will use ubidots web to collect and analyze the sensor data and develop IOT application. If any abnormal condition is occurred in patient health that means patient heart rate, blood pressure is increasing above the normal range then ubidots web give the alert to the doctor by message .for that we will create account on ubidots web for getting current information regarding patient health. We will also use html web page to store and display the result.



**Figure 1:** Block Diagram of Medical System

### 5. BENEFITS OF IOT IN MEDICAL SYSTEM

**5.1 REDUCES COST:** The IOT enable monitoring devices monitors the patient in real time, thus effectively avoid the visit to physician, hospital and readmission.

**5.2 IMPROVEMENT IN TREATMENT:** IOT enables the major improvement in treatment on time and help to make the good decision.

**5.3 FAST DIAGNOSIS:** 24 \* 7 monitoring the patient with real time data helps to diagnose the diseases fast So that treatment starts at the early stage.

**5.4 REDUCES ERROR:** IOT in medical application helps to doctor so that they can easily diagnose patient's health condition and improvement in patient health study without errors.

## 6. CONCLUSION

In this paper presenting the review of IOT in medical healthcare system. Day by day IOT is being used in all healthcare sectors but there is lot of research and improvement are remains. At the early stage of diagnosing the patient health problem can take necessary action and save the life. Hypertension affects one in five adults worldwide. For that we will develop model which is low power & low cost also we are using the application which is having global reliability and low barriers to entry. We will propose healthcare monitoring system for hypertensive patient in remote areas using various body sensors like temperature, blood pressure; pulse rate sensor and microcontroller have connection to the internet of things (IOT) which reduces the healthcare cost of patients also save our time and resources.

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