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# SECURING THE PATIENTS DATA ON IOT IN HEALTHCARE

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## ABSTRACT

Internet of things (IOT) in healthcare is the medical devices connected to the internet. In present there are many devices there are available such as ECG sensor, glucose sensor, Pulse sensor. Using this the vital signs can be monitored, controlled and actions can be taken during emergency situation. Thus IOT in healthcare can be used in an effective way for human community. Using the above health sensors they are connected to the internet for real time monitoring of the patient's vital sign to take the action needed to the patient during an abnormal condition. So the works done so far using the IoT in healthcare and discuss the pros and cons of each system, and a secured system is proposed that use the IP address of the device and the GPS location information to encrypt the sensor data and the base station has a list of secured path in terms of ensures the low loss of packet or no loss of packet. Conclude what can be done further in healthcare using IOT.

**KEYWORDS:** **IOT, Healthcare, Security.**

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# INTRODUCTION

Internet of things is a network of things connected to the internet. The things are embedded with the sensors to sense the environment and electronics for various functionalities such as connectivity and software for integrity of things to other things. The things when connected to internet, users can access the things through the internet and has a control over the things. The environment is monitored and controlled in a real time. One application is healthcare. Internet of things in healthcare is a field that is used for remote monitoring of a patient, care for elderly people. There are many sensors such as ECG sensor EEG sensor Temperature sensor Glucose sensor to monitor the health condition of the user. By using the above health sensors connected to internet used to monitor the health condition in a real time. When the IOT is combined with the resulting system is an effective as it is used to take action when user is in abnormal condition, used in emergency care, used for analysis and intelligent decision making.

### *IOT FOR A HOSPITAL ENVIRONMENT*

A complete wireless body-area network (WBAN) system has been proposed to deploy in medical environments. The wireless system in the WBAN uses medical bands to get physiological data from sensor nodes. The medical bands are particular to reduce the intervention of other data and thus increase the coexistence of sensor node with nearby other network devices available at medical centers. The collected data is transferred to remote stations with a multi-hopping technique using the medical gateway wireless boards. The gateway nodes connect the sensor nodes to the local area network or the Internet[1]. In a hospital zone to render quality of service the system consists of a mobile-care device, which is responsible for capturing and wirelessly sending the patient's ECG data, a wireless multi-hop relay network (WMHRN) that is in charge of relaying the data sent by the former, and A residential gateway (RG), which is responsible for gathering and uploading the received ECG data to the remote care server through the Internet to carry out the patient's health condition monitoring and the management of pathological data. an emergency alert service using short message service (SMS), based on the detection of abnormal variation of HR(heart rate), is also used in the RG to further enhance the healthcare service quality [2].

### *IOT FOR REMOTE MONITORING OF A PATIENT*

The various types of sensors and the challenges in BSN where discussed and proposed a model in which the sensors were placed in patient body and the sensed information was transmitted to internet through a mobile or a system or through a modem that act as an node controller, stored in medical server and accessed by the doctors and nurses [3].Each user wearing sensors from different location sends the sensor information to the health care station from health care station the information are forwarded to the specialized physician based on the compliance of each user. In order to ensure integrity the medical server will send a key to the user encrypt the sensor information using the key and get the guidance of the specialized physician. If needed the physician can inform the emergence care to reach the user. In this paper they have proposed an algorithm and implemented to encrypt the information using a key, send the information to the health care center [4].To improve the security and to maintain integrity on both user and hospital server there will be a PDS (Proxy Doctor Server) in doctors side that contain previous medical history and PPS (proxy patient server) that has a data of patient and previous history. The sensors are placed in user's body and the sensor information are transferred to a PDS server through a secure connection and from PDS server the information is accessed by the doctor. By maintain data in PPS and PDS any change should be done in both so that Prevents and make secure of data [5].A secured communication channel between the sensor and the back end cloud is formed. The secure channel is formed by distributed crypto keys that can be hide by physiological signal. The physiology signal generated is unique for each patient and only physiological signal can access the information stored in cloud [6].The sensor information collected by wearable sensors is transmitted to a personal digital device such as the smartphones. These smartphones serve as a data forwarder and first-level analyzer. These medical data are transmitted to the remote healthcare data center. Remote health management system then read the data from the healthcare data center. The doctors can interact with the patients regarding their health condition. The healthcare data center is a central database, where all the patients' monitoring data is stored and the treatment and medication records are saved [7].Real time cardio vascular disease is monitored using a smart phone and personalized health record is generated. This is same as the normal ECG monitor instead the ECG readings are displayed on a windows smart phone. The user can use this to know their abnormal beat and take steps to reduce it. Alive technology ECG heart rate monitor is used to get the real time ECG signal which comes with a Bluetooth transmitter to transmit the ECG signal to the display.' Heart to go' a multithread application written in C# is developed to display the ECG signal in a real time. Heart to go runs on windows smart phone and a live ECG monitor communicates with the heart to go by means of Bluetooth serial port profile (SPP[8].Android based application is developed to measure the systolic and diastolic blood pressure and heart beat by using an electronic sphygmomanometer. The electronic sphygmomanometer the measured blood pressure and heart beat is transferred to android application by means of Bluetooth. If the measured blood pressure and heart beat doesn't lies in normal range then the patient is alerted by message and to their family and doctors. Using this measured values the data can be transmitted to the hospital by wireless transmission or through wired transmission and through internet [9].A RFID environment is set up in a smart home. The user wears the RFID tag and there are ambient sensors in each area of the

home that detects the temp, hum, and toxic in the air and many RFID tagged chemical sensors are present in various area of the house and sends the collected data and processed by data mining algorithm [10]. A smart healthcare system is the environment (SHS) where there are sensors to monitor the patient and the information is transported by to a control center that is access even by the remote person (doc, nurses) [11].The sensor node are clustered and has a clustered head like this a group of cluster head forms connected to home IOT. Each home IOT (HIOT) is registered under an authenticated cloud server (ACS).Whenever the user wants information has to obtain from the authenticated cloud server (ACS) [12]. A RFID based environment is discussed and found the security breaches in the RFID environment and they proposed an ECG based RFID environment that uses elliptic curve cryptography technique for security [13].An ihome system is proposed based on IoT. The ihome environment has an imed box that keeps track of medicines and the amount in it. And an imedpack which is an intelligent pharmaceutical pack of tablets used to keep track of tablets taken by the user. These imed box and imedpack are enabled with the passive RFID. The user/patient wears the bio-patch sensors. The information from the imedbox, imedpack and bio-patch sensors are transmitted to the health IoT cloud from which the access is given to physician emergency care and medicine supply people[14].An overview of the IoT. Overview of some IoT enabling technologies, protocols, and applications. A relation between the IoT and other emerging technologies including big data analytics and cloud and fog computing is also discussed [15]. Using the standard rules of OSI and TCP/IP a protocol stack is proposed that has IEEE 802.15.4-2006 PHY layer, IEEE 802.15.4e MAC layer, the IETF 6LoWPAN for internet connectivity, the IETF ROLL routing protocol enabling availability, the IETF CoAP for transport protocol [16]. A survey of various fields have been made and classified in five different area's 1) smart wearable; 2) smart home; 3) smart city; 4) smart environment; and 5) smart enterprise where the IoT can be a solution in the field is discussed [17]. In intelligent package and intelligent medical management a system is proposed in which there is imed box that record the medicine in box and register the new medicine and make a statistic on it. Each medicine is tracked and identified by RFID tags in it. The imed box can download the prescription from the hospital and make a reminder to user to have medicine. The patient activities such as taking the medicine, skipping their medicine, disposing their medicine without knowing are recorded and the user cannot open the imed box until or unless the open command given by the imed box. To enable all the things said above it has a wireless internet connection (Wi-Fi), display screens and speakers to alert the user [18]. To aid the elderly and handicapped people in their walking activities and to avoid from falling down a cane robot is designed that use a force sensor to determine the intention on their walking, a tilt angle sensor to control and to prevent from falling and it has three Omni wheel [19].

***PROPOSED SYSTEM***

The patient's vital signs are monitored by the health sensors such as ECG sensor, pulse sensor; the sensor information is transmitted to the nearby base station. The base station has a list of secured channel or a path through which the data has to be transmitted.

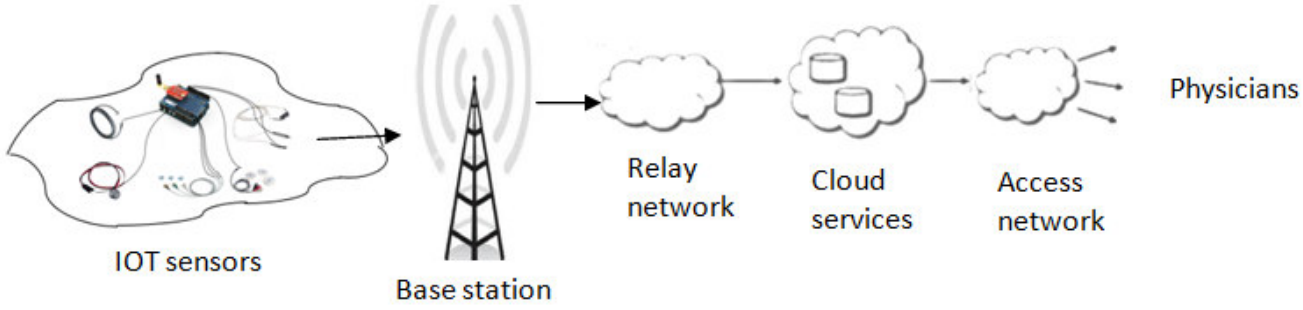


**Figure 1**
***Sensor Data Transmission in Cloud***

Then from the base station a secured path from the list is chosen and then forwarded to the node in the selected secured path. The chosen secured path forms relay networks that receive and relay the information to the next node. And then reaches the cloud provider. The base station usually chose a path randomly from a list of secure path and even the intruder tries to hack they don't know or the probability of the path chosen by the base station and the hacker is very less. The data's stored in cloud is accessed by the doctors, nurses, aesthetician's. So the patient is monitored and given care during emergency time. The base station computes the secured path by sending an empty message to next all possible nodes and see how it receives an acknowledgement packet. I.e. in which path the loss of packets are very less or no packet loss. Each device is uniquely identified with the IP address, and the value of each sensor node is signed with the time stamp by their IP address along with their GPS location latitude, longitude values. So the intruders may hack the information and but they can't open it as the packet contain only the source and destination address not the GPS latitude and longitude

values. The admin (doctors and nurses) from the cloud side has a registry of a list of user details with their device IP address and their GPS location longitude and latitude values. Using that information the admin (doctors and nurses) they access the information of the user/patient. The access to information in cloud is also given only after proper authentication. Whenever there is a fall down in sensor values then an alert message is also send to the doctors and nurses. To provide security the key exchange method is not chosen as it is time taking and security should be provided for the key transmitted which doubles the complexity in security.

## DISCUSSION

The sensors were used to capture the physiological [1] and ECG rate [2], [8] of the patient's and transmitted to the internet by multihop technique or through a gateway. The data from the sensor is also transmitted to the smart phone to forward it to internet [9], [8], [7].the transmitted data is stored in a remote server and accessed by the doctors and nurses. For secured transmission of the data a secured channel for the communication is maintained and data is transferred only in the secured channel path [6]. To maintain the integrity of the data the transmitted data is stored in a server PPS and the received data is also stored in another server PDS [5]. A key is used to encrypt the data and then transferred to remote server in [4].

## CONCLUSION

The above discussion proposed has the ability to monitor the patient's and the data are stored in a remote server. Encryption key is used for encrypting the data, a secured channel is used for transmission of data. For identifying information's about the patient state is time taking as immediate care has to be given to the patient when admitted. Then in distributing key to the user for encryption of data the transmission of key itself should be secured. The promising solution in future is IOT in healthcare can be focused on security where fast data transmission is required. It is ensured that no data packets transferred are not lost because of traffic in network.

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