A REVIEW ON IOT BASED REMOTE PATIENT HEALTH MONITORING SYSTEM

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Abstract:

The current review work tries to understand the existing technologies used to monitor the patient health and to find out the existence of research gap. The gap found out in the review will be addressed by designing a new system that will help to monitor the health of the patient effectively.

1. Introduction:

The integration of Internet of Things (IoT) technologies in healthcare has transformed patient monitoring, enabling remote tracking of health parameters. This review explores the existing literature on IoT-based Remote Patient Health Monitoring systems, emphasizing technological advancements, applications, challenges, and future directions.

1.1 Remote Health Monitoring

A Remote health monitoring system is an extension of a hospital medical system where a patient's vital body state can be monitored remotely. Traditionally the detection systems were only found in hospitals and were characterized by huge and complex circuitry which required high power consumption. Continuous advances in the semiconductor technology industry have led to sensors and microcontrollers that are smaller in size, faster in operation, low in power consumption and affordable in cost.

This has further seen development in the remote monitoring of vital life signs of patients especially the elderly. The remote health monitoring system can be applied in the following scenarios:

1. A patient is known to have a medical condition with unstable regulatory body system. This is in cases where a new drug is being introduced to a patient.

2. A patient is prone to heart attacks or may have suffered one before. The vitals may be monitored to predict and alert in advance any indication of the body status.

3. Critical body organ situation

4. The situation leading to the development of a risky life-threatening condition. This is for people at an advanced age and maybe having failing health conditions.

5. Athletes during training. To know which training regimes will produce better results.

In recent times, several systems have come up to address the issue of remote health monitoring. The systems have a wireless detection system that sends the sensor information wirelessly to a remote server. Some even adopted a service model that requires one to pay a subscription fee. In developing countries, this is a hindrance as some people cannot use them due to cost issue involved. There is also the issue of internet connectivity where some systems to operate, good quality internet for a real-time remote connection is required. Internet penetration is still a problem in developing countries.

Many of the systems were introduced in the developed countries where the infrastructure is working perfectly. In most cases, the systems are adapted to work in developing countries. To reduce some of these problems there is need to approach the remote detection from a ground-up approach to suit the basic minimal conditions presently available in developing countries.

A simple patient monitoring system design can be approached by the number of parameters it can detect. In some instances, by detecting one parameter several readings can be calculated. For simplicity considerations parameter detection are:

i) Single parameter monitoring system: In this instance, a single parameter is monitored e.g. Electrocardiogram (ECG) reading. From the ECG or heartbeat detection, several readings can be got depending on the algorithm used. An ECG reading can give the heart rate and oxygen saturation.

ii) Multi-parameter monitoring system: This has multiple parameters being monitored at the same time. An example of such a system can be found in High Dependency Units (HDU), Intensive Care Units (ICU), during the surgery at a hospital theatre or Post surgery recovery units in Hospitals. Several parameters that are monitored include the ECG, blood pressure, respiration rate. The multiparameter monitoring system basically proves that patient is alive or recovering. In developing countries, just after retiring from their daily career routine majority of the elderly age group, move to the rural areas. In developed countries, they may move to assisted living group homes. This is where a remote health monitoring system can come in handy. Remote health monitoring can provide useful physiological information in the home. This monitoring is useful for elderly or chronically ill patients who would like to avoid a long hospital stay. Wireless sensors are used to collect and transmit signals of interest and a processor is programmed to receive and automatically analyze the sensor signals.

1.3 Desired characteristics of the medical applications

a) Integration with current trends in medical practices and technology,

b) Real-time, long-term, remote monitoring, miniature, wearable sensors and long battery life of a designed device.

c) Assistance to the elderly and chronic patients. The device should be easy to use with minimal buttons.

2. Literature Review

Sneha N. Malokar et al designed and build the sensing data that conditions the system to display accurate body parameters of the patients. They supervised the heart rate, blood pressure, temperature and ECG continuously through respective sensors. The recorded data is sent to the device and if the value exceeds, the alert message will be sent to the doctor.

Raghavendra K K et al presented "An IOT Based Smart Health care system using Raspberry Pi". They have used an exclusive sensor to monitor a patient's health parameters hence they has used platform Raspberry Pi

for IoT. They have concentrated over the idea of separating wireless sensor network and cloud computing. Once sensors are connected to patients' bodies, they start to receive and transmit data to the database sensors like temperature (DS18B20), heartbeat, blood pressure, ECG (AD8232) services available in the cloud are responsible for receiving, storing, and distributing patient's data.

Cristina Elena Turcua et al has presented "Internet of Things as Key Enabler for Sustainable Healthcare Delivery". Here the author considers IOT as a global network infrastructure, linking physical and virtual objects. This architecture consists of existing and evolving internet and network developments. Exclusive object identification, sensor and connection capability are offered. Hence sensors will be characterized by a high degree of data capture. This paper aims to show how radio frequencies are identified and Internet of Things technologies allow patients to access healthcare services.

R. Rubasri et al has presented "Simulation of Health care Monitoring System in Internet of Things by Using RFID". They designed the effective healthcare monitoring system using the IoT. The sensors are used to observe the patient's condition frequently. The information report of patient is transmitted to the website through IOT system so that the doctor can know about the condition of the patient. There is a discussion over the security requirements of authentication. Particularly they have represented an ECC-based RFID authentication in terms of implementation and authentication.

Thirumurugan,S. et al presented "A Literature Survey in ECG Feature Extraction". Patient's health has been observed in this paper. There is a well organized health monitoring system developed and designed by author. The system enables the doctors to monitor patient's health parameters (temp, heartbeat, ECG, position). The parameters of the patient are measured continuously (temp, heartbeat, ECG) and wirelessly transmitted using zigbee. It provides a solution for improving the performance and power management of the patient health monitoring system.

Vivek Pardeshi et al, studied "IOT Based Patient Monitoring System". It is a mobile physiological monitoring system that is capable of continuously monitoring the patient's heart rate using ECG. Using replaceable electrodes ECG sensor can be attached to the patient's chest. Signals produced during muscle contraction is sensed by the system and recorded. The signals collected from the body are converted to an electrical signal. This paper shows the use of smart healthcare system. This new technology is capable of offering a large range of benefits to patients through early detection of abnormal conditions.

Ashlesha A. Patil et al presented "Health Monitoring Systems using IoT and Raspberry Pi". IOT Raspberry Pi based health care monitoring system has been analyzed by author in this paper. Any unusualitiy in condition of patient health can be detected and informed to the related person of patient. The elemental component of ECG is Instrumentation Amplifier, which is responsible for taking the differences in the voltage. The exhibited system is efficient and easy to understand. It is a connection between patient and doctor.

Esrat Jahan et al reviewed architecture of Smart Health Care Monitoring and IOT and is also demonstrated by author. ECG signals are obtained by electrodes that are placed on the chest. Later wires are connected to ECG sensor (AD8232).The sensor is used in measuring the electrical activity of the heart. Problems and challenges that could be faced in future are presented by this system. Applications of IOT can be improved using new methodologies and technologies. Sensors like Blood pressure, Temperature, Heart rate, ECG are used in IOT along with Raspberry Pi kit and Wi-Fi module.

Dogan Ibrahim et al created a low-cost device that measures the heart rate of the patient by placing sensors on the fingers, later the result will be displayed on LCD. The designed system can be used by unprofessional people. The change in heart rate can be displayed by graph using graphical LCD. Over a period of time,

maximum and minimum heart rate can be displayed using the designed system. Abnormalities are displayed on LCD indicated by buzzer. In order to send heart rate to PC output should be attached.

Nikunj Patel et al have presented "Heart rate Measurement from the Finger Using a Low Cost Microcontroller". IOT has a wide range of application. IoT has been developed for Wireless sensor network (WSN). Using IOT, health monitoring designs are presented. There are some problems that are related to health monitoring and IOT. New technologies help to minimize better quality as well as security concept. New technologies and methodologies are used. Arduino board, Wi-Fi modules, temperature, pulse oximeter, blood pressure, heartbeat rate sensors are used in IoT.

3. Gap Identification:

The review of literature has shown some gaps in the existing systems and technologies used. By using those gaps we have identified the problem statement and the main objective of study has been decided and the objective is to design a Patient Monitoring System with two-way communication i.e. not only the patient's data will be sent to the doctor through SMS and email on emergencies, but also the doctor can send required suggestions to the patient or guardians through SMS or Call or Emails. And Patient or guardian can able to track patient's location at any point in time through Google Maps which would enable to send medical services in case of an emergency for non-bed ridden patients.

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