

INTELLIGENT HEALTH MONITORING SYSTEM

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Abstract:

Health has taken utmost importance in our day-to-day life. Good health is important to do the daily chores properly. This article gives the design of a real-time health monitoring system which can store a patient's basic health parameters. The use of mobile phones and smart devices has increased significantly in the modern world. The main objective of the present work is to design and develop an "IoT based Integrated Health Monitoring System" to monitor vital parameters of patients like body temperature, oxygen level and pulse rate with the help of pulse oximeter sensor and IR based thermal scanner. To read and process sensory information an Arduino supported Wi-Fi enabled NodeMCU controller has been used. Thus, IoT based patient monitoring system effectively monitor patients' health status and save life on time.

Introduction:

Today, there is an astronomical increase in the number of people with chronic disease, the cause of which can be ascribed to various factors like dietary habits, liquor consumption, physical inactivity etc. The symptoms as well as the treatment of chronic diseases can vary significantly [1].

Early detection and diagnosis of potentially dangerous physiological conditions like heart attack require continuous monitoring of patient's health following transfer from hospital to home. Studies have shown that 30% of patients after discharge are diagnosed with heart failure are admitted again at least once in 90 days with readmission rates ranging from 25 to 54% within 3 - 6 months. To cater these types of needs, health monitoring systems are being proposed as a low cost solution. A system like this consists of physiological data that is stored, processed and communicated through a local manner such as smart phones, personal computers. Such systems should satisfy strict safety, security, reliability, and long-term real-time operation requirements [2].

In the past few decades use of wireless technology is rising for the need of various sectors. In these few years IoT

grabbed a large share of industrial area specially automation and control. Biomedical is one of recent trends to provide better healthcare. Not only in hospitals but also the personal care facilities are opened by the IoT technology. So having a smart system, various parameters are observed that consume power, cost and increase efficiency [3].

The progression of the advancement of the technology has constantly intrigued us. Moreover, we additionally found that there are very few critical examines on computerization technology for hospital's need for an IoT based Patient Monitoring System. IoT is a network where all the physical objects are connected to the internet via different sensors, devices etc. IoT is an intelligent technique which can reduce the human effort and interaction [4].

The objectives of the present work are as follows:

- It will be a very useful device since it reflects all the data collection and information by using only the internet. So, it can lessen the workloads and stress of the friend and relatives of the patient who are not nearby.
- When a patient gets health service at home on a real time basis, there is no need for unnecessary doctor or nursing visit. Particularly, this project helps to reduce the cost for hospital stays and readmissions.
- Through IoT, doctors and relatives can do their work without any hesitation as they can monitor the patient's health condition from anywhere.

Literature Survey:

In [5], the author has proposed a system to measure vital parameters using the sensors Temperature, ECG, Heart-beat and Accelerometer connected to an Arduino board. The values from the microcontroller can be given to the Web server using Ethernet Shield. The parameter values can be viewed by the Android application installed in doctors and patient's mobile phone.

In [6] K. Swaroop, Kavitha Chandu, R. Gorrepotu & Subimal Dev advanced a system which uses different standard

data formats and transmission protocols to get interfaced with the sensors and communicating the data over the three defined modes. Temperature sensor: The 1-Wire bus system employs a single bus master to control slave devices. DS18B20 always assumes the role of a slave. All data and commands transmits the least significant bit first over the 1-Wire bus. All transactions on the 1-Wire bus begin with an initialization sequence.

In [7] the author proposed a system that introduces security of health care and cloud of things. System works in two main parts which are storage stage and data retrieving stage. In storage stage, data is stored and updated or improved for future use. In data retrieving stage, the data is retrieved from the cloud. The cloud server can be shared with authenticated users. The worn device will send results to phone using Bluetooth connection or NFC technology. The data can be provided to cloud server using GSM or 3G. At cloud server each patient is defined with unique address. So, at cloud server, each patient is defined by unique address. So, data at cloud can authenticate the right patient and provide the required request.

In [8] A. Bansal, S. Kumar, A. Bajpai, Vijay N. Tiwari, M. Nayak, S. Venkatesan, R. Narayan focuses on development of a system which is capable of detecting critical cardiac events. Using an advance remote monitoring system to detect symptoms which lead to fatal cardiac events.

In [9] Afef Mdhaffar, Tarak Chaari, Kaouthar Larbi, Mohamed Jmaiel and Bernd Freisleben has explained low power WAN network to perform analysis of monitored data in health caring system. They have established WAN network for communication upto the range of 33m² at around 12 m altitude. Also they have shown that power consumed by LoRaWAN network is significantly lesser than the GPRS/3G/4G. The IOT architecture is given for the step wise working for interpretation of IOT. The main benefit of LoRaWAN is the for energy consumption. The power consumption in idle mode for LoRaWAN is 2.8mA while in GPRS is 20mA. Hardware cost in LoRaWAN is 10dollar while in GPRS is 50 dollar. Maximum data rate in LoRaWAN is 50kbps (uplink), 50 kbps downlink while in GPRS is 86.5 kbps (uplink) ,14kbps(downlink). These results gives the overall efficiency of LoRaWAN in the demonstration of IOT for health monitoring system.

In [10] Mohammad M. Masud, Mohamed Adel Serhani, and Alramzana Nujum Navaz had given the computation and measure of ECG signals at different intervals and in various situations. They have used energy aware, limited computing resources and got rid of network continuity challenges. For these challenges; mathematical model has been devised to carry out each task sequentially. There are three approaches designed to work out the process

.The first is mobile based monitoring approach, data mining and the last is machine learning approach.

In [11] Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian Anuradha. "Digital hospital" term is introduced for hospital management. It allows automatic electronic medical records in standard. Also discusses with the implemented real world framework of smart autonomous hospital management with the use of IOT.

In [12] Shivakumar proposed Design of vital sign monitor based on wireless sensor networks and telemedicine technology (2014), Vital sign monitor can be accomplished with the help of Bluetooth technology which is embedded with sensor, the transmitter will include the application oriented smart phone enable with 3G or IEEE 802.11 i.e. Wi-Fi based transmission. The data from transmitter will be sending to cloud for centralized monitoring takes place; the expert from anywhere even the remotest of places can view all the data of the patient and in case of emergency can take appropriate action.

In [13] the authors analyzed Raspberry-Pi based health monitoring system using IoT. Any adverse change in the health conditions of the patient can be known directly. The proposed system is simple, power saving and easy to comprehend. It plays the role of a link between patient and doctor. The hardware for the project is implemented and the output results are verified successfully. In this paper a real-time low cost heart disease monitoring system is introduced.

In [14] Telemonitoring system via WBAN is evolving for the need for home based mobile health and personalized medicine. WBAN would be able to gather the data received from the sensor and record and store the output. This output results are sent to controller wirelessly to health monitoring system. In this paper, Zigbee is also used in WBAN technology due to its guaranteed delay requirement for health Telemonitoring system. Zigbee used in the communication.

In [15] Jieran et. al (2012) developed a RFID technology and intelligent systems, which detects the disinfected articles and alerts the medical staff to wash the hands after the contact with the disinfectant articles. IoT techniques can be used to promote healthcare in a better way. The health related information could be interacted with doctors who are in emergency. Even in the absence of the doctor near the patient or in the hospital, the doctor can know the patients' status so that the doctor's advice is given in critical cases.

In [16] Cristina et. Al (2013) developed an approach to maintain health care data of a patient collected in differ-

ent geographic locations. The data is available to doctors, hospitals, laboratories etc., to check the medical history of the patients.

In [17] Boyi et.al (2014) presented IoT based system for providing support to emergency medical services by demonstrating how IoT data can be collected and integrated for interoperability.

Comparison Table:

Sr. No	Title of Paper	Sensors used	Technology used
1	Internet Of Things (IOT) Enabled Smart Autonomous Hospital Management System - A Real World Health Care Use Case with the Technology Drivers	Various types of sensors used	Digital Hospital
2	Remote health monitoring system for detecting cardiac disorders	12-lead ECG probe	Mobile based algorithm deployment ,Bluetooth sensor device
3	IoT-based Health Monitoring via LoRaWAN	B.P, Temp., glucose	LoRa network
4	Resource-Aware Mobile-Based Health Monitoring	ECG sensor	ECG processing analytics module
5	Internet Of Things (IOT) Enabled Smart Autonomous Hospital	ECG,EKG	IoT enabled data modeling

Management System-A Real World Health Care Use Case with Technology Drivers		
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Conclusion:

A brief summary of Health Monitoring system is discussed in this paper. This paper includes varied technologies and applications for IOT based Health Monitoring system. It also explains and analyzes various applications, implementation and arrangements for the process of IOT based Health Monitoring system. Every technology has got their own applications and restrictions. The summary of this paper shows that which technique and applications should be adopted to improve the quality of IOT based Health Monitoring system.

Future Scope:

The future work of the project is very essential in order to make the design system more advanced. In the designed system and devices the improvement and strengthening would be by connecting additional sensors to internet which records and stores various other health parameters and would be useful for patient’s monitoring i.e linking all the sensors and devices to internet for fast and easy access. Establishing a Wi-Fi mesh type network to increase in the communication range [18].

The systems developed in the future can make use of Wi-Fi and IR sensors to overcome the range limitations of Bluetooth devices. Smartphones can be used as a health monitoring system as it makes the interaction between multiple sensors very easy. Various machine learning algorithms can be used to make the systems more accurate. In microcontroller-based systems, raspberry pi can be used for easy presentation of the monitoring data on websites [19].

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