

A REVIEW PAPER ON SMART HEALTH CARE SYSTEM USING INTERNET OF THINGS

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Abstract

Health is fundamental need. And it is human right to get quality Health Care. Nowadays India is facing many health issues because of less resource. This review paper presents the idea of solving health issues using latest technology, Internet of Things. It presents the architectural review of smart health care system using Internet of Things which is aimed to provide Quality Health Care to everyone. Using this system architecture, patients' body parameters can be measure in real time. Sensors collects patients body parameters and transfers that data to Arduino Uno which further transfer that data to cloud with the help of WiFi module. This data is stored into MySql database server which manages data and provides accessibility. User can view this data with the help of Android App. Which one can install in Smart phone, Tablet or PC. Cloud computing handles authentication, privacy, security, data management etc. If data is abnormal then patient gets notification also care takers will get mail. With the help of different decision making algorithms decisions can be made and according to it people have access to database. Patient can check their medical record Hence, this system provides Quality Health Care to everyone and error free and smooth communication to patients.

Keywords: IOT, e-health, Arduino Uno

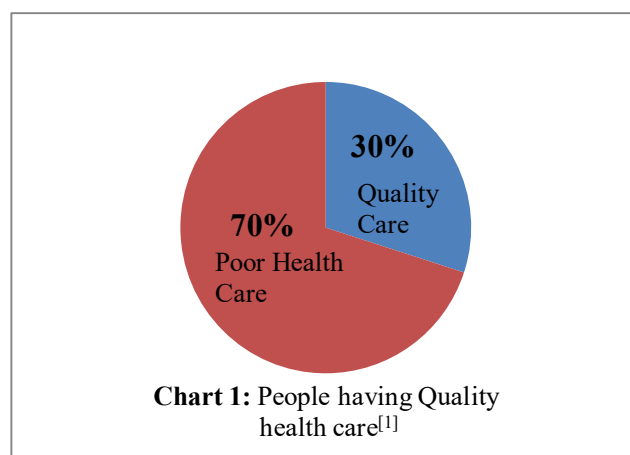
1. HEALTH CHALLENGES

- Health is primary element that human require. It is important for individual the growth of individual as well as for the growth of society. So physical and mental fitness is very important as it plays important roll for development. Now a days Global health issue is major concern.
- Definition of health according to World Health Organization is - "A state of complete physical, mental and social well being and not merely absence of disease and infirmity." [1]
- Most of the countries having health care as their top most concern. Especially country like India which has 2nd rank in population [13], health issue effect their growth and development. It effect major population of India. There are many chronicle and non chronicle disease which plays major roll in health issue.

1.1 Major Concern

- One of the concerns is death of childrens.
- The second major concern is poor sanitation. According to one survey of WHO only 30% of people of India gets quality health care. [2]
- We have major diseases like: Malaria, Cancer, Blood pressure, Chronicle disease, Hepatitis, AIDS/HIV, Diarrhea and Typhoid [2].
- Also people live in villages cannot get proper health care as we have large gap between rural and urban area. [5].
- India faces high burden of disease because of lack of environmental sanitation and safe drinking water, under-nutrition, poor living conditions, and limited access to preventive and curative health services [4].

- Expenditure on health by the Government continues to be low.
- Raised blood pressure
- Raised blood glucose
- Heart disease



2. IOT AND SMART HEALTH

This section explains brief idea about Internet of Things and integration of IoT and smart health.

2.1 Internet of Things

- IoT term was first coined by Kevin Ashton in 1999 [7]. The concept of Internet of Things entails the use of electronics devices that capture or monitor data and are connected to the private or public cloud, enabling them to automatically trigger certain events [3]. It enables

everyday devices to communicate with each other and/or with humans, allows object to sense and control often is referred to as the Internet of Things (IoT). It is a highly dynamic and radically distributed networked system, composed of a very large number of smart objects.

- Three main system-level characteristics of IoT [8] are:
 - Anything communicates
 - Anything is identified
 - Anything interacts

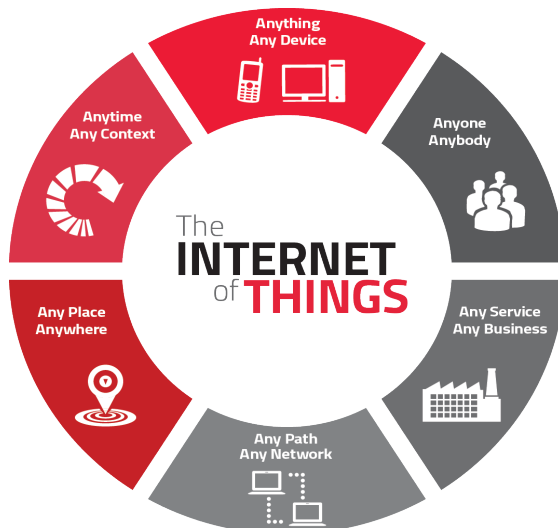


Figure 1: Concept of Internet of Things [6]

- IoT basically connects different objects(sensors) to each other. Through connecting medium which can be wireless or wired. When object can be sensed then we can perform action according to that. And that is known as smart objects.
- Basically IoT made day to day life easy and we can do things automatically with using IoT technology. It includes many fields like home automation, health care, smart environment.
- For example, if you have connected in your room then you can get notification in your smart phone if it senses motion while you're not home.
- Health care is also one major focus of IoT researchers. Many companies and research organizations focus on projects and case studies whose goal is healthcare improvements and achieving the foundations for a global health system. [9]

2.2 Health Care System

"Smart Health" refers to the implementation of different biometric sensors that capture the human body parameters. And that sensor data can be used many ways to provide smart health.

- IoT has given rise to smart health and the focus is on improving the operating efficiency and achieving a cost-effective system while maintaining quality, providing health records, privacy to data. Thus, it results in quality health care for users.



- Using smart one can access his or her medical data and can get that knowledge of their physical fitness. Also in this field different mobile apps, notifications are used that give alerts when data is abnormal.
- Following figure shows the flow for smart health care. Where cloud is used to provide data from the sensor and then patient, health care provider or care taker can have access to that data and they can check the status of patients' health. Smart health care provides full-way communication between patient and care taker or health care provider.



Figure 2: The confluence brought about by the IoT [6]

2.4 Objective

- This proposed work solves most of the health issues by including 'smart' terms to health care. The objective of this work is to provide real-time data to patients and in a more accessible way.

3. HEALTH CARE SYSTEM

We know that smart city is a buzzword. Many researchers and multinational companies are working on its application and cloud computing has taken this to the next level.

- This Health Care system is the complete system that provides full-way communication of user and health care provider. For this system, temperature and heartbeat sensors are used. They sense body temperature according to their function and then with the help of a microcontroller we can have the data, which can be processed

further. In this system Arduino uno ATmega 328P Microcontroller is used.

- To provide two way communication cloud system is used. Here Real Time Health Portal stores all the data that has been sensed by sensors for that My SQL database server is used.
- For the user interaction this data are visible into Android app which is written in JAVA Programming Language. This app can be installed on Android mobile, PC, Tablet, Laptop. So user can view the data in real Time.
- To complete the path Ethernet Shield is used which provides Internet Connection and sends data in real time in database.
- So basically, This remote health monitoring system is integration of three parts:
 - (1) Data acquisition
 - (2) Cloud system
 - (3) Real time health portal

3.1 System Flow

Following figure shows the work flow of health care system. And its three parts are described below in brief.

(1) Data Acquisition:

- This part contains the sensor which is DS18B20 digital temperature sensor, heart beat sensor and microcontroller Arduino Uno ATmega 328P.
- This block will sense the data and then data acquisition process is done. Then processed latest real time data is transferred to the HLK-RM04 Serial to WiFi Module for further processing.

(2) Cloud system:

- The HLK-RM04 Serial to WiFi Module uses WiFi to send the data to the MySQL server. It provides serial communication and uses HTTP protocol. Here database stores all the data that has been transferred by the WiFi module.

(3) Real Time Health Portal:

- Now, by using the real health portal user can have access to the database and can view the data. In this system Android App is used which is written in JAVA language that provides the access to the database, so that user can view data anytime anywhere. This app can be installed in Anroid mobile, tablet, PC and laptop.
- Here if data is abnormal then notifications goes to user mobile and also mail can be deliver to the care taker or health care provider

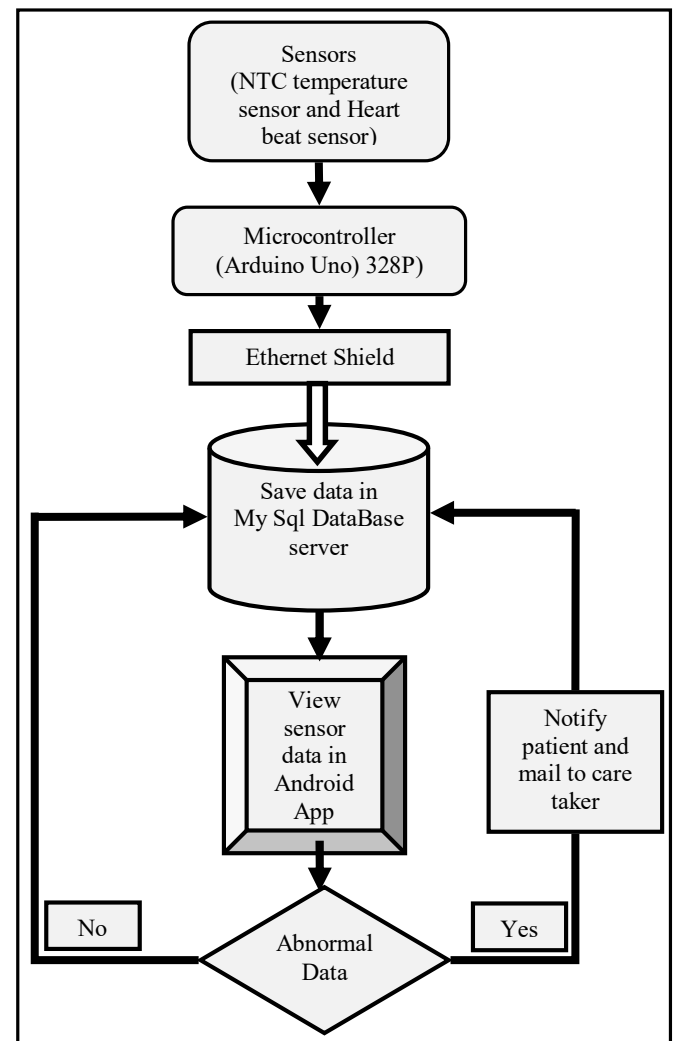


Figure 3: Health care system Flow

3.2 Block Diagram of System

Following diagram shows the complete transmitter and receiver flow.

- Here two sensors are connected to Arduino Uno, (1) DS18B20 digital temperature sensor, which measures the temperature of patients' body. And its output is in digital form. and (2) Heartbeat sensor which measures heart rate of patients body. These sensors are connected to Arduino Uno which is further connected to HLK-RM04 Serial to WiFi Module which provides serial communication. Then data is transferred to MySQL database. This stores real time data and provides accessibility for data.
- Here Iot plays its roll, which connects two objects, here sensors and high-end and low-end computational devices like Desktop and mobile respectively. User can view that data into Android App.

For communication between WiFi module and web server HTTP protocol is used which provides easy communication. User only gets notification if data is abnormal. And for mail transformation FTP protocol is used.

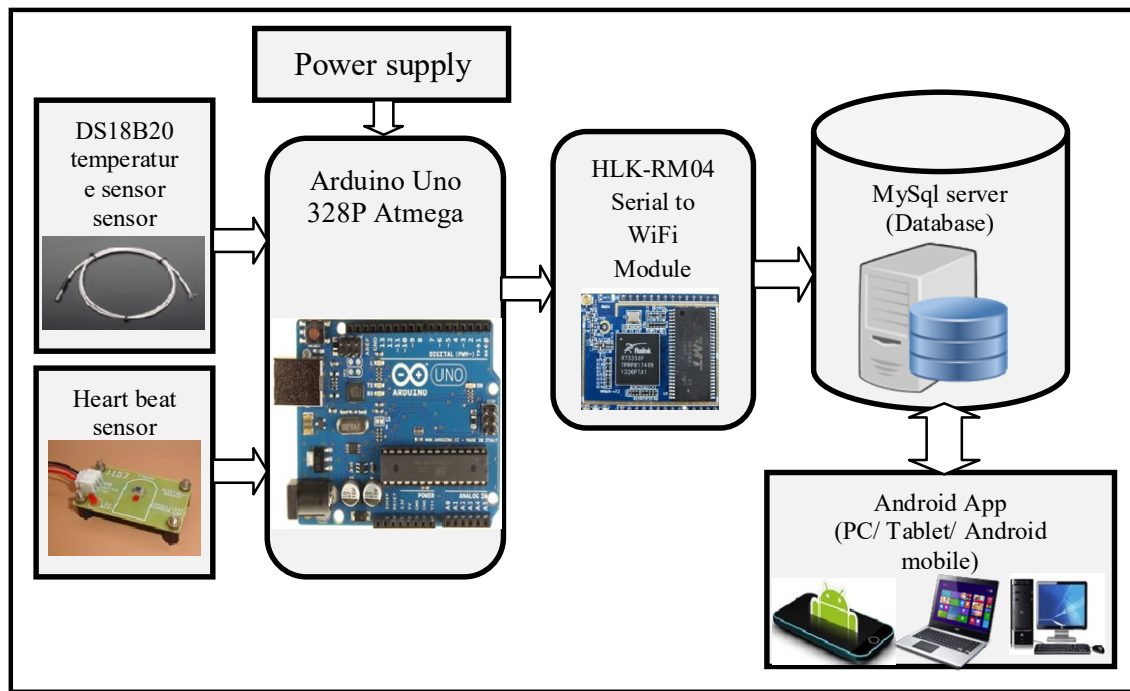


Figure 4: Block Diagram of System

- Following figure shows the architecture of this system which is integration of hardware and software. Here, hardware includes sensors which measures body parameters and microcontroller and software which includes cloud system that handles different protocols and data flow.

3.3 Hardware Used

In this work two sensors, one is temperature sensor and second is heart beat sensor is used. Also one microcontroller and one WiFi shield is used that is shown in following section and their technical specifications are also mentioned.

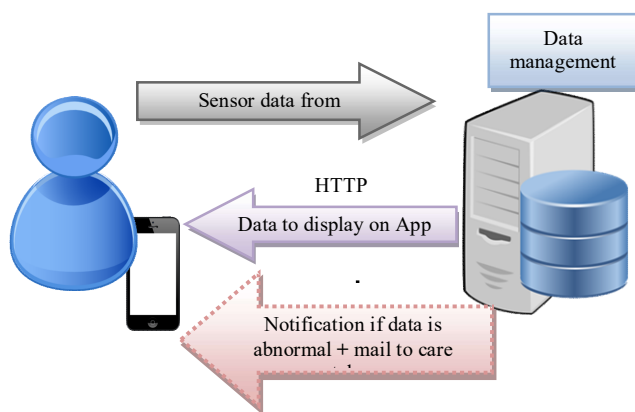
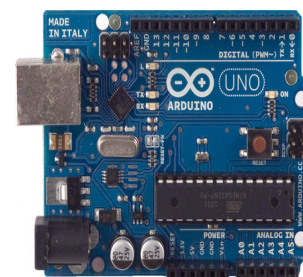


Figure 5: Architecture of system



- Arduino Uno
 - ATmega328 microcontroller
 - Input voltage: 7-12V
 - 14 Digital I/O Pins
 - 6 Analog Inputs
 - 16 MHz clock speed [11]



- HLK-RM04 WiFi module
 - built-in TCP / IP protocol stack
 - Maximum transmission rate 230400 bps
 - TCP connection Max connection number >20 [10]

3.3 Function of System

This IoT powered smart health system includes the following functions:

- **Function of System**
 - Health at Home (HaH)
 - Smart lab
 - Patient monitoring
 - Helps chronicle condition
 - Reduce paperwork
 - Electronic Medical Record (EMR)



➤ DS18B20 Digital temperature sensor

- Temperature range: -55 to 125 °C
- 9 to 12 bit selectable resolution
- ±0.5°C Accuracy from -10°C to +85°C [12]



➤ Heart beat sensor

- +5V DC regulated operating voltage
- Operating current 100mA
- 5v TTL output data level
- Pulse detection: using LED [13]

4. CONCLUSIONS AND FUTURE WORK

- A Smart Health care system is integration of hardware and software. Here hardware includes sensor & microcontroller and cloud system is software part. This is complete remote monitoring system which includes task like data acquisition, data monitoring, data storing & managing. Using this system one can measure their own body parameters without help of health provider.
- After studying and understanding literature review and other existing work, I propose a technique which uses fewer amounts of hardware i.e. sensor & micro controller only and then data is store in the data base for future use. Also patient or his care taker or health care provider can be notify by email, if data is abnormal.
- In this system future work can be done by providing more sensors & providing more settings to android apps so that person can have more user friendly environment and will be able to do more task automatically rather than manually. This will enhance system performance.

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BIOGRAPHY



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