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ESP8266 BASED HEALTH MONITORING SYSTEM USING ARDUINO

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Abstract - *With the ongoing development in innovation, remote sensors systems (WSN) are currently utilized in clinical social insurance application particularly in identify human heartbeat. The improvement of Wireless Sensors for far off checking of cardiovascular movement is one of the most significant fields in telemedicine. The checking and procurement of patients' physiological data are very Crucial for the further treatment. Numerous patients can profit by consistent checking as a piece of a symptomatic system, ideal support of an incessant condition or during regulated recuperation from an intense occasion or surgery. In any case, in the vast majority of these explores, assignments like sensor information preparing, wellbeing state choices making and crisis messages sending are finished by a far-off server. Transmitting and giving with an enormous size of information from body sensors expend a great deal of correspondence asset, carry a weight to the distant server and postpone the choice time and warning time. System Security is the most essential part in data security since it is answerable for making sure about all data went through organized PCs. It alludes to all equipment and programming capacities, attributes, highlights, operational systems, responsibility, measures, get to control, and authoritative and the executive's strategy required to give a satisfactory degree of security for Hardware and Software and data in a system. In this paper we propose a social insurance checking framework in human services applications without considering security makes tolerant protection powerless dependent on a propelled Wireless Sensor Network (WSN) because of the necessary degree of dependability and the need to guarantee the right data of clinical information.*

Key Words: **WSN, Security, etc.**

1. INTRODUCTION

By the swift development of mobile Internet, Internet of Things (IoT), and wearable devices, the health monitoring has revealed an intelligent trend in recent years. Many hospitals have already made use of mobile phone apps for appointment registration, inquiring electronic medical records, and examination results. In addition, medical wearable devices [such as 3G vital sign meter, Bluetooth blood glucose meter, and smart electrocardiograph (ECG) device] are accustomed monitor blood pressure, blood sugar, ECG and other physiological signs. The monitoring records are finally sent to the knowledge platform for real time diagnosis or to a medical database for record keeping [1].

The introduction of intelligent devices to hospitals can save the patient cost, enhance the medical experience of patients and reduce the labor intensity of medical staff [2]. However, connecting those intelligent things to achieve such goals is still a great challenge. The main limitation is the communication protocol [3]. The wired communication is not suitable for mobile devices. Many researchers have tried to build architecture for connecting intelligent things by short range and long-range wireless communications. Boudra et al. [4] introduced a monitoring system for patients using ZigBee and a long-range wireless protocol. Catarinucci et al. [5] proposed three-tier network architecture for monitoring and tracking of patients and environmental data in hospitals, which contains three parts: 1) the radio frequency identification (RFID), it enhanced wireless sensor network which called as hybrid sensing network (HSN); 2) the IoT smart gateway; and 3) user interfaces for data visualization and management. The HSN tracked sensor devices with RFID Gen2 tags and forward their data to the Internet or local area network by the middle layer. Alharbe et al. [6] proposed a way of using ZigBee and RFID to build an information management system of hospitals. In this system, ZigBee was used to transmit the collected information to the cloud center, and RFID was used to identify objects automatically. Nasri and Mtibaa [7] proposed an idea of transmitting data from terminals to smart phones using 5G communication techniques, which were finally sent to the cloud center for the further treatment. Zhanwei and Yongjian [8] put some smart devices on patients to upload data to the cloud platform. However, the existing architecture cannot connect all types of devices in hospitals due to the limitation of wireless protocols. Short range wireless protocols like Wi-Fi, ZigBee are limited by the communication distance. Long range wireless protocols usually have high energy consumptions which are not suitable for smart devices in hospitals [9-10].

As we see now days, heart disease is one of serious diseases that may threaten human life. The electrocardiogram (ECG) is vital role within the prevention, diagnosis the abnormality of patients and rescue of heart condition. In progress has been made within the development of a foreign monitoring system for ECG signals, the deployment of packet data services over telecommunication network with new applications. The tele-transmitting and receiving of ECG signal is that the key problem to understand the tele-diagnosis and monitoring of ECG signals. Telemedicine is that the use of medical information exchanged from one site to a different via electronic communications to enhance patients' health status. Telemedicine is a newest technology which combining telecommunication and information technology for medical purposes [11]. It gives a new way to deliver health care services when the distance between the

doctor and patient is significantly away. Rural area will get the benefit from this application. Patient monitoring is one among the telemedicine, which always needs improvement to create it better. It is vital to care in operating and emergency rooms, intensive care and critical care units. It is also important for respiratory therapy, recovery rooms, out-patient care, and radiology, ambulatory, home and sleep screening applications. The advantages of a patient monitoring system are it can reduce the risk of infection and other complication so as to make the patients comfortable. Furthermore, implement of patient monitoring in hospitals might reduce the costs in terms of installation and also maintenance of wiring [12].

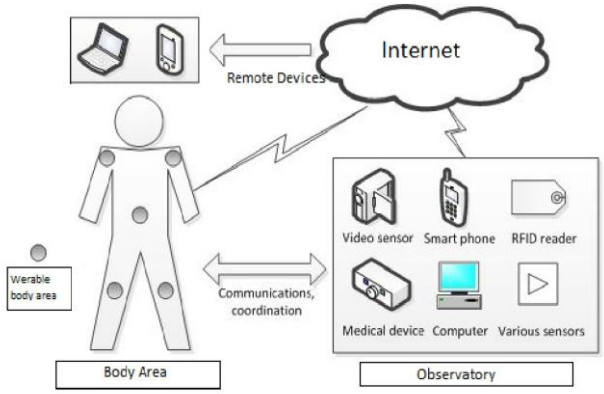

Fig-1: Wireless sensor network for health monitoring

Since many critical patients need a high attention in intensive care unit (ICU) and cardiac care unit (CCU), thus the bedside in the hospitals over the limit as provided to the patients. Otherwise, this creation wills help more elderly patients who need constant monitoring, both in the hospital or home environment. Previously, the available medical monitoring system is usually bulky and thus uncomfortable to be carried by patients. Patient monitoring using wireless sensor network features a greater potential within the future in order to realize the most effective performance health care services and also to avoid from cost pressure in the hospital. In this era of automation and advanced computing the social and commercial needs of mankind are changing very frequently. To keep up with these changes, we need to develop systems which are capable of performing different functions within some specified limits of time, accuracy and cost. Automation can be very effective to reduce human effort and involvement in different areas. This can be a boon for those fields which need a lot of skilled employees and also in areas where it is dangerous for lives of people involved in that job. Now-a-days in medical field there is a need of data monitoring and control, for this application embedded web server can prove to be a very good system which may be capable of reducing the need of skilled workers. An embedded system is a device that has computer intelligence and is devoted to performing one task, or a bunch of related tasks. An embedded system often performs monitoring the medical parameters of a patient. A web server is a system which hosts websites and provides services for any requesting clients. The general-purpose web server composes of an OS, websites or web application and a large amount of memory and sometimes a special hardware. The embedded web server is that the combination of embedded device and Internet technology, which provides a versatile remote device monitoring and management function supported Internet browser and it has become an advanced development trend of embedded technology [13].

2. LITERATURE SURVEY

Internet of Things (IoT) and cloud computing plays a crucial role in today's Tele-monitoring health system. This technique keeps track of patient's physiological parameters through collection of body sensors' data using microcontroller. The patient's health card is developed by the doctors and displayed on a webpage where doctors and patients can access and communicate one another without physical presence [14]. Using cloud computing, the info is often stored, updated and accessed from anywhere within the world. It's very suitable for rural areas where medical facilities aren't available. In Remote health monitoring system using IoT, Body wireless sensor Network (BWSN) is employed to transmit the patients' health parameters collected through microcontroller to the physicians and caretaker wirelessly [15]. Being long range wireless technology, emergency situation of the patient's health is quickly detected and timely intervention results in save the lifetime of the patient.

Owing to costlier healthcare and long waiting time in hospitals, the concept of in-home patient monitoring system has been emerging within the recent years. This technique collects data of varied body parameters through Biosensors, wearable devices and smart textiles and it transmits the info to central node server securely through Cipher text Policy Attribute Based Encryption (CP-ABE) method. In turn, the server shares the collected data to the hospitals for further treatment. The server rings alarm to the ambulance [16] during emergency situation. It's very beneficial for elders and chronic patients who require continuous monitoring.

The specialized healthcare monitoring system for elderly people could also be a growing need within the aging population world. This technique performs basic health checkups by measuring the body parameters regularly and report the info to the doctors. The result data are then displayed as statements during a web application where doctors and patients can interact with one another [17]. The most challenge is to form elders equipped with for growing new technologies and to become familiarity towards Smartphone, computer, etc. IoT based Smart healthcare with the assistance of smart devices and objects improves the healthcare monitoring system effectively, thus by reducing the inefficiencies of existing healthcare system. Smart devices with new and upgraded technologies enhances the

info accuracy to be collected, real-time accessibility of patient's condition, intelligent integration of knowledge collected, maintaining the integrated data smartly through cloud service, etc. [18]. IoT alongside smart devices reduce complexity and complications within the healthcare system. The penetration of mobile technologies and smart devices over healthcare system cause huge impact on the planet. The full-fledge utilization of M-health and E-health applications in today's world is formed aware to the people for improving and maintaining the great quality of life. Aside from regular monitoring of patient's condition through M-health system, the most objective is to teach them through recommendations of healthy eating habits and effective workout routines for improving their quality of healthy life [19]. In remote mobile health monitoring system, the patient health parameters are recorded by a sensible phone by eliminating a further hardware and transmit data through an internet interface [20]. It facilitates end to finish monitoring screen through three steps. Firstly, the important time health parameters are measured through wearable sensors and transmitted to a sensible phone which shows the patient health status in graphical interface. Secondly, this technique provides knowledge to loved one and doctor through web interface for further monitoring. Thirdly, I provide real time alarm if the patient is at emergency situation like attack, etc. Despite monitoring, there are quite few challenges in using the wearable tracking devices for an extended time. Firstly, the daily use of wearable tracking devices is predicated mainly on small size, rough use and low energy consumption [21]. Secondly, the main challenge is of the accuracy, validity and integrity of measurement data with other devices. Thirdly, the usability and therefore the experiences of the user with the device and its friendly supporting software play vital role in continuing regular and long period use of wearable tracking devices.

The use of Internet of Things (IoT) and its e-Health applications within the Tele-medicine health system leads to seamless flow of knowledge between doctors and patients, thus making healthcare cost effective and improving the standard of patients' treatment. This technique uses the K53 Tower System platform for e-Health applications to point out the benefits of IoT in medical system. The 2 fundamental aspects in monitoring people in danger are: 1) Prevention 2) Effective and early intervention during medical emergency [22]. With the sensors being designed target wearable technology like watches wristbands et al. included in high-end cell phones, important health care data is collected and uploaded online instantly. The uploaded data is stored in online storage popularly referred to as cloud storage. The devices have adopted the web of Things (IoT) concept. A knowledge log of a patient can then be generated and kept for reference. This has seen minimal visits to the hospital as doctors or health specialists can intervene in time when a patient's data chart turns critical from the real-time generated data.

Patients affected by chronic conditions like Congestive coronary failure (CHF), Chronic Obstructive Pulmonary Disease (COPD), diabetes, asthma, hypertension and a few other health conditions can enjoy the remote health care management taking advantage of remote patient monitoring technology. Once the patient is mentioned the remote healthcare program by a healthcare professional within the hospital or at a medical care facility, they're introduced to a healthcare specialist team which can proceed to trace and adjust the execution of the care plan also as provide support and guidance for the patient.

3. Existing System

1. Health monitoring system using ZigBee:

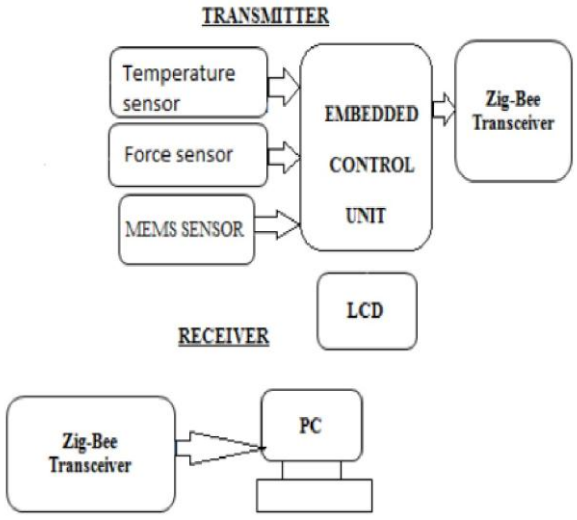

Fig -2: Health Monitoring System using ZigBee Transmitter

A smart sensor coordinator which is nothing but the embedded control unit (ARM-7 microcontroller) collects data from the sensing units and forward to the computer system for data processing. Rather than in-home monitoring if the system is ON at home then we are able to monitor from anywhere round the world through web monitoring system (i.e. with the help of IP address). The major task of our work is to recognize the essential daily living behavior of the elderly through sensor fusion by using minimal sensors at elderly home.

For this, WSN consisting of different types of sensors such as MEMS sensors to analyze the gestures such as (walking, sleeping & sitting); EPIC and temperature sensors with ZigBee module sensing units are installed. EPIC sensors are often used to measure ECG signals without physical skin contact.

While sensors are often embedded during a chair or seat, the techniques are equally applicable to sensors mounted on a mattress, in clothing or in other situations. There are several

applications where EPIC can be utilized in cars. For example, driver monitoring for health and alertness by detecting pulse and respiration or determining the occupancy of the car to regulate the ride, handling and bag deployment depending on the size and location of occupants. The EPIC sensor electrodes are often easily and discretely incorporated inside the seat backs to accumulate the required biometric data. In our project each sensor connected to various divisions are considered as nodes [23].

2. Health Monitoring System using Bluetooth:

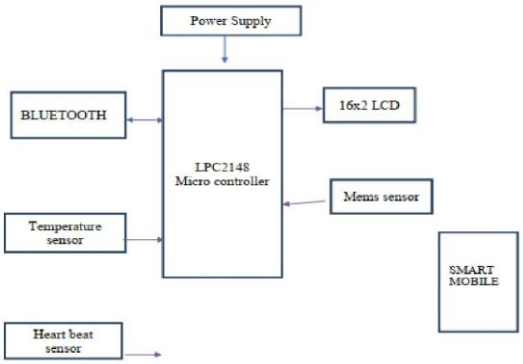

Fig -3: Health Monitoring System using Bluetooth

The undertaking is designing of LPC2148 microcontroller its operative with Bluetooth and sensors, during this task a digital circuit we'll be predisposed to vicinity unit mistreatment to look at patent's temperature and heartbeat identity in hospitals for patents health observance purpose. Here we are a unit interfacing heartbeat and temperature sensors to our small controller, the sensors continuously transmit the understanding to sensible cellular through mistreatment Bluetooth generation. If the controller gets greater values then predefined values the system will offer the alert otherwise it unendingly transmits the sensors know-how to the microcontroller then the microcontroller ships the knowledge to the sensible mobile mistreatment Bluetooth and a few other features of this venture is imparting vital conductivity detection of patent and with alert. Smart Mobile System for Body sensing detail Network evolved by means of applying WSN and Bluetooth generation is conferred. It can determine the blood heat, heartbeat and switch the facts unendingly [24].

4. PROPOSED SYSTEM

In this proposed system, the Arduino microcontroller with ESP8266 uses for sending data to cloud. The microcontroller is useful to access sensors values and forward it. The pulse sensor uses to calculate the pulse rate of human being.

Usually, blood temperature varies by person, age, activity, and time of day. The average normal blood heat is 98.6°F (37°C), theoretically. Some studies have shown that the "normal" blood heat can have a good range, from 97°F (36.1°C) to 99°F (37.2°C). A temperature over 100.4°F (38°C) most frequently means you've got a fever caused by an infection or disease.

A tilt sensor is an instrument that's used for measuring the lean in multiple axes of a reference plane. Tilt sensors measure the tilting position with respect to gravity and are applied in numerous applications. They enable the easy detection of orientation or inclination of body. To detect movement or motion of any part of body.

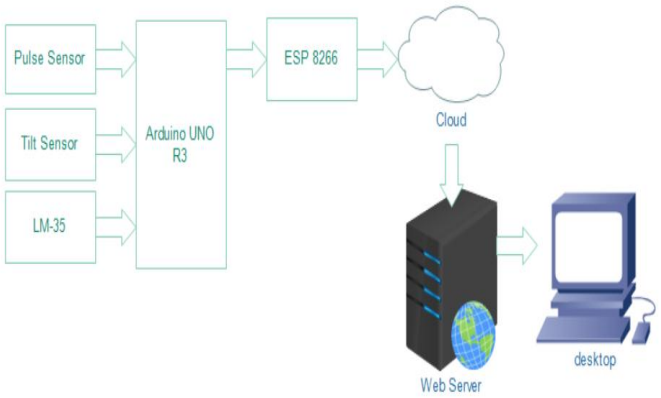

Fig -4: Proposed System

The all sensor connected to Arduino microcontroller, the sensed data transfer to internet through ESP8266. The cloud "ThingSpeak" accept values and will generate graph as per values received meanwhile the data also transfer to webserver also. Web Portal uses here to access data of patient through remote place.

5. IMPLEMENTATION

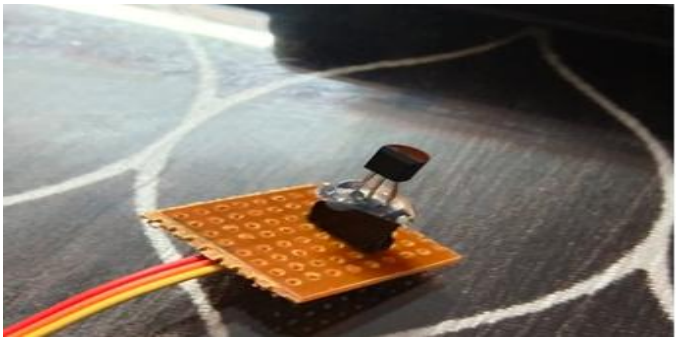

Fig -5: LM35 Sensor

LM-35 is connected with Arduino with analog pin with ground and Vcc.

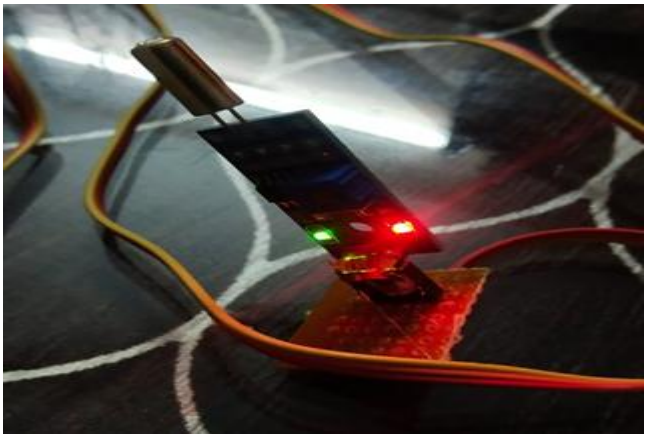

Fig -6: Tilt Sensor

This is tilt sensor connected with Arduino UNO R3 for sensing axial position of patient.

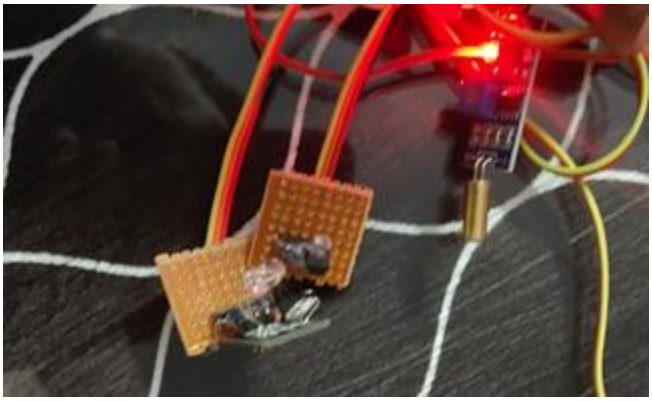

Fig -7: All Sensors are working

All sensors are gathered together these are ky039, tilt sensor and lm35 sensor for temperature sensing.

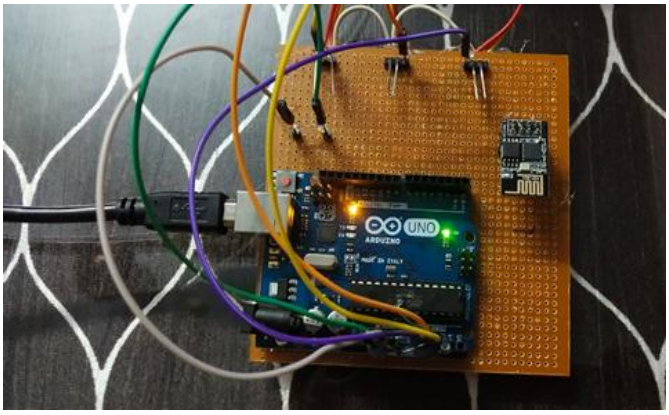

Fig -8: Arduino Uno and ESP 8266 interfacing

Arduino UNO R3 and ESP8266 are connected with sensor. ESP8266 is used for connecting to internet; basically it's a Wi-Fi module.

Fig -9: KY039 measures Heartbeats

Here, KY039 is heart rate sensor. User measuring his heart rate.

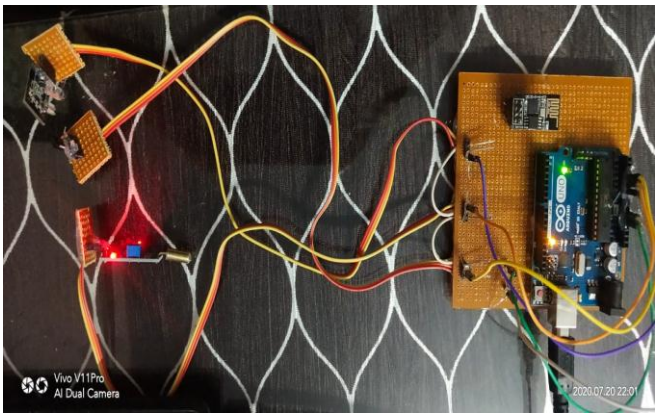

Fig -10: Circuit

All over circuit connected and working.

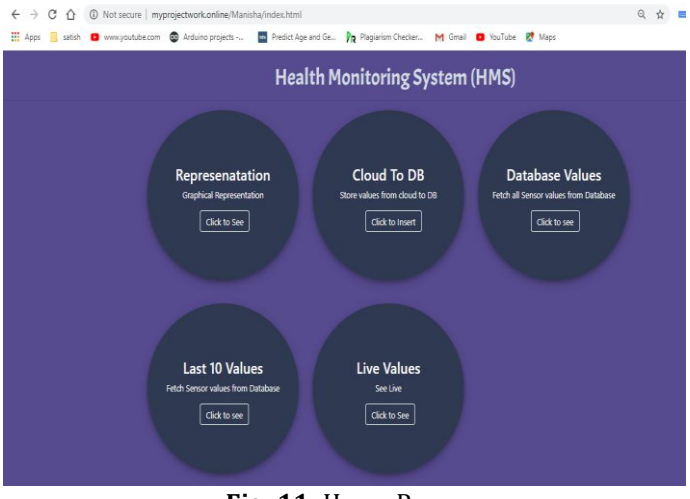

Fig -11: Home Page

This is the dashboard, which contain the live reading of pulse rate, temperature and movements, shows values individually. The all three sensors current values shown. The last ten record shown. The all data which stored on database also shown.

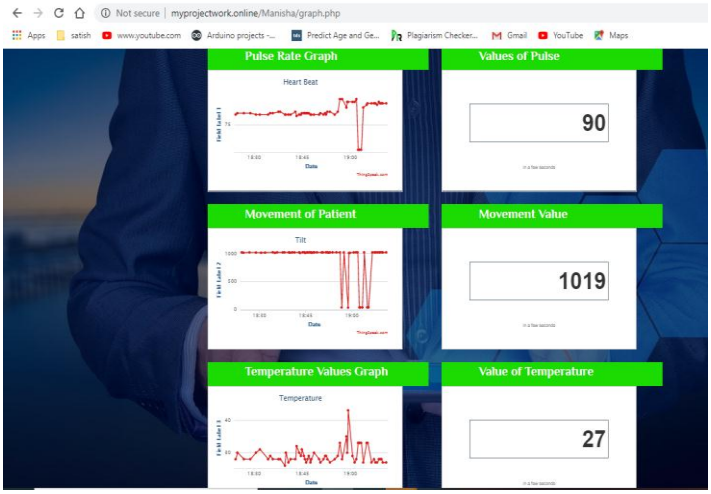

Fig -12: Graphical Representation

The above figure shows the graphical representation of all sensors with respective values of sensors. Here used pulse rate, tilt and body temperature measure sensors.

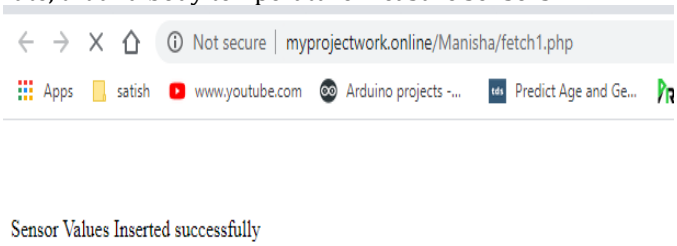

Fig -13: Values from Cloud to DB

Above figure shows the insertion of cloud values into MYSQL database.

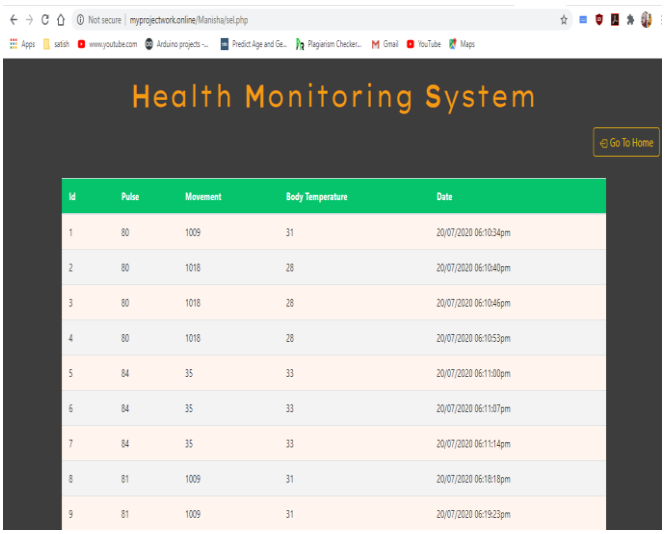

Fig -14: Database all values

Fig - 15: Database all values

The above both figure shows the all the stored values of database retrieved from cloud.

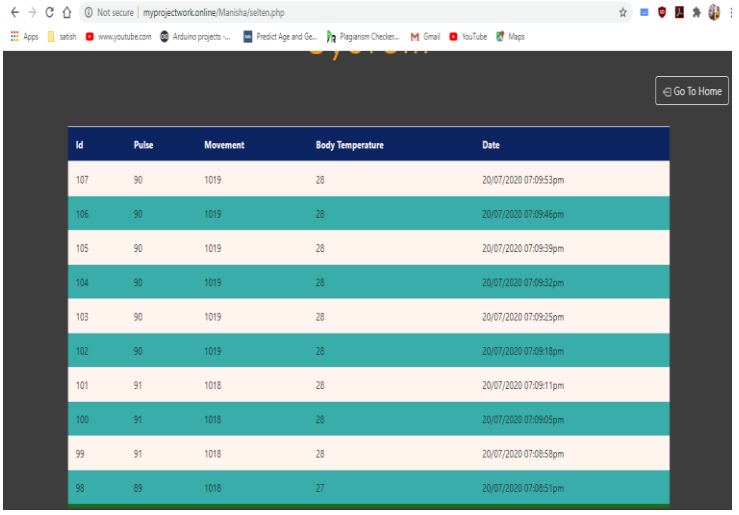

Fig -16: Last 10 Values

Above figure shows the last ten record of all three sensors.

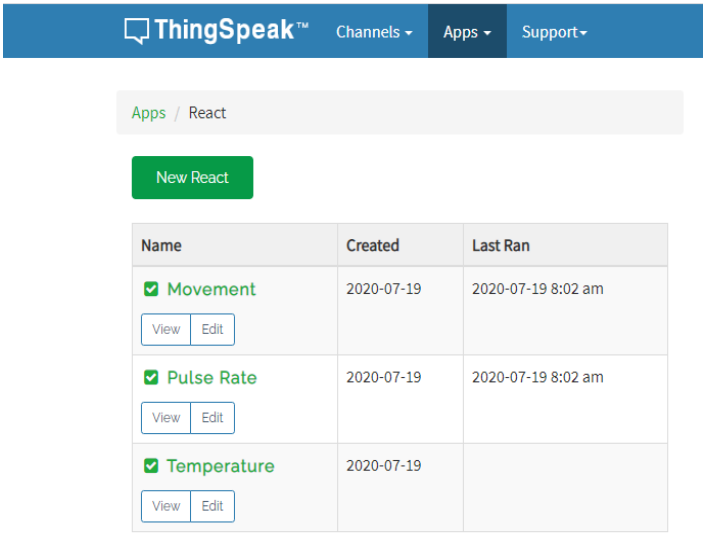

Fig -17: Create Reacts

Above figure shows the thingspeak reacts, here created three reacts as per sensor values retrieved and accordingly the notification will shows on twitter account.

Fig -18: Observation

Above figure shows the observation of all sensors values.

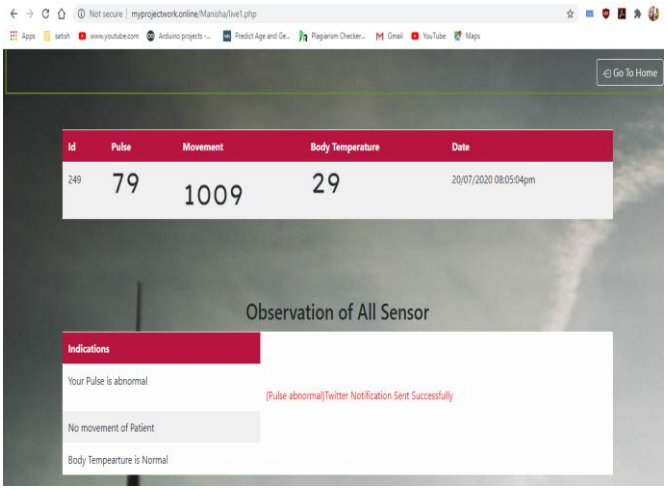

Fig -19: Movement Done

Above figure shows the abnormal values of pulse which is less than 80 BPM, so it will alert on website and also sent notification on twitter.

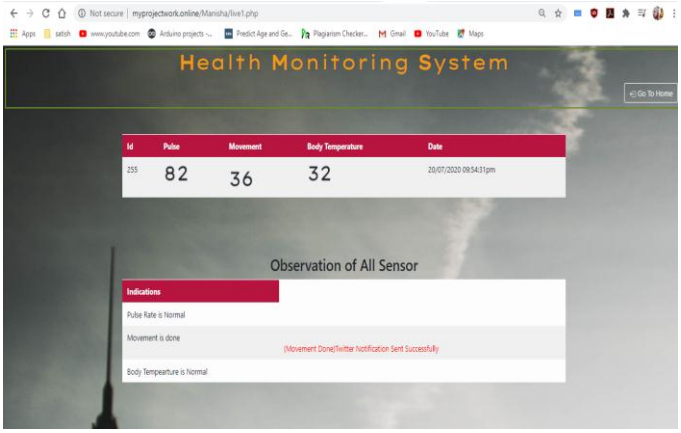

Fig -20: Movement is done

Above figure shows the abnormal values when patient moves from left to right or right to left, so it will alert on website and also sent notification on twitter.

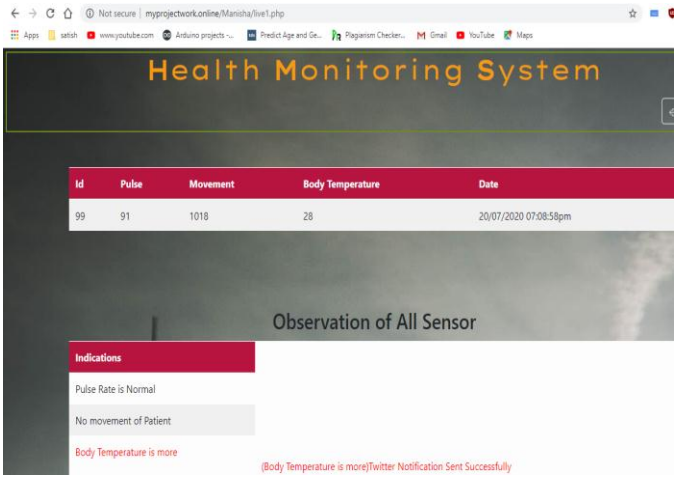

Fig -21: Temperature is high

Above figure shows the abnormal values of body temperature which is greater than 50 degree Celsius, so it will alert on website and also sent notification on twitter.

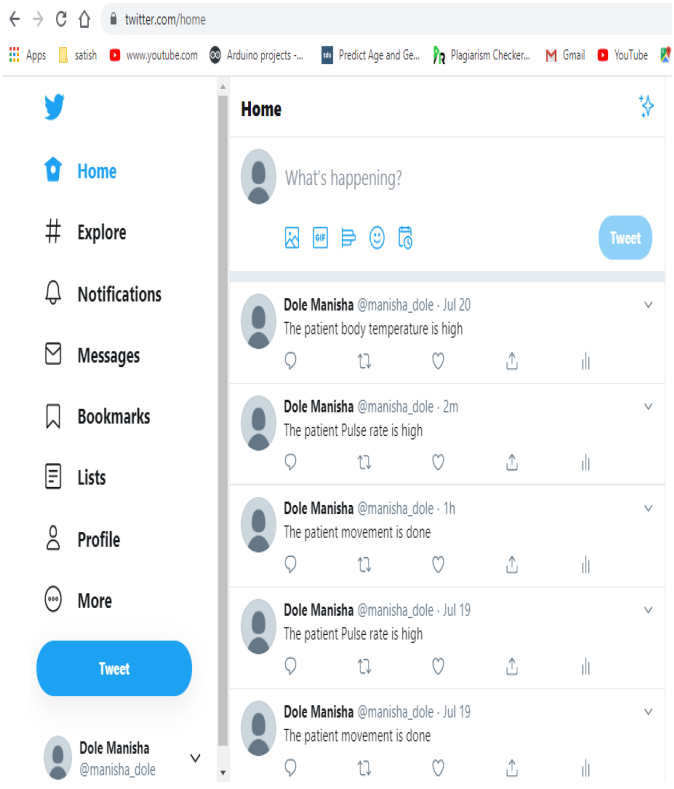

Fig -22: Twitter Notification

6. FUTURE SCOPE

As we see, in these few years as technology of IoT develop then many other systems develop by referring it. So, as we develop system of health monitoring system using IoT. This paper focuses on a real-time pervasive healthcare monitoring system using IoT and cloud computing service which is more beneficial for elders and chronic diseases' patients. In future processor can be change with the compact one latest processor.

7. CONCLUSION

A wireless health monitoring system has been presented in this work. By referring the system, the healthcare professionals can monitor, diagnose, and guide their patients all the time. The physiological data are stored and published online. Hence, the healthcare professional can monitor their patients from a foreign location at any time. Our system is simple. This system is just few wires connected to a small kit with a smartphone. The system is very power efficient. It is reliable to use, fast, accurate, and high efficiency. Finally, the reliability and validity of our system are ensured via field tests. During field test it show that our system can produce medical data that readings are same as values produced by the existing medical equipment.

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