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IMPLEMENTATION OF CLOUD BASED HEALTH CARE MONITORING SYSTEM USING IoT

Dr.P.Kannan (M.E, PhD)[1], Nandhini.S[2], Nasrine Jaheer[3], Naveena.R[4], Rajeshwari.V[5]

[1]*Professor, Department of Electronics & Communication Engineering, Panimalar Engineering College, Chennai, Tamil Nadu -600123*

[2,3,4,5]*UG Scholar, Department of Electronics & Communication Engineering, Panimalar Engineering College, Chennai, Tamil Nadu -600123*

Abstract – *Diagnosis and monitoring of health is a very important task in the healthcare industry. Many studies show that early prediction is the best way to cure health because early diagnosis will help and alert the doctors to know the health status. With the increasing use of technology, there is an urgent need to have such a smart health monitoring system that can communicate between network devices and application which will help the patients and doctors to monitor, track and record the patient's sensitive data containing medical information. This paper depicts the idea of solving health issues using the latest technology, the Internet of Things (IoT). Using this system architecture, the patient's body parameters can be measured in real time. Sensors collect patients body parameters like temperature, motion, eye blink and the moisture which transfers the data to Microcontroller ATMEL 89s52 which further transfers that data to the Cloud server. Medical History is stored in the cloud for easily accessing and future analysis.*

Key Words: **Internet of Things (IoT), Cloud Server, Temperature, Motion, Eyeblink, Moisture, Internet of Medical Things (IoMT).**

1.INTRODUCTION

The Internet of Medical Things (**IoMT**) is a subcategory of IoT and is transforming the healthcare sector. Connected systems of sensors and devices, either on or near the patient, are capturing vital data which is being used to support clinical decision making.

A thing, in the Internet of Things, can be a person with a heart monitor implant, a farm animal with a biochip transponder - or any other natural or man-made object that can be assigned an IP address and provided with the ability to transfer data over a network.

1.1 EXISTING SYSTEM

With the development of IoT health monitoring in real time has become easier. There are various instruments available in the market to keep track of internal body changes. But there are many limits in maintenance part due to their heavy cost, size of instruments and mobility of patients. In the existing system, we use different types of sensors to get the analog values from the patient and uses the Arduino microcontroller with the baud rate of 9600 and IoT module to update the sensor values to the cloud. This helps the doctor to access the patient's health status from anywhere. But medical systems require very precise and faster real-time updates as it deals with extremely critical conditions. Hence we need faster synchronizing of sensor data. Slow monitoring leads to inadequate assessment for analyzing the patient's status. Hence early detection of any significant changes is hindered.

1.2 PROPOSED SYSTEM

In our project, we use PIC microcontroller which is faster and gives more precise data computations. Sensors on the device are enabled by suitable communications to measure physiological parameters. Real-time data are sent from sensors to the microcontroller which is then computed and sent to the cloud for the future references by the doctor. Depending on the patient's current health status which is monitored appropriate steps can be taken immediately to aid in any emergency situations. Key features of Real-Time health monitoring devices is that it enables early detection of deterioration; thereby reducing the number of emergency department visits, hospitalizations, and duration of hospital stays.

Fig.1. Benefits of IoMT(Internet of Medical Things)

2. LITERATURE SURVEY

2.1 IoT BASED HEALTH MONITORING FOR PATIENTS WITH CHRONIC ILLNESS

Barathram Ramkumar and M. Sabarimalai Manikandan, have explained Internet of Things (IoT) driven health and wellness monitoring systems to enable remote and continuous monitoring of individuals, with applications in chronic conditions, such as hypertension, diabetes, heart failure, asthma, depression, and elderly care support. The IoT-driven healthcare system employs networked biosensors to simultaneously collect multiple physiological signals and wireless connectivity to share/transmit gathered signals directly to the cloud diagnostic server and the caregivers for further analysis and clinical review.

2.2 REMOTE MONITORING OF HEALTH STATUS WITH IoT

Arundhati Sen and T.K. Rana have explained care of critically ill patient require prompt & accurate measures. This paper presents a reliable, energy efficient patient continuous monitoring system from a local as well as from a remote place. This system is able to send patient's health parameters like temperature, body movement and eye blink function in real time enabling the doctors or the family members to take measures.

2.3 WIRELESS HEALTH MONITORING SYSTEM

Nicolas and Wai-Chi Fang have explained an advanced patient-centric bedside monitoring system design based on wireless body area sensor networks and telemedicine technologies is proposed in this paper where each patient uses sensors with wireless transmission capabilities and transmit the physiological signals with a larger advanced network, which is connected to a secured section of the public network.

2.4 CLOUD BASED HEALTHCARE ANALYSIS

Atul S. Minhas and Poonam Kumari, (2017) [4] have explained wearable devices for human activity tracking have been emerging rapidly. Most of these devices are capable of sending health statistics to smartphones, smartwatches or smart bands. Such services could supplement the shortage of staff in primary healthcare centers thereby reducing the burden on healthcare service providers. The enormous amount of data created from such services could also be utilized for planning future therapies by studying recovery cycles of existing patients.

3. WORKING PRINCIPLE

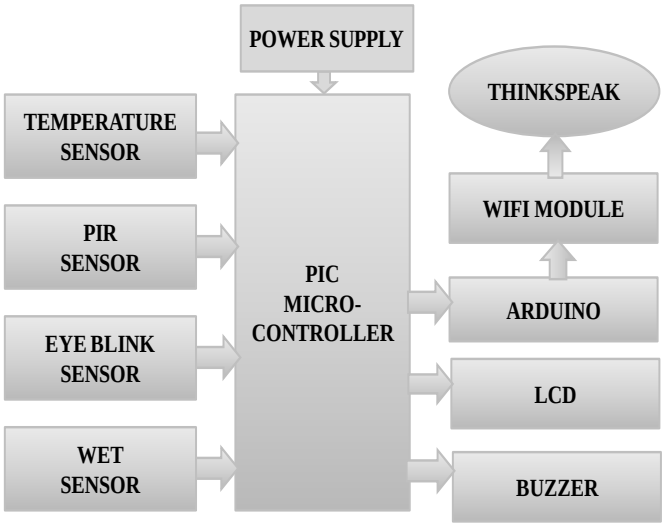

Fig.2.Block Diagram

The sensors like temperature sensor, passive infrared red sensor, wet sensor, eye blink sensor act as the analog or digital inputs to the PIC microcontroller. The temperature sensor and the passive infrared red sensor act as the analog inputs to the microcontroller and the wet sensor and the eye blink sensor act as the digital inputs to the PIC microcontroller. The PIC16F877A microcontroller gives the sensed analog and digital values to the Arduino which sends the sensed information to the IoT module (ESP8266 Wi-Fi

module) and updates them in the ThinkSpeak application.

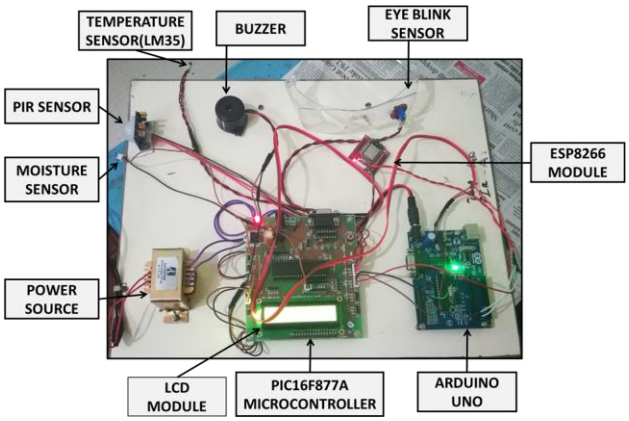

Fig.3. Circuit Implementation

4. PIC 16F778A MICROCONTROLLER

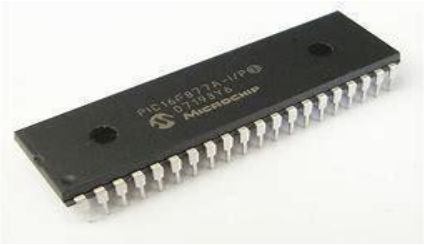

Fig .4. PIC Microcontroller

The PIC microcontroller PIC16F877A is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. It has a total number of 40 pins and there are 33 pins for input and output.PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and in many industrial instruments.

4.1 ARDUINO UNO

Fig .5. Arduino UNO Board

Arduino is an open source computer hardware and software company, the project that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. In our project, we use this module to as an interface to connect our PIC microcontroller to the Wi-Fi module for cloud processing. Arduino Uno R3 serves an important role in data processing.

4.3 Wi-Fi MODULE (ESP 8266)

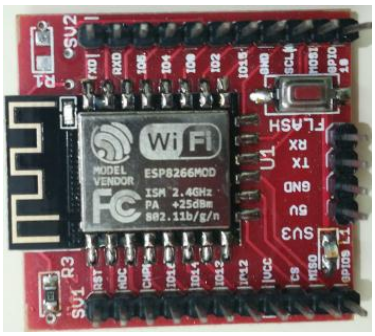

Fig.6. Wi-Fi Module

There are various types of Wi-Fi modules like **ESP8266,** Arduino Shield or Heavy module. The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your **Wi-Fi** network. The **ESP8266** is capable of either hosting an application or offloading all **Wi-Fi** networking functions from another application processor.

4.4 TEMPERATURE SENSOR

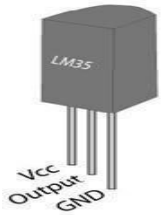

Fig .6. Temperature Sensor

LM35 is a precision IC **temperature sensor** with its output proportional to the temperature (in C). The

sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, the temperature sensor can be measured more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1ºC temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ºf rising/fall in ambient temperature.

4.5 PIR SENSOR

Fig .7. PIR sensor

A **Passive Infrared sensor** (**PIR sensor**) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually, this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose.
Whenever a human being (even a warm body or object with some temperature) passes through the field of view of the PIR sensor, then it detects the infrared radiation emitted by hot body motion. Hence we can detect the motion immediately and aid to the patient as the buzzer rings.

4.6 EYE BLINK SENSOR

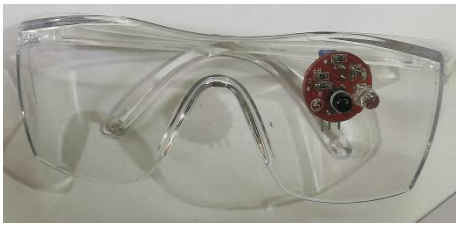

Fig .8. Eye Blink Sensor

The IR receiver is used to receive the reflected infrared rays of the eye. If the eye is closed means the output of IR receiver is high otherwise the IR receiver output is low. This to know the eye is closing or opening position. This output is given to the logic circuit to indicate the alarm and LCD.

4.7 MOISTURE SENSOR

Fig .9. Moisture sensor

The moisture sensor is a self-designed sensor it detects the patient's wet condition and intimates to the nurse via the buzzer. It displays the condition of the patient via the LCD i.e wet detected or not so that the patient could be helped out as soon as possible to reduce the risk of infection and cold.

4.8 BUZZER

Fig.10. Buzzer

A buzzer is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Here if any of the values from the sensors reach more than a threshold level or shows any abnormality then the buzzer rings to alert the nearby caretakers to give immediate help to the patient.

4.9 LCD MODULE

LCD (Liquid Crystal Display) [16*2] is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies. The LCD module is used to display the values coming out from the sensor indicating the present health status of the patient. In this LCD each character is displayed in a 5*7pixel matrix.

4.10 THING SPEAK APPLICATION

The data obtained from the sensors is processed by the microcontrollers and then using the Wi-Fi module is sent to the cloud. The doctor can log in in his/her device to monitor the current status of the patient. This saves the time and cost for the doctor and remote monitoring is done easily.

5. FUTURE SCOPE

Wireless sensors networks, a well-known technology consist of small, battery-powered "motes" with limited computation and capability. With the usage of sensors security issues and safety can be improved. Sensors gather information about the physical world or environment to take a decision i.e. automated interactions with the environment. The remote monitoring of the patients through automated devices such as sensors for necessity interaction or movements in the body. Our current work can also be extended further to monitor a patient's blood pressure, their heartbeat, pulse rate etc., and directed to the doctor via

IoT.

6. RESULT AND OBSERVATION

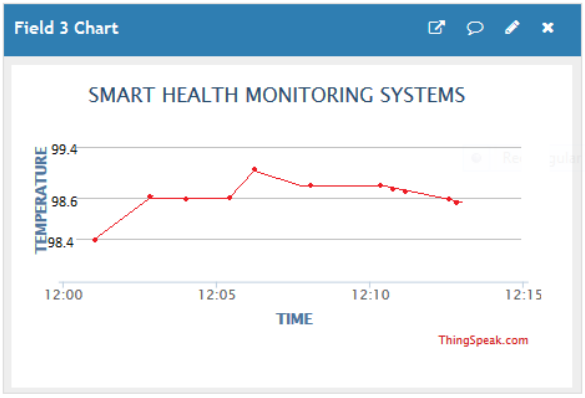

Fig .11. Temperature sensor output.

Figure 11 describes the normal person body temperature with respect to the situation. It depicts the range of temperature across various intervals of time measured by the temperature sensor. The output voltage is proportional to the temperature. From this graph showing the temperature ranges of a normal patient, we can be able to compare these values with the temperature ranges of the patient or the coma patient. The temperature sensor measures the patient's body temperature and checks whether the temperature is normal and makes an alert if the temperature rises abnormally.

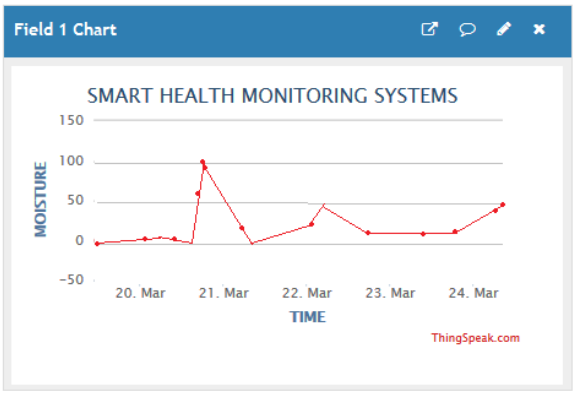

Fig .12: Moisture sensor output

In Table 1, we can see the body temperatures of many patients with respect to the situation. For normal patients, body temperature lies in the range of 98.4'F to 98.6'F. But when the patient's body temperature lies above the normal temperature, then the patient needs attention.

Here eight patients are considered their body temperature is measured with respect to the situation. It depicts the range of temperature across various intervals of time measured by the temperature sensor for all the patients.

Person /time	6:00 am - 11.00 am	11:00 am - 4.00 pm	4:00 pm - 9.00 pm	9:00 pm - 2.00 am	2:00 am - 6.00 am
Patient1	98.5	98.5	98.54	98.62	98.6
Patient_2	98.6	98.72	98.84	99.08	99.93
Patient_3	98.44	99.4	98.49	98.55	98.5
Patient_4	98.62	98.89	99.34	99.8	100.36
Patient_5	98.52	98.45	98.45	98.47	98.49
Patient_6	98.46	98.48	98.45	98.45	98.48
Patient_7	98.56	98.45	98.51	98.62	98.6
Patient_8	98.84	99.64	100.18	100.78	101.99

Table.1. Temperature Database

By comparing the graph of different person it makes the doctor analyze the affected patient's status much easier. The graph shown below compares the body temperature status of different patients so that the doctor can analyze the affected patient's body conditions. Here in this graph, the body temperatures of 8 patients are compared.

From this graph, it can be said that patient_1, patient_3, patient_5, patient_6, patient_7 have their normal body temperature and the patient_2, patient_4, patient_8, have the body temperature higher than the normal body temperature.

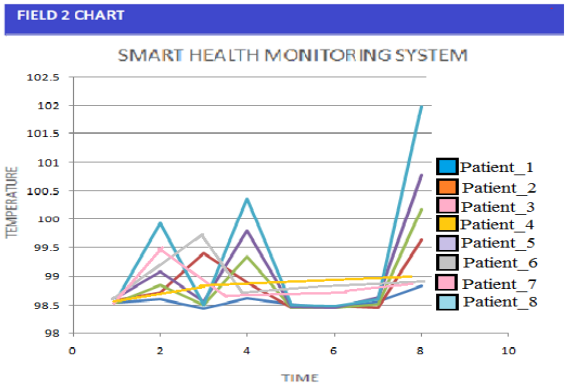

Fig .13. Temperature Graph (multiple patients)

The above figure depicts the moisture levels of the sheets across various intervals of time measured by the moisture sensor. The moisture sensor measures the moisture level of the sheets and checks whether the sheet is dry and makes an alert if the sheet becomes wet to the nearby caretakers.

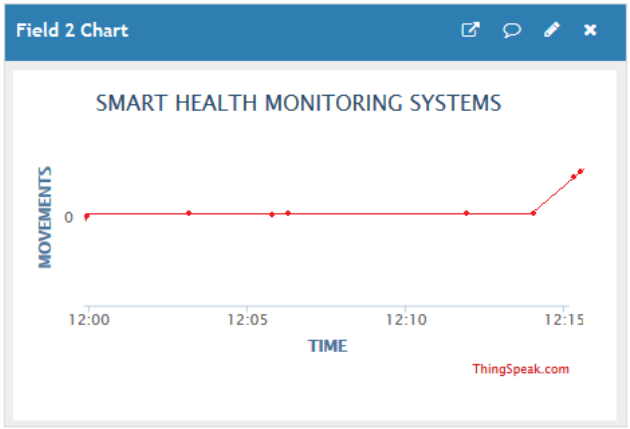

Fig .14. PIR Sensor output

The above figure This parameter displays the body movement of the patients. This depicts the movements of the patients across various intervals of time measured by the PIR sensor. The PIR sensor measures the body movements of the patients and checks whether the body movement is detected and makes an alert to the nearby caretakers if the PIR sensor detects any body movements to the nearby caretakers.

In the table shown below, we can see the body movements of three patients with respect to the situation. Here the patient_1 and patient_3 is not idle and hence it can be said patient_1 and patient_3 are not at the critical stage to keep them under the observation. From the graph, it shows that the patient_2 is idle for a long period and hence he will be kept in observation. The doctors can use these database values for analyzing the health status of these patients in the future.

Patient/ Time	12:01pm	12:05pm	12:10pm	12:15pm
Patient_1	612	636	634	619
Patient_2	00	00	00	00
Patient_3	517	639	650	614

Table.2. PIR Sensor monitored data

The graph depicts the various body movements of three different patients, patient_1, patient_2, patient_3. This graph shows that the two patients patient_1 and patient_3 are normal and the patient_2 has to be kept under the observation.

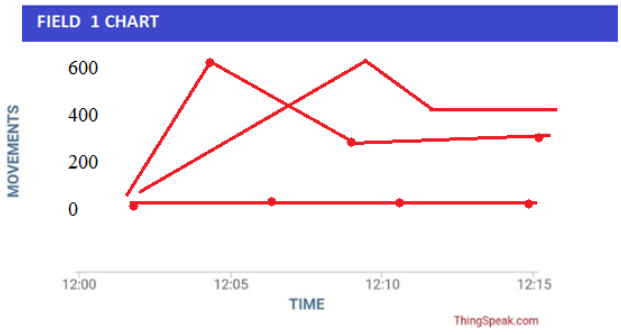

Fig.15. PIR Sensor output (multiple patients)

The below figure shows the database report for future analysis. The doctor can view this report for future analysis and clinical review. The enormous amount of data created from such services could also be utilized for planning future therapies by studying recovery cycles of existing patients. We can also predict the activity of the patients which helps the doctors to assist the patients more precisely.

Created_at	Entry _Id	Field 1	Field 2	Field 3
2019-03-19 06:16:16 UTC	1	41	0	589
2019-03-19 06:26:18 UTC	2	39	0	591
2019-03-19 06:26:38 UTC	3	53	636	559
2019-03-19 06:26:58 UTC	4	60	634	786
2019-03-19 06:27:18 UTC	5	42	0	483
2019-03-19 06:27:38 UTC	6	101	0	510
2019-03-19 06:27:58 UTC	7	43	0	397
2019-03-24 06:36:29 UTC	8	106	0	970
2019-03-24 06:36:59 UTC	9	46	0	972
2019-03-24 06:38:22 UTC	10	110	0	976
2019-03-24 06:38:39 UTC	11	70	636	976
2019-03-24 06:38:59 UTC	12	70	0	976
2019-03-24 06:39:19 UTC	13	51	0	976
2019-03-24 06:39:39 UTC	14	101	0	977
2019-03-24 06:39:59 UTC	15	68	0	970

Table.3. Database report for analysis

7. CONCLUSION

In the health care field, issues such as long-term patient care in hospitals support the patients for their health monitoring and make it easy for the doctors. The proposed model reduces healthcare costs by collecting, recording, analyzing and sharing large data streams in real time and efficiently. This project is to reduce the headache of a doctor to visit a patient every time he needs to check his pulse, temperature etc. Hence the time of doctors are saved and they can also help in the emergency scenario as much as possible collecting data information which includes patient's body movement, eye movement, and temperature and sends an emergency alert to patient's doctor with his current status and full medical information via IoT.

8. REFERENCES

[1]Barathram Ramkumar and M. Sabarimalai Manikandan "Real-Time Quality Aware ECG Telemetry System for IoT- Based Health Monitoring IEEE internet of things journals Vol. 5, No. 3,2017.

[2] Arundhati Sen and T.K. Rana on "Real-time healthcare monitoring of a patient in a remote place" IEEE internet of things journals Vol .3 No.12,2017.

[3]Nicolas and Wai Chi Fang" An advanced patient bedside monitoring system design based on the WBAN and telemedicine technologies " IEEE internet of things journals, Online (1567),2017.

[4]Atul S. Minhas and Poonam Kumari on "Wearable Internet of Things – human activity tracking to clinical test integration" IEEE internet of things journals, Vol. 9 Issue 6,2015.