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HEALTH MONITORING SYSTEM USING LoRaWAN (NodeMCU)

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Abstract - Health has prime importance in our day-to-day life. Sound health is necessary to do the daily work properly. This project aims at developing a system which gives body temperature and heart rate using LM35 and pulse sensor respectively. These sensors are interfaced with controller Arduino uno board. Wireless data transmission done by Arduino through NodeMCU module. NodeMCU (LoRaWAN) is used for wireless data transmission on IoT platform i.e. thing speak. Data visualization is done on Thing speak. So that record of data can be stored over period of time .This data stored on web server so that it can seen to who logged.

Keywords—Health monitoring system, controller, pulse sensor, temperature sensor, IOT

I. INTRODUCTION

In the recent years wireless technology has increasing for the need of upholding various sectors .In these recent years IoT graphed the most of industrial area specially automation and control. Biomedical is one of recent trend to provide better health care. Not only in hospitals but also the personal health caring facilities are opened by the IoT technology. So having a smart system various parameters are observed that consumes power, cost and increase efficiency .In according to this smart system, this paper is reviewed.

In traditional method, doctors play an important role in health check up. For this process requires a lot of time for registration, appointment and then check up. Also reports are generated later. Due to this lengthy process working people tend to ignore the checkups or postpone it. This modern approach reduces time consumption in the process.

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Medical scientists are trying in the field of innovation and research since many decades to get better health services and happiness in human lives.

Their contribution in medical area is very important to us and cannot be neglected. Today's automotive structures have the root ideas coming from yesterday's basics. Also Early detection of chronic diseases can be easy with these technology.[4]

The body temperature, heart rate, blood pressure, respiration rate are prime parameters to diagnose the disease. This project gives temperature and heart rate values using IoT.

II. MOTIVATION

In rural hospitals, the facilities for health caring are limited. The poor quality of health management enables issues in health care system Everyone should get the knowledge of own health as easy and early as possible. Also it should be worth for each .Latest report of The India Spend analysis of data says that the 500,000 doctors shortage in India. WHO defines the doctor patient ratio will be 1:1000 which has been failed in India.

In developing countries there is lack of resources and management to reach out the problems of individuals. A common man cannot afford the expensive and daily check up for his health. For this purpose various systems which give easy and assured caring unit have been developed. Theses system reduces time with safely handled equipment.

III. RELATED WORK

Modern health care system introduces new technologies like wearable devices or cloud of things. It provides flexibility in terms of recording patients monitored data and send it remotely via IOT. For this connection, there is need of secure data transmission .To transmit the data with privacy is the Moto of this paper. The proposed system introduces security of health care and cloud of things. System works in two major parts viz. storage stage and data retrieving stage. In storage stage, data is stored, updated for future use. In data retrieving stage, retrieve data from cloud. The cloud server can share with authenticated user as per request. A patient with wearable devices continually updates his record every 5 or 10 min. In emergency mode, it updates for every 1min. The wearied device will send results to phone using Bluetooth connection or NFC technology. This can able to give to cloud server using GSM and 3G. At cloud server, each patient is defines with unique address. So data at cloud can authenticate the right patient and provide the required request.[1]

Tele-monitoring system via WBAN is evolving for the need for home based mobile health and personalized medicine. WBAN can able to collect the data acquired from sensor and record the output. This output results sent to controller wirelessly to health monitoring system. In this paper, Zigbee is used to in WBAN technology due to its guaranteed delay requirement for health tele-monitoring system. Zigbee used in the communication.[2]

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 demonstrated that power consumed by LoRaWAN network is ten times less than the GPRS/3G/4G.The IOT architecture has been given for step wise working for understanding of IOT .The main purpose of LoRaWAN is the energy consumption. The power consumption in idle mode for LoRaWAN is 2.8mA while in GPRS is 20mA.Hardware cost in LoRaWAN is 10doller 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 [5]. Mohammad M. Masud, Mohamed Adel Serhani, and Alramzana Nujum Navaz had given the measurement of ECG signals at various intervals and at different situations. They have considered energy aware, limited computing resources and lose network continuity challenges .For these challenges; mathematical model has been developed to execute each task

sequentially. There are three approaches designed to work out the process .One is mobile based monitoring approach, data mining and third is machine learning approach [6].

Ayush Bansal , Sunil Kumar, Anurag Bajpai, Vijay N. Tiwari, Mithun Nayak, Shankar Venkatesan, Rangavittal Narayanan focuses on development of a system which is capable of detecting critical cardiac events. Using an advanced remote monitoring system to detect symptoms which lead to fatal cardiac events [7]

Hamid Al-Hamadi and Ing-Ray Chen gives trust based health IOT protocol that considers risk classification, reliability trust, and loss of health probability as design dimensions for decision making. Comparative analysis of trust based protocol and baseline protocols te check feasibility.[8]

Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian Anuradha ."Digital hospital" term is introduced for hospital management. It enables automatic electronic medical records in standard. Also discusses with the implemented real world scenario of smart autonomous hospital management with IOT.[9]

Table 1: Comparison of sensors and technology used [1,7,5,6,9]

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 WSN	B.P, Temp., glucose	WSN network
4	Resource-Aware Mobile-Based Health Monitoring	ECG sensor	ECG processing analytics module

IV. SYSTEM AND OVERVIEW

A. Objective

- To develop health monitoring system i.e. it measures body temperature and heart rate.
- To design a system to store the patient data over a period of time using database management.
- To do analysis of collected data of sensors.

B. Block Digram

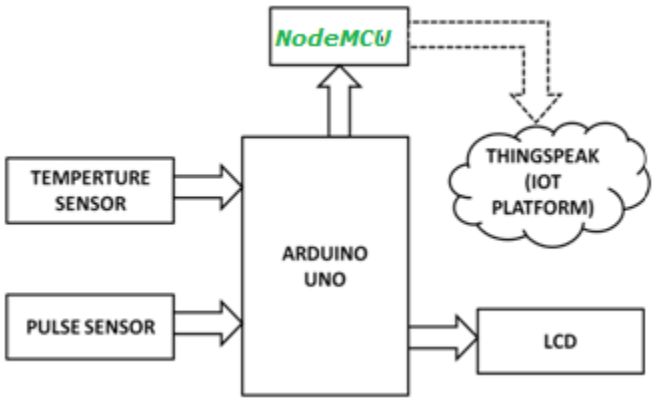

Fig 1: Block diagram of system

Fig 1 shows the proposed system .The health monitoring sensors are used to collect health related data i.e. for data acquisition. Communication can be done by controller for sending data on internet wirelessly. Data processing has been done at server. All data collected and aggregated at server point. To get health related information in understandable format it can be shown on web page i.e. data management.

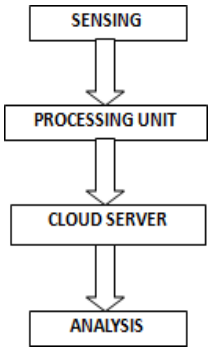

Fig 2: Working of system

Fig 2 shows the working flow of system. The results collected from sensor are analyzed i.e. if abnormal behavior has been detected , then emergency plan activated to inform the Doctor about patient's health .So it reduces critical conditions in Hospital.

C. Components Used

Table 2 gives the modules used in the system and their required specification. Following

1) Arduino uno:

Arduino uno is microntroller based on ATMega 328.Simulation is done on Arduino IDE software. The ATmega 16U2 provides serial data to the main processor and has a built-in USB peripheral. Arduino Uno power cable Standard A-B USB cable.It has 14 digital I/O pins.

2) Temperature Sensor:

LM35 sensor is used for measurement of body temperature. Sensor is put in contact with body and it senses body temperature. It is calibrated linearly in Celsius. It has low self heating capability. Also id doesn't require external calibration.

3) *Pulse Sensor:*

Pulse sensor is designed to give analog output of heart beat when a finger is placed on sensor. It starts working; LED on top side will starts blinking with each heart beat. To see the sensor output, output pin of sensor is connected to controller .The working principle of sensor is based on light modulation by blood flow through nerves at each heart pulse.

Table 2: Specification of System [10]

Module	Item	Specification
Controller	Operating voltage, digital pins, Flash memory	5V, 14,32 KB
Temperature sensor	Temperature range, power, output impendence	-55C to 150C,4- 30V,0.1W for 1mA load
Pulse sensor	LED, gain, Power	Infrared LED,100,3.3V
NodeMCU module	Power ,baud rate ,range	3.3V,9600BPS, Up to 10m
LCD	Power, display	5V,plasma display

4) *NodeMCU Module:*

The NodeMCU module is a self contained SOC with incorporated TCP/IP protocol stack that can offer any controller access to NodeMCU network. It uses 802.11 b/g/n protocols. Standby power consumption is less than 0.1mW.

5)

6) *IoT Platform:*

a) Use the Thinkspeak platform to send data to the cloud from any Internet-enabled device.

b) You can then configure actions and alerts based on your real-time data and unlock the value of your data through visual tools.

c) Use the Think speak offers a platform for developers that enable them to easily capture sensors data and turn it into useful information.

D) *Results*

Fig 3 shows the interfacing of controller to sensors & LCD.

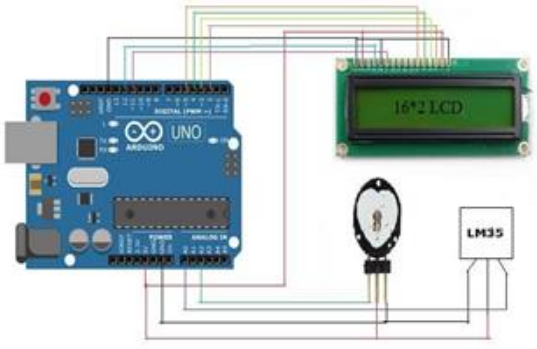

Fig 3: Interfacing of LCD and sensors with Arduino

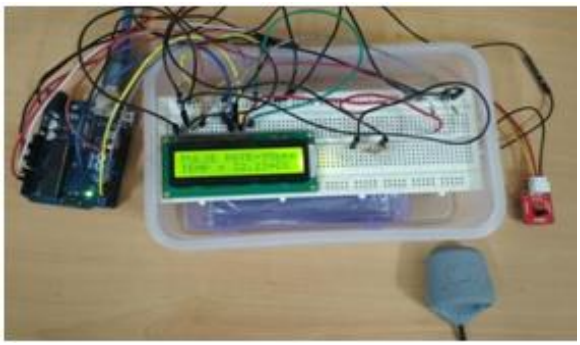

Fig 4: Setup of System

Fig 4 shows the Output on LCD of pulse sensor and temperature sensor.

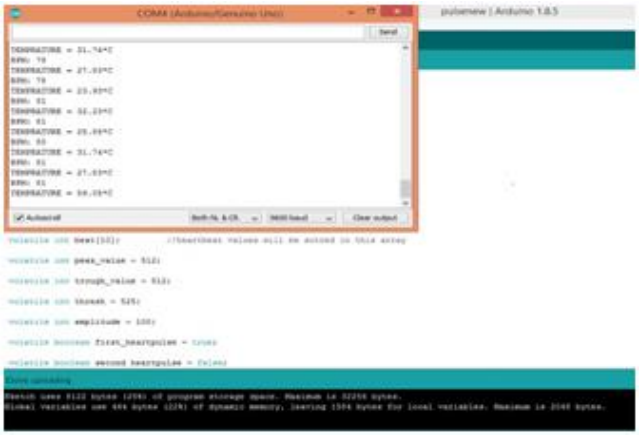

Fig 5: Simulation of system on Arduino IDE

Fig 5 is the simulation window of Arduino IDE of program. Fig 6 gives parameters that is temperature and pulse rate is shown online on IOT platform.

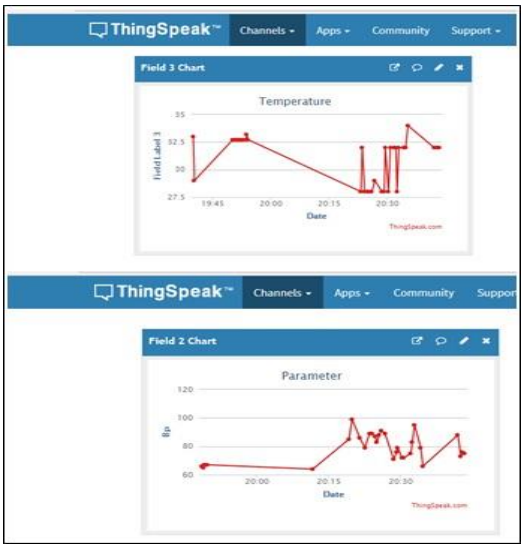

Fig 6: Graphs of sensor output

CONCLUSION

Our main objective in this project was to successfully monitor the basic four criteria's namely temperature, pulse, using of toilet and sleep and react during emergency situation without any human interaction. We wanted to make a mark on the field of IoT with the health sector. With the rise of IoT, the era of technology is moving towards a far superior dimension. In order to keep pace with the new technologies, this project can sure make way for the advancement in this sector. Though our model is tested and implemented, it will be difficult to continue the project without superior quality hardware support along with a lot of new integration. The real benefit of this work can only be fully realized when it can be implemented in full scale.

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