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Improved Medical Healthcare System Based On IoT

Shafaque Nasruddin Soparkar¹, Dr. Lochan Jolly²

P.G. Student, Dept. of Electronics and Telecommunication Engineering, TCET College, Kandivali, Mumbai, India¹

Professor, Dept. of Electronics and Telecommunication Engineering, TCET College, Kandivali, Mumbai, India²

ABSTRACT: Internet of Things (IoT) is the emerging paradigm, where huge number of smart object and smart devices connected to the internet for communication. The quick development of Internet of things (IoT) technology makes it possible for connecting various smart objects together through the Internet and providing better and more data interoperability methods for significant use and other application purpose. IoT devices are used in many fields which make the user's day to day life more easy and comfortable. Patient Physiological information monitoring is very important in any hospital, this system proposed patient physiological information monitoring system based on IoT ,hardware and software, this system can show temperature, heart rate with accuracy and notification and panic condition of patient. In order to save energy effectively in proposed system ARM7 is chosen for data processing and Wi-Fi Module for complete data transmission.

KEYWORDS: EAGLE 7.2.0, smart healthcare system, IoT (Internet of Things), Body Sensors, LPC2148.

I. INTRODUCTION

One of the global challenges faced by humanity is health. In any healthcare monitoring system, constant monitoring of physiological parameter is necessary. For example a the parameters required continuous monitoring of pregnant woman such as blood pressure (BP), heart rate of the woman and heart rate and movements of fetal to control their health condition. Likewise if patient suffering from any chronic disease or physiological disorder, then it is difficult to monitor his/her health continuously. The difficulty found is that, physician has to frequently visit the patient and asses his/her condition by analyzing the measured parameters such as body temperature, blood pressure, and other physiological parameters. In emergencies, the nurses or other care taker may not be available for constant monitoring of patient's health; due to delay the patient's health becomes critical. To avoid such conditions, there has to be a mechanism by which the doctor can remotely measure the vital parameters at any instant of time.

The development of the Internet of Things will greatly facilitate the process of patient's diagnosis and monitoring, with small IP-based wireless sensors implemented on the patient's body, through which his physiological parameters, such as body temperature and heart rate can be monitored remotely and continuously.

Depending on an individual's biological and behavioural characteristics, the healthy and unite practice of wellbeing, healthcare and patient support is defined as personalized. This emancipates each and every individual by following the basic healthcare principle of "the suitable care for the right person at the right time", which leads to more desirable results and improvement thus making healthcare cost effective and reliable. An efficient healthcare service should deal with prevention, early pathology detection and homecare instead of the high-priced clinical care.

II. LITERATURE REVIEW

The report of World Health Organization (WHO) indicates that the medical systems of various countries are under intense pressure for the population aging problem, which is more and more severe due to the limited quantity of medical facilities and medical personnel [8]. A survey was conducted in many countries to observe the functioning of different medical centers and the improvement in healthcare delivery with the introduction of information technology. The survey reveals that patient records in many of the hospitals were not managed properly; also the patient

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information among various hospitals was based on paper documents. As facilities were not available to precisely estimate patient’s history, the healthcare quality was inefficient. The survey revealed that healthcare facilities can be improved with the help of Information Technology. The literature survey is done on healthcare system and many papers are taken into considerations, which are explained below.

C. N. Scanail, B. Ahearne and G. M. Lyons[1] A Telemonitoring system, based on short message service (SMS) has been developed to remotely monitor the long-term mobility levels of elderly people in their natural environment.

N. P. Jain, P. N. Jain and T. P. Agarkar [2] in above paper the implementation was only to monitor the mobility of an elder person. Now this paper shows the system where physical Wireless, remote patient monitoring system and control using feedback and GSM technology is used to monitor the different parameters of an ICU patient remotely and also control over medicine dosage is provided.

S. Tewary et al.[3] A Smart Health Monitoring System, such as the one designed in this study, aims to automate patient monitoring tasks. In this paper they have designed and developed a GSM (Global System for Mobile) based smart wearable system with 3-axis Accelerometer, 3-lead ECG recording system and real-time NIBP analysis system.

K. Aziz, S. Tarapiyah, S. H. Ismail and S. Atalla [4], in this proposed system, they have focused on monitoring of patient’s blood pressure and body temperature. The objective of this work is providing an effective application for Real Time Health Monitoring and Tracking. The system track, trace, monitors patients and facilitate taking care of their health; so efficient medical services could be provided at appropriate time.

R. K. Kodali, G. Swamy and B. Lakshmi [5] They have include the concept of IoT which eliminates need for a health care professional come by at regular intervals by providing ubiquitous monitoring system using sensors, gateways and cloud to analyze and store the data and communicate it wirelessly to physicians for further analysis.

A. Archip, N. Botezatu, E. Șerban, P. C. Herghelegiu and A. Zală [6], present a prototype system for remote patient monitoring. The main purpose of this prototype is to fill the gap in monitoring a patient’s vital signs between ICU and the actual hospital discharge.

The research work carried out in above papers were dependent on hardware embedded system, also accuracy and cost are the problems which are found during study. The proposed system takes care of all these parameters.

III. PROPOSED SYSTEM

The key motive of the designed system is to continuous monitoring of the patients over internet. The Proposed System architecture for IOT Healthcare is as shown in the Figure 1.

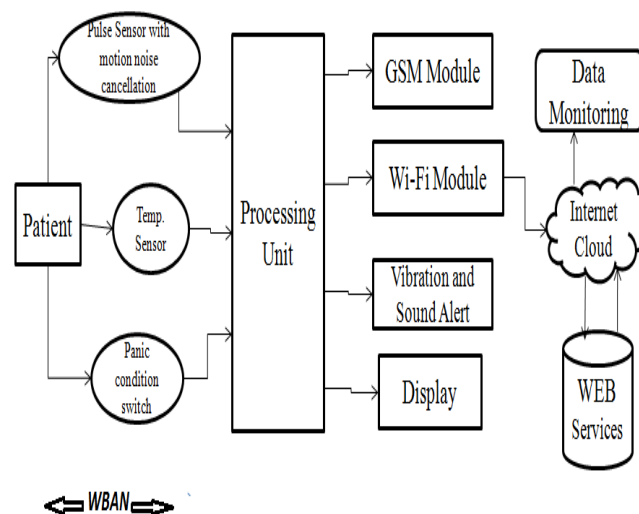


Figure 1: Proposed Block diagram of Healthcare System

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The model consists of LPC2148 Microcontroller, Temperature sensor, Pulse Sensor, Liquid Crystal Display (16x2), GSM Module, Buzzer, Wi-Fi Module, Max232, GSM regulated Power Supply. In this system LPC2148 Microcontroller collects the data from the sensors and sends the data through Wi-Fi Protocol. The Protected data sent can be accessed anytime by the doctors by typing the corresponding unique IP address in any of the Internet Browser at the end user device(ex: Laptop, Desktop, Tablet, Mobile phone).

The GSM Modem is connected to Microcontroller which will provide information to doctor/caretaker when the heart rate is above or below the threshold value and when the temperature is above or below the threshold value. During this time the buzzer/alarm turns on and alerts the caretaker. LCD is connected to microcontroller to display the transaction process and other healthcare data. And the user interface html webpage will automatically refresh for every time hence patient health status is continuously sent to the doctor. Hence continuous monitoring of patient data is achieved.

1. Hardware Implementation:

Software Used for PCB design (EAGLE): EAGLE is one of much available scriptable electronic design automation application with schematic capture, printed circuit board layout, auto-router and computer-aided manufacturing features. EAGLE stands for Easily Applicable Graphical Layout Editor (German: Einfach Anzuwendender Grafischer Layout-Editor) and is developed by CadSoft Computer GmbH. EAGLE contains a schematic editor, for designing circuit diagrams [11].

Figure 2 shows the circuit implementation which is designed in Eagle 7.2.0. Below circuit shows the interfacing of different components with controller LPC2148.

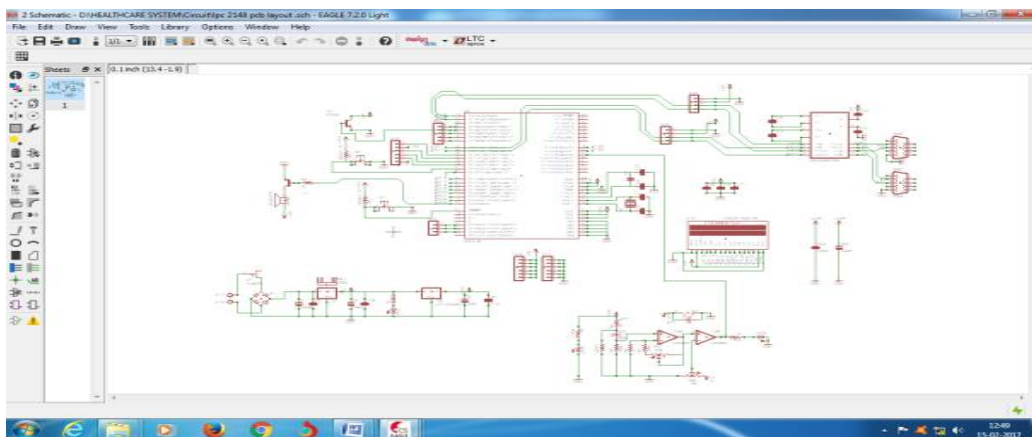


Figure 2: Circuit diagram of System

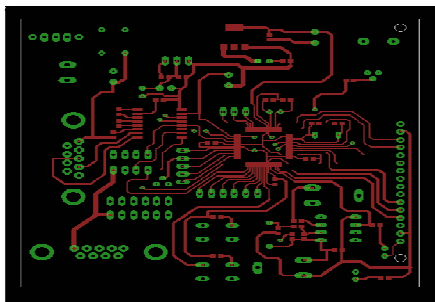


Figure 3: Top layer PCB

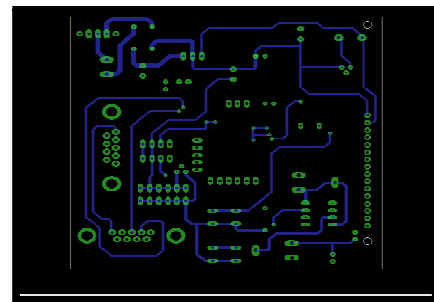


Figure 4: Bottom Layer PCB

Figure 3 and Figure 4 shows the PCB Layout which contains Top and Bottom Layer respectively.

Main PCB of system: This system is based on IoT, as the system is not focuses on M2M communication but it includes human interface. This board contains power supply, different sensor pins where sensor output will be provided

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for further processing, interfacing of DB-9 connectors for serial communication, LCD for display, integration for GSM module and Wi-Fi is also done in above system.

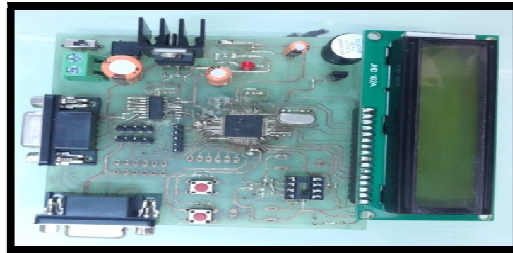


Figure 5: Main Hardware Board of System

Figure 5 shows the main PCB board of system, where different components are interfaced with LPC2148 controller.

2. Software Simulation

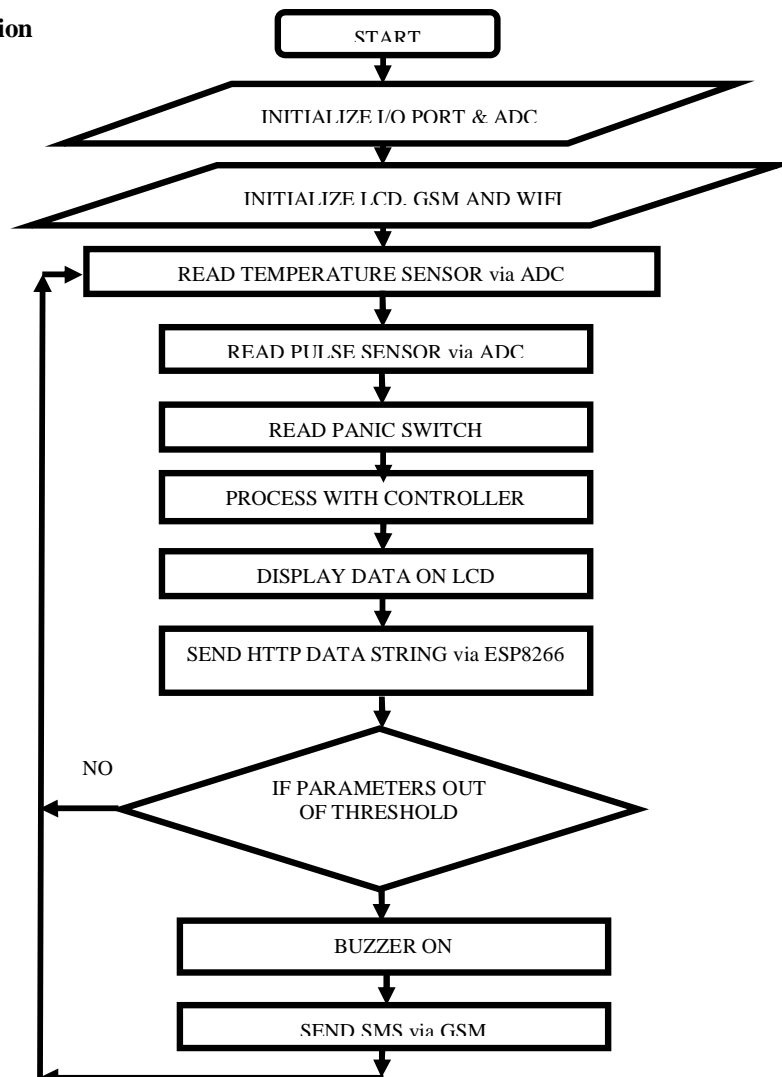


Figure 6: System Flow

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A program for LPC2148 may be written in embedded C or in Assembly language for a compiler that produces binary machine code for the target processor. Figure 6 describe the flow of system where, first initialization of all input/output port, ADC, LCD, GSM and Wi-Fi is done. As different sensors like temperature sensor and pulse sensor are connected, they will sense the data and passes to controller for further processing. All the data will be display on LCD. Simultaneously all data string will be send to server via Wi-Fi module (ESP8266). If measured parameters are out of threshold value, emergency actions will be taken like buzzer will get on and message will be send to care taker or doctor. And if parameters measured are normal then cycle will continue and continuously monitoring will be done.

IV. RESULTS AND DISCUSSION

This healthcare system is implemented for patient physiological information monitoring system which is based on IoT, hardware and software; the system can show temperature, heart rate with accuracy and notification for panic condition of patient. All the data is displayed on LCD as shown in figure 7 and if any panic condition occurs then emergency message is sent to care taker on his/her mobile which can be seen in Figure 8.

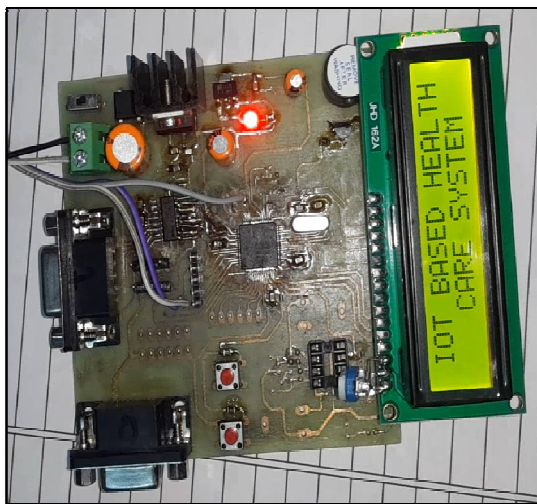


Figure 7: Data Display on LCD



Figure 8: Emergency/Panic condition message on Mobile

As the data string is continuously uploaded to server, “ThingSpeak” platform App is used which is an open source IoT application and API to store and retrieve using the HTTP protocol over the Internet via Local area network. ThingSpeak enables the creation of sensor logging application; locating tracking application and social network of things with status update [10].

Figure 9 and Figure 10 gives the ThingSpeak chart field which gives graphical analysis of temperature and Heartbeat respectively, where temperature and heartbeat is monitored continuously. As doctor or any care taker can analyze the patients health from any remote location and they can provide better action if required.

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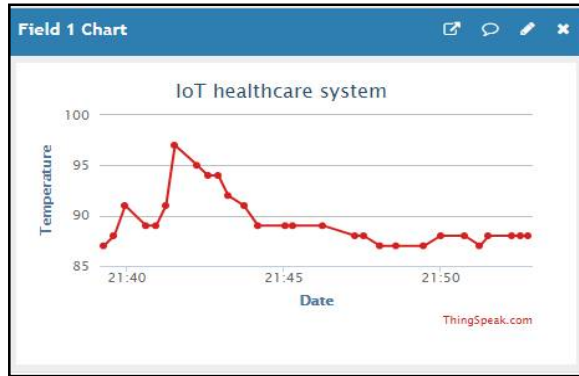


Figure 9: Visualization of temperature on IoT field chart

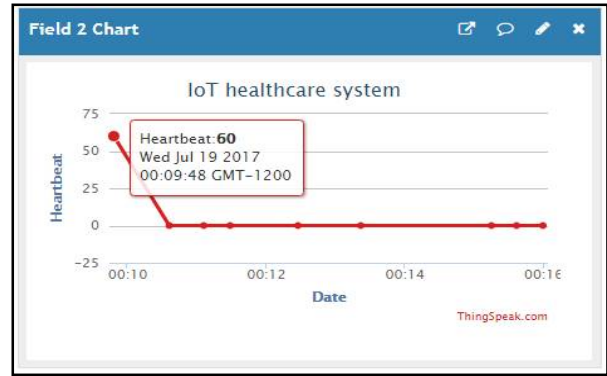


Figure 10: Visualization of Heartbeat on IoT field chart

ThingSpeak application provides secure data communication. All the data which are analyzed by graph can be stored as excel file which contains all the information of patient and it can be used in future if required. Below tabular data (As per excel sheet after downloading from ThingSpeak App) gives the same data information as graph.

Table 1: Temperature data

created_at	entry_id	field1
2017-07-28 09:39:16 UTC	1	87
2017-07-28 09:39:36 UTC	2	88
2017-07-28 09:39:57 UTC	3	91
2017-07-28 09:40:37 UTC	4	89
2017-07-28 09:40:56 UTC	5	89
2017-07-28 09:41:15 UTC	6	91
2017-07-28 09:41:32 UTC	7	97
2017-07-28 09:42:15 UTC	8	95

Table 2: Heartbeat data

created_at	entry_id	field2
2017-07-19 12:09:48 UTC	1	60
2017-07-19 12:10:36 UTC	2	0
2017-07-19 12:11:06 UTC	3	0
2017-07-19 12:11:29 UTC	4	0
2017-07-19 12:12:28 UTC	5	0
2017-07-19 12:13:22 UTC	6	0
2017-07-19 12:15:15 UTC	7	0

Table 1 and Table 2 contain all the data related to temperature and heartbeat respectively, where 3 fields are generated named as created_at, entry_id and field. The field name created_at gives us the date and time for which patient's information is analyzed. As per second field entry_id, we can count the entries. Third field in Table1 is field1 which is for temperature data and field2 in Table 2 shows the Heartbeat data of patient. Now if we compare with graphs shown in Figure 9 and 10, every point which contains different values of temperature and heartbeat is given in table data. It will be very useful for patient's database for future use.

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V. CONCLUSION

IoT is combination of various technologies, it allows objects to be sensed and controlled remotely and it provides the information through smart objects. IoT has wide range of applications, including healthcare, which is the primary focus of this work. Healthcare system makes use of smart sensing devices to establish an IoT network, where patient's health can be monitor remotely and continuously.

By using this system the healthcare professionals or any caretaker who all are authorized can monitor, diagnose, and advice their patients all the time. The health parameters data are stored and published online. Hence, the healthcare professional can monitor their patients from a remote location at any time. This paper tries to intensify on a health care system which is enabled with IoT technology that not only realizes the illustration and traceability of health care actors but guarantee the accurate and improved health care services. The key motive behind the proposed system is to provide better and efficient health services to the patients by implementing networked information so that experts and doctors can make use this data and could provide fast and efficient solution.

VI. FUTURE SCOPE

In the designed system the enhancement would be connecting more sensors in system which measures various other health parameters and would be beneficial for patient monitoring i.e. connecting all the objects to internet for quick and simple access. Also we can establish a Wi-Fi mesh type network to increase the communication range. This type of enhancement will make the design system more advanced and efficient.

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