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Health Care System by Monitoring the Patient Health Using IOT and GSM

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***Abstract*—The main objective of "Health Care System by Monitoring Patient Health" using IOT and GSM is to check the patient health in abnormal condition and send the message to the doctor and getting advice to trouble shoot the problem and to improve abnormal condition of patient. To avoid death and to save persons live, this project is focusing on health parameters like Heart, Temperature and Drowsiness of patient.In real time this project is implemented by using a Embedded microcontroller which is of specified task and different types of Sensors are attached to microcontroller. Sensing elements to monitor health are:-Heart beat sensor, Temperature sensor and IR sensor. Communications between the users are performed by using Internet of things and GSM. Sensors attached to the main object will monitor every sensible element time to time and in any abnormal case the message will be sent to the doctor's mobile as well as to the cloud by using internet connectivity. Now the doctor will receive the message and sent the advice to improve the patient health condition and saves his/her life. The functioning of the parameters are also sent to remote internet location. Doctor can check the message anywhere in the in/outdoor world. By using this system we can save time, cost and life. The programming in this project is complied through Embedded C using keil µvision4.This system can save time, cost and life.**

***Index terms: Health care system, outdoor patient monitoring, remote device, sensors, microcontroller, keil µvision*.**

I. INTRODUCTION

Now days, health is the universal challenges for human beings. In advance computer and communication technologies electronic health care systems leads to develop monitoring and alarming system units that can be integrate with mobile phone[1,2] and Internet. In recent times, Wireless Communications using sensor have been implemented for checking different health parameters of the system. To improve the patient health condition wireless communication network is the best method. By introducing this type of system we can improve the health condition of the patient as well as sudden death can be reduced.

In this project processing is done by transmitting and receiving the data in the form of message using **"Global System for mobile Communication module and Internet Of Things".** Mainly it will be profitable to the doctors to save time, quick suggestion can be made. Applications of wireless sensor technology for healthcare monitoring make possible doctors to monitor their patients anywhere and at any time without any physical constraints and without the need for the patient to stay in hospital. In real-time measurement mostly ill patient face the problem of different health parameters such as heart rate, blood pressure, temperature, and many other parameter in their normal life..There are many monitoring systems in medical centers used to collect and monitor patient's health. The health data are then used by doctors to generate the suitable decision. Critically ill patients require accurate monitoring and alarming system during their normal life. Therefore, it is useful to integrate the monitoring unit together with wireless sensor technology to fellow up the patient's status outside the intensive-care unit (ICU) in the hospital [2,4]. In this case, the wireless monitoring system can be modified to provide the patient through his/her phone and internet with accurate and immediate medical treatment decisions to save patient life.

Chung and his group[8] proposed WSN-based mobile healthcare monitoring system with ECG and blood pressure measurement, where the mobile phone performs continuous data analysis and then transmits data over a wireless sensor network. The proposed method consists of heath monitoring system of the patient using IOT and GSM. However, the fast change of health parameters is the big challenges, especially when the patient is outside home doing any usual activity and feels something wrong, and when arrived the hospital for testing, they find that everything is normal. In fact, it is not easy to detect all kinds of abnormal activity unless real-time monitoring, which can be done either by keeping the patient in the hospital for few days or more (which will of course lead to high costs). In such a case, a wireless real-time portable monitoring device can be used to help the physician and the medical center to give proper medical treatment and procedures. It is so important to integrate low-power electronic devices, such as sensors and a microcontroller, with wireless communication technology to open new research trends in healthcare applications. The main objective of the project is to implement the health care system by monitoring the patient health using wireless communication.The system is based on a single-chip microcontroller equipped with set of sensors and wireless communication unit. In this research, the proto type system is attached to the patient's. In patient abnormal conditions the message is sent to the doctors mobile as well as to cloud through internet connectivity. The following section outlines the general overview of the proposed system. Section 2 discusses the related works, Section 3 discuses the detailed hardware and software design, while section 4 illustrates the procedures of the prototype testing and calibration. Finally, a fruitful conclusion and future work are listed.

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II. Related Works

The related work in this project consists of general block diagram is shown in figure1.It consists of Embedded microcontroller and a set of sensors connected to the microcontroller to monitor the health parameters of the person. This system is mainly used to monitor the health condition automatically. Sensors used in the system are we heartbeat sensor, Temperature sensor,,IR sensor for monitoring the patient heath. The system using these sensors will sense the health parameters of the person time to time, if any one condition is abnormal the message is send through GSM to Personal Doctor. All the information is send to internet through IOT. Real time mobile healthcare system for monitoring the patient's condition from indoor or outdoor locations [3]. A bio-signal sensor and a smart phone are the major components of the system. The data has been collected by the bio-signal sensor and are transmitted to an intelligent server via GSM network. The GSM system is able to monitor the location of the patient. The proposed system consists of a body sensor network that is used to measure and collect Physiological data of patient. A system to monitor the blood pressure of a hypertensive patient using mobile technologies has been proposed in [4]. By using the system a doctor can carefully monitor the patient and can perform diagnosis.

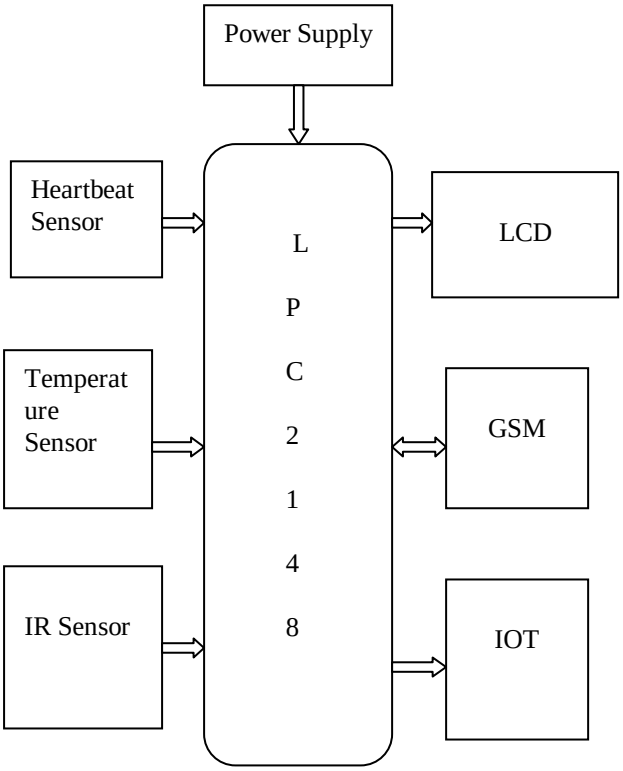

Figure1: Block Diagram

III. Design Requirements

The system requires some Hardware and software components which are listed below:

Hardware:

- LPC 2148 IC
- GSM module
- IOT
- LCD
- Heartbeat Sensor(Pulse Sensor)
- Temperature Sensor(LM35)
- IR Sensor
- Power supply

Software:

- Keil µVision4,
- Embedded C
- Proteus

Communication Protocol:

- HTTP
- GSM

IV. Description

4.1 ARM Microcontroller

ARM was formerly known as ACORN RISC Machine founded by ACORN COMPUTERS LTD in 1983-85, later named as Advanced Risc Machine in 1990.ARM is basically a general purpose 32 bit processor. It is incorporated with the 32 bit controllers manufactured by Philips with the banner name LPC series controllers.ARM family started with the series number from ARM 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13.The series till ARM 6 were basically 16 bit microcontrollers.ARM 7 was the first 32 bit controller given by ARM. The even number of series was reserved for the company's R&D purpose and the odd version was released to the market for commercial purpose. ARM 10 is the only even series that was released to the market.

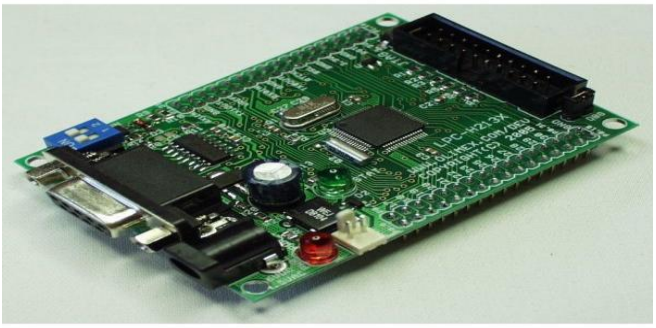

Figure 2 : ARM Microcontroller Board

LPC2148

LPC2148 is 64 pin IC manufactured by Philips and widely used in ARM-7 family. To make the beginners more efficient and reliable the IC is pre-loaded with many in-built peripherals and it is very much useful for is high end application developer.

Figure 3: Top view of LPC214X

The bundle of LPC 2148 have 16/32-bit ARM7TDMI-S microcontroller in a small LQFP64 bundle. It consists 8 to 40kB of on-chip static RAM and 32 and 32 to 512 kB of on-chip flash program memory. The operation speed is high of 60MHz due to128 bit wide interface/accelerator. USB 2.0 Full Speed compliant Device Controller with 2 kB of endpoint RAM.In addition, the LPC2146/8 provides 8 kB of on-chip RAM accessible to USB by DMA. One or two **(LPC2141/2 vs. LPC2144/6/8)** 10-bit A/D converters provide a total of 6/14analog inputs, with conversion times as low as 2.44 us per channel. Single 10-bit D/A converter provides variable analog output. Low power real-time clock with independent power and dedicated 32 kHz clock input. Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus(400 kbit/s), SPI and SSP with buffering and variable data length capabilities. Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package. Up to nine edge or level sensitive external interrupt pins available. On-chip integrated oscillator operates with an external crystal in range from 1 MHz to30 MHz and with an external oscillator up to 50 MHz.Power saving modes include Idle and Power-down. Single power supply chip with Power-On Reset (POR) and BOD circuits. CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/O pads.

4.2 GSM Module

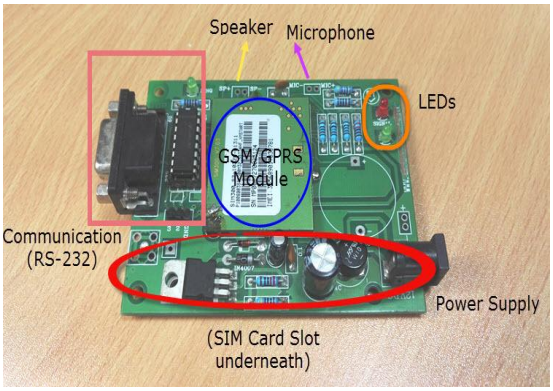

Figure 4: GSM module

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service).GSM module is an embedded piece of hardware thatis integrated with equipment.

The working of GSM modem is based on commands, the commands always start with AT (which means Attention) and finish with a <CR> character. For example, the dialing command is ATD<number>; ATD3314629080; here the dialing command ends with semicolon. The AT commands are given to the GSM modem with the help of PC or controller. The GSM modem is serially interfaced with the controller with the help of MAX 232. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal based on RS 232 levels. The T1_OUT and R1_IN pin of MAX 232 is connected to the TX and RX pin of GSM modem.

4.3 IOT

The internet of things(IOT) is the network of physical devices, vehicles, buildings and other items embedded with electronics,software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IOT-GSI) defined the IOT as "the infrastructure of the information society. The IOT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. In the future experts estimate that the IOT will consists of almost some billions by 2020.

4.3 LCD

"Liquid Crystal Display"is the abbreviation of LCD. Combination of two states of mater namely the solid and the liquid is a LCD. It has two rows which can accommodate 16 characters in each row. The back light on the LCD screen is provided by LED. On the off chance that you control up the LCD screen you can see the rectangles in which characters are put and furthermore can see the pixels that make up each character. You can see the rectangles for each character on the show and the pixels that make up each character. The characters are appeared on green foundation with dark text style shading.

A LCD show has two glass sheets, a thin layer (around 10 u m), and cathodes. These two thin layers are sandwiched between two glass sheets, and the straightforward terminals are stored on their inside appearances. On the off chance that both the glass sheets straightforward then the is known as transmittive sort cell. On the off chance that one glass sheet is straightforward and different has intelligent covering then that kind of cell is called intelligent covering. The LCD does not deliver its own particular enlightenment. Light delivered on LCD is altogether given by some other outside source with a specific end goal to give visual impacts.

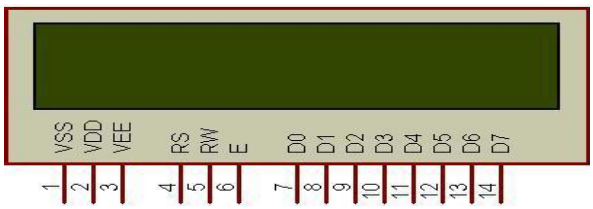

Figure 5: LCD Display

4.4 Heart Beat sensor

Heartbeat sensor is used to measure the pulse rate of the blood cells when the finger is tapped on the pulse sensor amped. If the patient heart pulse rate exceeds the threshold value then the LCD displays as High BP take medicine. By using the system a doctor can carefully monitor the patient and can perform diagnosis.

Figure 6: Pulse sensor

Specification:

- Operating Voltage = +5V DC regulated
- Operating Current = 100 mA
- Output Data Level = 5V TTL level
- Pin details

  RED wire= +3V to +5V, BLACK wire = GND, PURPLE wire = Signal

4.5 Temperature Sensor

In order to monitor the Temperature of person, LM35 has been selected in the design. The expansion in set-point triggers expanded muscle compression and causes a sentiment cool. This outcome in more noteworthy warmth generation and endeavors to monitor warm. Infrequently a fever may trigger a febrile seizure. This is more typical in youthful kids. If the temperature exceeds the threshold value then the LCD displays as High temperature take medicine.

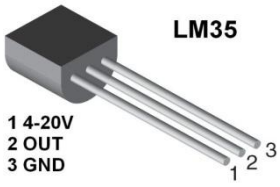

Figure 7: Temperature Sensor

4.6 IR Sensor

The IR sensor is used to monitor the drowsiness of the patient. If the patient is active then LCD displays as EYE OPENED. If the patient is ill or feeling drowsy and try to close the eyes then LCD displays EYE CLOSED.

Figure 8: IR Sensor Board

4.7 Power supply

A **Power Supply** is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another.To run the circuit power supply is used in the project with fixed voltage. From the above figure step down transformer applied AC of 230v to primary side of transformer, the secondary side is connected to rectifier to get pulsating DC output then it is given to regulator in order to get constant output voltage. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 7805.

4.8 Communiacation Structure of the Project

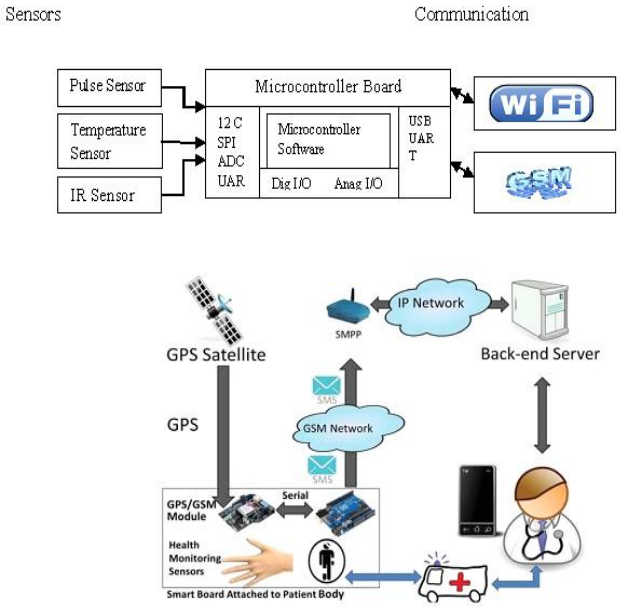

Figure 9: Structurefor Monitoring Patient and wireless Network Structure

V. PROCEDURE TO EXECUTE THE PROJECT

1. Insert the SIM in the GSM module Board.
2. Switch ON the supply of the board .
3. Heart care System using IOT will be displayed on the LCD Screen.
4. When the SIM is activated Green LED will be blinking.

5. Now press the reset button near the Microcontroller board.
6. Send the mobile number will be displayed.
7. The mobile is send to the SIM by the typing * with the mobile number in the text box. Now the messages will be send to Doctor or to mobile initialized number.
8. Now to monitor the patient health and the functioning of the sensors the following steps to be followed.
9. Being a prototype device to observe the functioning of Heart beat sensor, hold the pulse sensor amped if the pulse rate > 70 then HB high take medicine will be displayed.
10. For temperature sensor if threshold value exceeds >40 then high TEMP will be displayed.
11. If the patient feels drowsiness then EYE CLOSED will be displayed.
12. This project will propagate message through GSM as well it is linked to internet access using IOT.
13. The Client number is linked in the http protocol.
14. The client can check the message using internet access also.
15. By this we can monitor the patient and save his or her life.

VI. RESULTS

The model has been simulated by using by Proteus Software to monitor the human health using different sensors. The change in body temperature, Heart beat and drowsiness will be detected by respective sensors and can be determined.

- The Project Healthcare system by monitoring Patient health using wireless sensor network consists of the following circuit.

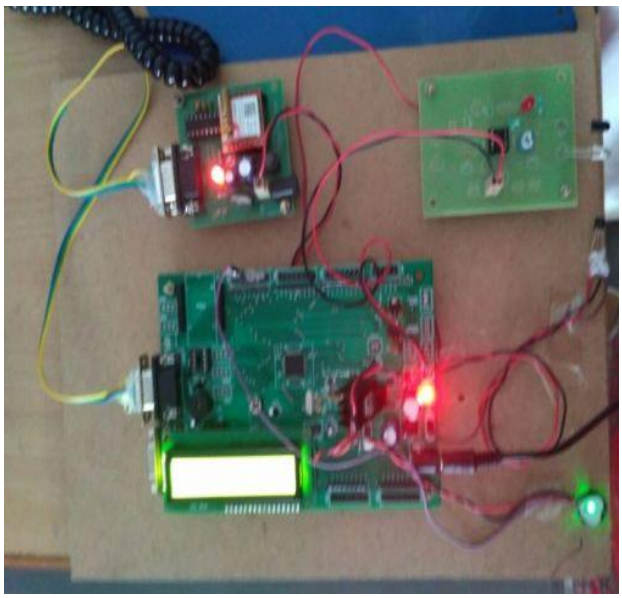

Figure 10: Model of the kit

- Internet links and results when doctor check the message by typing links using internet. These links shows the output of sensing elements of heartbeat, temperature and IR.

http://thingspeak.com/channels219582/feed.json
http://thingsspeak.com/channels219582/charts/1
http://thingspeak.com/channels/219582/charts/2

Table.1. Condition for monitoring human health

Parameter Range	Range
Temperature	> 40° C
Heart beat	>72 bpm
Drowsiness	Eye Closed

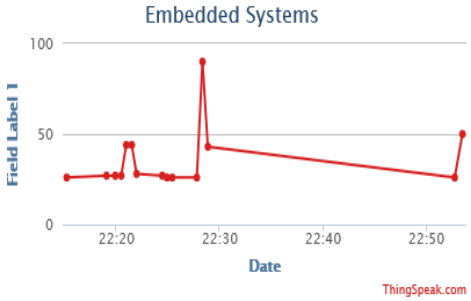

Figure 11: Temperture Sensor graph

VII.CONCLUSION AND FUTURE SCOPE

The availability of low-cost single-chip microcontrollers, and advances in wireless communication technology has encouraged engineers to design low-cost embedded systems for healthcare monitoring applications. Such systems have ability to process real-time signals generated from bio sensors and transmit the measured signals through the patient's phone to the medical center's server. In future we aim to improve the hardware of the AmboBot to more exible structure such as unidirectional. We also consider improve the system from robot to multiple robots for collaborative performance. We even consider equipping the current mobile robot, with a drone robot partner which can fly in collaboration with the current system for faster performance in addition for operation in higher elevations

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