A Survey on Healthcare Monitoring System Using Iot

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Abstract- *The internet of things (IoT) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices. The Internet of Things refers to the ever-growing network of physical objects by using an IP address for internet connectivity, and the communication that occurs between objects and other Internet-enabled devices. In this survey we aim to identify that the IOT devices used in many application fields which make the users' day to day life more comfortable. Such devices are used to collect body temperature, blood pressure, heart rate and sugar level etc., which are used to evaluate the health conditions of the patient. Based on the collected information, the doctor can monitor the patients regularly. In addition to that we are focusing on adding hemoglobin sensor which senses the hemoglobin at noninvasive method. So the human health conditions are evaluated with the parameters like hemoglobin, heartbeat, body temperature, blood pressure etc. and the decisions can be made based on the data obtained.*

Keywords- Internet of things(IOT), Arduino, sensors,Atmega328 Microcontroller, Healthcare.

I. INTRODUCTION

Today Internet has become one of the important part of our daily life. It has changed how people live, work, play and learn. Internet serves for many purpose educations, finance, Business, industries, entertainment, social networking, shopping, E-commerce etc. The next new mega trend of Internet is Internet of Things (IOT).

In low and middle income countries, there is increasingly growing number of people with chronic diseases due to different risk factors such as dietary habits, physical inactivity, and alcohol consumption among others. According to the World Health Organization report, 4.9 million people die from lung cancer from the consumption of snuff, overweight 2.6 million, 4.4 million for elevated cholesterol and 7.1 million for high blood pressure. Chronic diseases are highly variable in their symptoms as well as their evolution and treatment. Some if not monitored and treated early, they can end the patient's life.

The internet of things applied to the care and monitoring of patients is increasingly common in the health sector, seeking to improve the quality of life of people. The Internet of things is defined as the integration of all devices that connect to the network, which can be managed from the web and in turn provide information in real time, to allow interaction with people they use it . On the other hand, the Internet of things can be seen from three paradigms, which are Internet-oriented middleware, things sensors oriented and knowledge-oriented semantics.

The arduino is a programmable device that can sense and interact with its environment. It is great open source microcontroller platform that allows electronic enthusiasts to build quickly, easily and with low cost small automation and monitoring projects. The combination of IoT with arduino is the new way of introducing Internet of Things in Health care Monitoring system of patients.

In this paper, proposing a remote monitoring and sensing parameter of the human body which consists of hemoglobin that is noninvasive. There is no need of taking the blood samples in noninvasive which is the advanced technique used here. Adding a noninvasive hemoglobin sensor helps to keep track of patients HB level regularly. The sensing data will be collected in database continuously and will be used to inform patient to maintain the HB level in order to avoid the high risk like anemia, chronic diseases etc.

II. LITERATURE REVIEW

A WI-FI based remote health monitoring and control system using atmega328 microcontroller, which is capable to continuously monitor the patient's heart beat, blood pressure and other critical parameters in the hospital. They also proposed a continuous monitoring and control mechanism to monitor the patient condition and store the patient statistics in server. For the performance evaluation, simulation results are taken by using PROTEUS 7 simulation tool.[2]

As health care services are important part of our society, automating these services lessen the burden on humans and eases the measuring process. Also the transparency of this system helps patients to trust it. When

threshold value is reached, the alarm system that consists of buzzer and LED alerts the doctors and they can act more quickly. The objective of developing monitoring systems is to reduce healthcare costs by reducing physician office visits, hospitalizations and diagnostic testing procedure. [3]

Simulation is performed using Proteus software by placing appropriate sensors like temperature and heart beat rate for sensing the health condition and the results are analyzed under normal conditions andab normality conditions. [4]

The planning and implementation of a foreign Patient watching system supported wireless technology employing a mobile phone, to send Associate in Nursing SMS (Short Message Service) to the medical employees. The planned system combines 2 unremarkably used technologies specifically, international System for Mobile (GSM) and Zigbee technology. This so is a straightforward, practical, cheap and nevertheless terribly effective means for sending very important data to the attention employees and attention suppliers. [5]

LM35 is used as a temperature sensor in this project which measures the temperature of the body and the measured data is fed to the transmitter module. Wireless system is used to transmit the measured data to a remote location. The transmitter transmits the calculated beat rate and is received in another terminal called receiver module. Inconvenience of using wire is avoided in this research. Finally, the data are displayed in the mobile screen or PC at the receiving end where the specialist or physician can analyze the data and will be able to provide aid. The developed system is reliable, economical and user friendly. [7]

The remote physiological monitoring system is able to continuously monitor the patient's temperature, blood pressure, heart beat, and other critical parameters in the hospital. The same measured data can be used in future for statistical analysis and prevent similar kind of issues beforehand if it happens in any new patients. They can take proper actions like exercise, food diet etc to prevent from critical diseases. [8]

The system helps in remote heart rate monitoring of a person.

It detects abnormalities if any in the monitored heart rate and reports the abnormalities to the concerned person through message, E-mail and Watsapp. Information is stored in the cloud for future reference and analysis. [10]

An efficient PHMS is developed to monitor the up to date status of the patient irrespective of the presence of the doctor. The system collects information like temperature, blood pressure and pulse rate of the patient and updates the same to the doctor. The system is evaluated experimentally and collected the sample data of ten patients to verify the status of patients. The doctor can monitor the progress of patients' health now and then to advise them about their health. [11]

The present work is done to design an IOT based smart healthcare system using a PIC18F46K22 microcontroller. In this work the MCP6004 based Pulse oximeter is designed and DS1820B temperature sensor is used to read the temperature and heart rate of the patient and the microcontroller picks up the data and send it through ESP8266 Wi-Fi protocol. The data is also sent to the LCD for display so patient can know his health status. During extreme conditions to alert the doctor warning message is sent to the doctor's cell phone through GSM modem connected and at the same time the buzzer turns to alert the caretaker. The doctors can view the sent data by logging to the html webpage using unique IP and page refreshing option is given so continuously data reception achieved. Hence continuous patient monitoring system is designed. [12]

In this paper, we reviewed the methods to provide complete healthcare aids for a patient who is in lack of near ones with him. Wearable sensors collect the body parameters and store them in a cloud space. These datas are accessed via internet. Wheel chair facility and password based door lock system contributes the more convenient life for patients who are living in the home itself. [13]

A system that measures and detect Human Heartbeat and body temperature of the patient, sends the data to user or server end by using microcontroller with reasonable cost and great effect. Use two different sensors and these are mainly under the control of microcontroller. For Human Heartbeat measurement use fingertip, it's in bpm (beats per minute). These calculated rates will have stored in server by transferring through Wi-Fi module via internet. Liquid crystal display (LCD) has been used to display the calculated humanheart beat rate. To measure the human body temperature, use LM35 sensor, the measured data is given to transmitter module, it interns transfer these data to server through wireless system due to this notice avoided use of wires. Finally, the stored data in server will be displayed for further analysis by physician or specialist to provide better aid. From Experimental results, proposed system is user friendly, reliable, economical. [14]

III. EXISTING SYSTEM

In existing system, healthcare monitoring system involves Heart Rate sensor, Body temperature sensor, Blood pressure sensor, Respiration sensor, Accelerometer sensor. There is nosensor which detects HB level of human body which is one of the important parameter. Due to low level of HB level there may be a cause of High risk for the patients because they can't able to monitor their hemoglobin level regularly. Since, it istoo hard to take the blood samples every time to check the HB level. In order to overcome this problem we are proposing a hemoglobin sensor which monitors the HB level regularly without taking the blood samples which is invasively.

IV. PROPOSING SYSTEM

The proposed system architecture includes three main units namely monitor unit, sensor unit, control unit. The sensor unit senses the data such as temperature sensing, blood pressure sensing, hemoglobin level sensing, heart beat sensing from different sensors using various signal processing techniques.

The various composed parameters are given to the controller unit. It compares the collected data values to the original values. If any deviation occur, it generate control signal to patient through actuator. For monitoring purpose LCD display is used.

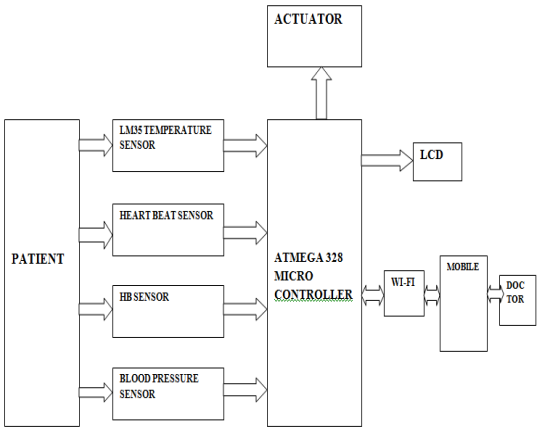


Fig: block diagram of healthcare monitoring system

SENSOR UNIT

A sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to a computer processor.A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C (it is basically the slope Dy/Dx assuming a linear characteristic). Some sensors can also affect what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors are usually designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as microsensors using MEMS technology. In most cases, a microsensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches

The sensor unit consist of four sensors namely, Temperature sensor, Heart Beat sensor HB sensor and blood pressure sensor. It acquires body temperature, heart beat rate, hemoglobin level and blood pressure level from patient.

A. TEMPERATURE SENSOR

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range.The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy). The LM35-series devices are available packaged in hermetic TO transistor packages, while the LM35C, LM35CA, and LM35D devices are available in the plastic TO-92 transistor package. The LM35D device is available in an 8-lead surface-mount small-outline package and a plastic TO-220 package.

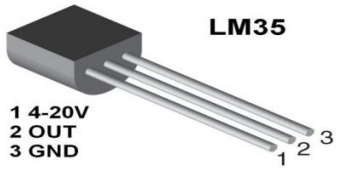


Fig: temperature sensor

B. HEARTBEAT SENSOR

The heartbeat sensor is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.The basic heartbeat sensor consists of a light emitting diode and a detector like a light detecting resistor or a photodiode. The heart beat pulses causes a variation in the flow of blood to different regions of the body. When a tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in thattissue. The detector output is in form of electrical signal andisproportional to the heart beat rate.

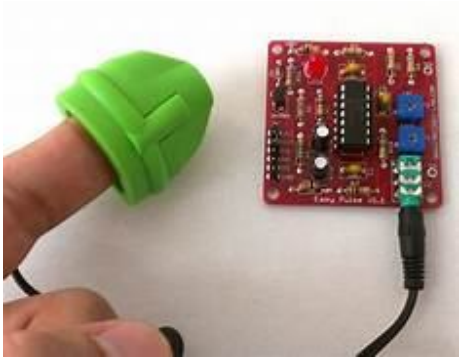


Fig: heartbeat sensor

C.HB SENSOR

We know blood is one of the important parts of our body and it does many magnificent works for our body like carrying oxygen to various part of body and many more. If hemoglobin count increases it may leads to clotting due to more density of blood. If hemoglobin count decreases anemia is caused. It put the heart, lungs and kidneys to work harder due to less count of hemoglobin. In order to overcome this, Hemoglobin sensor continuously detects the blood flow of the human body. Without taking the blood samples it senses the blood level. For male Normal hemoglobin level approximately ranges from 14 to 18 g/dL and for female Normal hemoglobin level approximately ranges from 12 to 15 g/dL. If there is any fluctuation from this range, it immediately forwards it to the patient for better prevention from high risk.

Fig: HB Sensor

D.BLOOD PRESSURE SENSOR

The purpose of Vernier Blood Pressure Sensor is used to measure systemic arterial blood pressure in humans (non-invasively). it can measure arterial blood pressure and estimate both the systolic and diastolicblood pressure using the oscillometric method. The dynamic sensor in this unit is the sensym SDX05D4pressure transducer. It has a membrane which flexes as pressure changes. This sensor is prearranged to measure differential pressure. It includes special circuitry to minimize errors caused by changes in temperature. We offer an amplifier circuit that conditions the signal from the pressure transducer. In this circuit, the output voltage from the Blood Pressure Sensor will be linear with respect to pressure.

Fig: Blood Pressure Sensor

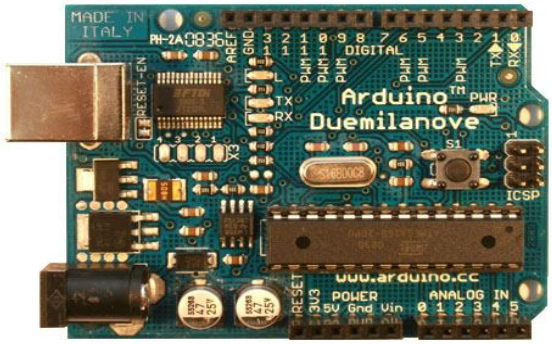
ControllerUnit:

E. Atmega328 Microcontroller

The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial

port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

The ATmega328 is a single chip miniature size controller produced by Atmel and belongs to the mega AVR series. The controller voltage range 1.8-5.5 V. The controller achieves throughputs approaching 1 MIPS per MHz; A common option to the ATmega328 is the "Pico Power" ATmega328P. The ATmega32 provides the following features: 32Kbytes of In-System Programmable Flash memory with Read-while-Write facilities, 1024bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines.



Monitoring unit:

F. LCD Display

A **liquid-crystal display** (**LCD**) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.[1] LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement.A liquid crystal cell consists of a thin layer (about 10 u m) of a liquid crystal sandwiched between two glass sheets with transparent electrodes deposited on their inside faces. With both glass sheets transparent, the cell is known as *transmittive type cell.* When one glass is transparent and the other has a reflective coating, the cell is called *reflective type.* The LCD does not produce any illumination of its own. It, in fact, depends entirely on illumination falling on it from an external source for its visual effect.

G. WI-FI

Wi-Fi is technology for radio wireless local area networkingof devices based on the IEEE 802.11 standards. *Wi-Fi* is a trademark of the Wi-Fi Alliance, which restricts the use of the term *Wi-Fi Certified* to products that successfully complete, then after many years of testing the 802.11 committee interoperability certification testing. Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internetand network connections. A common misconception is that the term Wi-Fi is short for "*wireless fidelity*," however this is not the case. Wi-Fi is simply a trademarked phrase that means *IEEE 802.11x.* Wi-Fi networks have no physical wired connection between sender and receiver by using radio frequency (RF) technology - a frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.

V. RESULT ANALYSIS

The system takes the data from the IoT devices for every sixty seconds and update in the database connected to the server. The doctor can view the patients' health condition every sixty seconds. The system gets the blood pressure data and check with the Table values to evaluate the

status of the patient. Similarly the pulse rate is compared and for the temperature the average temperature falls above 98.6°F (37°C) is considered as abnormal temperature. The data collected from the patients and its evaluation by the application, showed that the observed data is updated correctly.

AGE	Approximate Weight Kg	Systolic Blood Pressure mmHg	Heart Rate Beats/minute	Respiratory Rate Breaths/minute
Term	3.5	60-105	110-170	25-60
3 months	6	65-115	105-165	25-55
6 months	8	65-115	105-165	25-55
1 year	10	70-120	85-150	20-40
2 years	13	70-120	85-150	20-40
4 years	15	70-120	85-150	20-40
6 years	20	80-130	70-135	16-34
8 years	25	80-130	70-135	16-34
10 years	30	80-130	70-135	16-34
12 years	40	95-140	60-120	14-26
14 years	50	95-140	60-120	14-26
17+ years	70	95-140	60-120	14-26

PATIENT	GENDER	AGE	HB LEVEL	CONDITION
1	MALE	40	15	NORMAL
2	FEMALE	20	10	LOW
3	MALE	35	18	NORMAL
4	FEMALE	16	9	ABNORMAL
5	MALE	50	13	LOW
6	FEMALE	28	14	NORMAL

fig: table values

VI. CONCLUSION AND FUTURE WORK

In this paper, we proposed a Wi-Fi based remote health monitoring and control system using atmega328 microcontroller, which is capable to continuously monitor the patient's heartbeat, hemoglobin level, blood pressure, body temperature and other critical parameters in the hospital. We also proposed a continuous monitoring and control mechanism to monitor the patient condition and store the patient statistics in server. The Developed system that measures and detect Human Heartbeat and body temperature of the patient, sends the data to user or server end by using microcontroller with reasonable cost and great effect. Use two different sensors and these are mainly under the control of microcontroller. For Human Heart beat measurement use fingertip, it's in bpm (beats per minute). For hemoglobin level measurement, the blood flow can be measured through sensor invasively. To measure the human body temperature, use LM35 sensor, the measured data is given to transmitter module, it interns transfer these data to server through wireless system due to this notice avoided use of wires. Finally, the stored data in server will be displayed for further analysis by physician or specialist to provide better aid. These calculated rates will have stored in server by transferring through Wi-Fi module via internet. Liquid crystal display (LCD) has been used to display the calculated human heart beat rate, temperature level, blood pressure level and HB level.

VII. FUTURE SCOPE

According to the availability of sensors or development in healthcare monitoring system more parameter can be sensed and monitored which will drastically improve the efficiency of the wireless monitoring system in biomedical field. The system has further improved by predicting the diseases of the patient noninvasively from the hemoglobin sensor. From the sensor Doctors can create awareness about diseases and their symptoms through the mobile application. From the evaluation and the result obtained from analysis the system is better for patients and the doctor to improve their patients' medical evaluation.

REFERENCE

[1] M. A. Chowdhury, W. McIver, and J. Light, "Data association in remote health monitoring systems," IEEE Commun. Mag., vol. 50, no. 6,pp. 144–149, Jun. 2012.

[2] B. Priya, S. Rajendran, R. Bala, and R. Gobbi, "Remote wireless health monitoring systems," in Proc. Innovative Technol. Intell. Syst.Ind. Appl. (CITISIA), Jul. 2009, pp. 383–388.

[3] S. Manzari, C. Occhiuzzi, S. Newell, A. Catini, C. Di Natale, and G. Marrocco, Humidity sensing by polymer-loaded UHFRFID antennas," IEEE Sens. J., vol. 12, no. 9, pp. 2851–2858, Sep. 2012.

[4] S. Manzari and G. Marrocco, "Modeling and applications of a chemicalloaded UHF RFID sensing antenna with tuning capability," IEEE Trans. Antennas Propag., vol. 62, no. 1,pp.94–101, Jan. 2014.

[5] J. H. Hong, J.M. Kim, E. J. Cha, T. S. Lee "A wireless 3-channel ECG transmission system using PDA phone" 0-7695-3038-9/07

[6] Balakrishna D, Sujeethnanda M, Dr.G. Rama Murthy, "Mobile Wireless Sensor Networks: Healthcare in Hospitals", ifth International Conference on eHealth, Telemedicine, and Social Medicine(eTELEMED 2013).

[7] Swan,M. Sensor mania! The internet of things, wearable computing, objective metrics, and the quantified self 2.0. Journal of Sensor and Actuator Networks, 1(3), 217-253, 2012.

[8] Gómez, J., Huete, J. F., Hoyos, O., Perez, L., & Grigori, D. Interaction System based on Internet of Things as Support for Education. Procedia Computer Science, 21, 132-139, 2013

[9] M. C. Vuran, I. F. Akylidiz, Wireless Sensor Networks.Wiley, 2010. ISBN: 978-0-470-03601-3 516 pages. July 2010.

[10] Prosanta Gope and Tzonelih Hwang, ―BSN-Care: A Secure IoT-BasedModern Healthcare System Using Body Sensor Network,‖, IEEESensors journal vol.16,no.5,pp. 1368-1376, march 1, 2016.

[11] Wireless Sensor Networks for Healthcare, JeongGil Ko, Chenyang Lu, Mani B. Srivastava John A. Stankovic, Andreas Terzis, Matt Welsh. Published in: Proceedings of the IEEE (Volume:98, Issue:11). Page(s):1947-1960. ISSN: 0018-9219. Date of Publication: 13 September 2010. Date of current version:18 October 2010. INSPEC Accession Number: 11588456. Issue date: Nov. 2010. DOI: 10.1109/JPROC.2010.2065210. Sponsored by:IEEE. Published by:IEEE

[12] Corrado fellini, Massimo Merenda and Francesco G. Della Corte,―Battery-less smart RFID tagwith sensor capabilities, RFIDTechnologiesand Applications (RFID-TA), 2012 IEEE InternationalConference ,pp. 160-164.

[13] C.C.Gavimath, Krishnamurthy Bhat, C.L. Chayalakshmi , R. S. Hooli and B.E.Ravishankera, "Design and Development of versatile saline flow rate measuring system and GSM based remote monitoring device", International Journal of Pharmaceutical Applications ISSN 0976-2639. Vol 3, Issue 1,2012, pp 277-281.

[14] NakulPadhye and Preet Jain, "Implementation of ARM Embedded Web Server for DAS using Raspberry pi", VSRD IJEECE April 2013 .

[15] Ch. Sandeep Kumar Subudhi and S. Sivanandam, "Intelligent Wireless Patient Monitoring and Tracking System(Using Sensor Network and Wireless Communication)", International Journal of Interdisciplinary and Multidisciplinary Studies,2014,Vol 1,No.3,97-104.