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Wireless Sensor Network Based Health Care Monitoring System Using Arduino

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Abstract: *The health monitoring system has become popular these days due to uniqueness and diversified usage in the medical field. Everyday many lives are affected because the diseases are not timely and properly diagnosed so we didn't get a chance to provide medical help. To deal with these types of situations, this system will help to monitor a patient's certain parameters and predict the patient's condition from time to time. So the most recent development in healthcare communication methodology, IoT is customized. IoT is a catalyst for the healthcare and plays distinguished role in many applications. In this project, microcontroller is used as a gateway for communication. This system puts forward a wise patient health monitoring system that uses sensors to trace patient health and uses internet to intimate their loved ones or concerned doctors in case of any emergency. The controller is additionally connected with a buzzer to alert the caretaker regarding variation in detector output. The sensors are connected to a microcontroller to trace the status of the patient which in turn is interfaced with LCD display furthermore as wireless local area network association so as to transmit alerts. If the system detects any changes in patient pulse rate or BP, the system automatically sends an alert to the doctor regarding the patient status over IoT and additionally shows the details of heartbeat, BP and temperature of patient, live over the cloud. So IoT based patient health monitoring system effectively uses internet to watch patient health status and save lives on time. For this reason, fast conditional medication may be simply done by this technique. This system is easy to setup and is capable of high performance and time to time response.*

Keywords: Embedded System, IOT, Patient Health Monitoring, Microcontroller, Sensor

I. INTRODUCTION

Today internet has become one among the vital components of our daily life. It is modified to methodologies how individuals live, work, play and learn. Internet serves as a tool for several purposes like education, finance, business, industries, recreation, social networking, shopping and etc. Future new mega trend of internet is IoT. Visualising a world wherever several objects will sense, communicate and share data over a personal net protocol or public networks can be done through IoT. The interconnected objects collect the data at regular intervals, analyse and initiate needed action, providing associate intelligent networks for analysing, designing and decision making [1]. This is the world of Internet of Things. IoT is mostly thought about as connecting object to the internet and victimisation that affiliates for management of these objects or remote watching. But definition of IoT is creating a brilliant invisible network which may be detected, controlled and programmed [3]. The products developed based on IoT include embedded technology that permits them to exchange information, with one another or the internet and it is assessed that 8-50 billion devices are connected by 2020. Since these devices come online, they provide better life style, create safer and more engaged communities and revolutionised healthcare. In low and middle economical gain countries, there is more and more growing range of individuals with persistent diseases because of totally different risk factors like nutrient imbalance and physical inactivity. According to WHO report, 4.9million individuals die from carcinoma from the consumption of snuff, over weight a pair of 2.6million, 4.4million for increased cholesterol and 7.1million for high pressure [1]. Chronic diseases are extremely variable in their symptom, evolution and treatment. Some, if not monitored and treated early, will end the patient's life. For several years the standard measure of glucose level, pressure level and heart beat was calculated in specialised health

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centres. Due to the technological development, there is a great variety of running sensors giving important signs such as blood pressure cuff, glucometer and pulse monitor together with electrocardiogram, which permits the patient to take their vital signs daily. The readings taken daily are sent to doctors and enable them to suggest the medicine and physical exercise routine that enable them to improve the quality of life and overcome such disease. Internet of Things applied to the care and watching of patients is more and more common within the health sector, seeking to boost the standard of life of individuals. The Arduino is a programmable device that can sense and interact with its environment. The combination of Internet of Thing with Arduino is the new approach of introducing IoT in healthcare monitoring system of patient. The entire concept of IoT stands on sensor, gateway and wireless network that modify user to communicate and access the information. IoT offer more guarantee within the health awareness. As a saying goes Health is wealth its exponentially crucial to form utilisation of innovation for better well-being[4]. Arduino Uno collects the information from the sensor and transfers it to the IoT website.

II. EXISTING SYSTEM

The system used for health monitoring is the fixed monitoring system, which can be detected only when the patient is in hospital or in bed. Recently accessible systems are huge in size and available only in the hospitals in Intensive Care Unit [5]. Nowadays, zig bee can be used to transmit the patient information to their loved ones or to their concerned doctors.

2.1 Drawbacks

In existing system, patient needs to get hospitalised for regular monitoring of the patient. It is not possible once he/she is discharged from the hospital. This system cannot be used at home. The existing systems are measuring the health parameters of the patient and send it through zig bee, Bluetooth protocol etc., These are used for only short-range communication to transfer the data. Not all the time the doctor can fetch these details.

III. LITERATURE SURVEY

This involves the machinery to humidify and dry the paddy grains within the limited period of timeHasmahMansor et al [8] aimed at LM35 temperature sensor for measuring body temperature and interface LM35 sensor with Arduino UNO board. Thereafter website is created using SQL database in which data is stored, collected by Arduino.

Medical personnel can easily approach to webpage by just login. Through infrared receiver and transmitter of raspberry pi pulse rate of patients were monitored and thermistor was used to sense temperature of patient's body. Terminal Lx of d along with their feature and contribution in making the operation of health monitoring system possible. we have Raspberry pi 2, different sensors, pi camera, Arduino Nano (used as ADC), Power supply, LCD, Key board, Wi-Fi Dongle etc.

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A number of reviews were done in the past as part of research papers/technical reports on iot based Health Monitoring System.

(a) First System Here, researcher designed health monitoring system using ATmega8 microcontroller with Wireless Body Area Sensor Network (WBASN). In this work, the sensors which are used here are Temperature sensor, Blood pressure sensor, Heart beat sensor. These sensors are placed on the human body which helps to monitor the health condition without disturbing the daily schedule of the patient and these health-related parameters are then forwarded to physician's server using long range wireless technology GSM. Health monitoring system consists of sensors, microcontroller, LCD display and GSM modem to transmit or receive health related data to or from the doctor. Similarly, at the hospital the same GSM modem is used. Hence, GSM modem helps in the establishment of a network between patient's server and doctor's server. LCD (Liquid Crystal Display) display is provided to show the instant result to the patient. Here researcher

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used LM34 as temperature sensor, IR LED and red LED is used for heart rate monitoring and Pressure transducer or the sensor based on piezo-electrical material is used to measure the systolic BP and diastolic BP. Microcontroller reads data as given by the temperature sensor, blood pressure sensor and heart rate sensor and processing it gives the output in the form of digital and it gets directly displayed on LCD or it gets transmitted to the doctor's server through GSM modem. This system gives exact and instant results with high accuracy which gets directly displayed on LCD. It takes max 4-5 sec to monitor the doctor's server using GSM wireless technology. This system takes a small amount of time to know the health condition of the patient and then delivers the report to the doctor.

(b) Second System using the same system, health parameters are sanded by using RFID reader, Bluetooth, GSM and UMTS. This system gives facility to monitor the blood pressure of patients. The health parameter directly sends to the doctor using GSM and UTMS. Here, a video guide is used. This video guide feature serves the patients age and his blood pressure correctly. This system consists of three parts: Touchpad, remote server and reading of the Tag ID and BPM. For reading the Tag ID and BPM, use a microcontroller unit (MCU) as a kernel. The client touchpad receives the blood pressure measurement (BPM) data of a RFID through Bluetooth. Client touchpad sends the data to the health parameter. Also, these health parameters are directly sent to remote data centres and remote data centres to the doctor using GSM and UMTS wireless technology. Data gets transmitted in the form of the packets. This system helps to store previous data. Similarly, it takes less time to monitor the blood pressure of the patient.

(c) Third System shows the blood pressure monitoring system using microcontroller. This system includes a motor control unit, Microcontroller ATmega328, LCD display. The pressure sensor is directly connected to the cuff, which is inflated or deflated via a motor and valve. ON and OFF switches of the motor are controlled by the microcontroller at the correct time. Due to changes in the ON and OFF switches of the motor, the wrist cuff gets inflated and deflated, this pressure is measured by the pressure sensor. Pressure sensor generates the health parameter in the analog sensor. The processing of analog sensors is done with the help of the microcontroller and gives digital output which is displayed on the LCD or on the personal computer using RS232. Magneto resistive RAM (MRAM) stores the value of systolic and diastolic blood pressure and is directly connected to the microcontroller. Similarly, there is no need to pump the cuff by hand, all the system is controlled by the microcontroller. It is not required to calculate or observe blood pressure manually. Time consumption is very less compared to the old system.

IV. PROPOSED SYSTEM

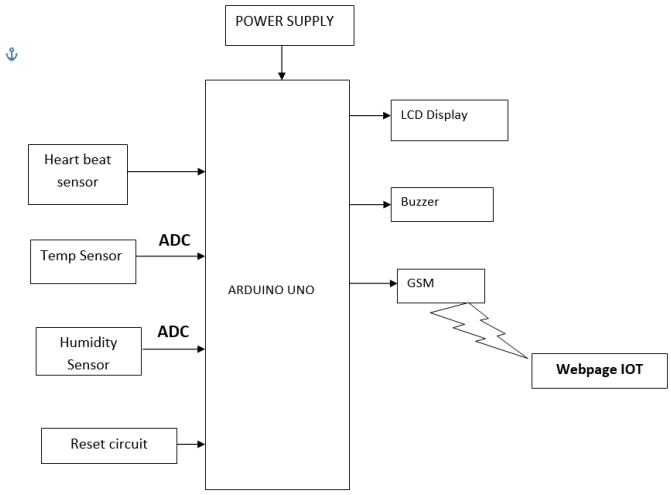

Figure 1: Block Diagram

In this project, detecting the various parameters of the patient using Internet of Things is done. In health monitoring system based on IoT projects, the real time factors of the patient are sent to the cloud by using internet connection. These data can be sent to anywhere in the world, so that the user will view the details anytime. This is the major advantage over SMS based health monitoring system. In IoT based patient health monitoring system, data of the patient health are often seen by doctors or their loved ones. The reason behind is that, the data has to be accessed by visiting an internet site or

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computer address. IoT based health monitoring system has 3 senses. Initial one is a temperature sensor, second one is heartbeat device, and the third one is respiratory sensor. This is extremely useful since the doctor will detect the patients' health parameters simply by visiting internet website or IP address. And today several IoT apps are also being developed. So, the doctor and relatives will monitor or track the patient health through Android apps. To operate an IoT based health tracking system, you will need.

IoT healthcare is the most emerging field in the medical area. This project is mainly for elderly person who is alone at home. It is also helpful for senior citizens living alone or with 1 or 2 members. This is really helpful when relatives or members of the family have to go out for some unavoidable reasons. Multi challenged person can use this project. Disabled patients who find difficulty to go to doctors on regular basis or for patients who need continuous monitoring from the doctor [3]. IoT tracking proves really useful when we need to record, monitor and keep track of changes in the health parameters of the patient. In Internet of Things based patient monitoring system, we can have the database of the health parameters. This helps the doctor to easily find the changes in the health parameters or history of the patient while suggesting the treatment or medicine for patient. Hospital stays are reduced due to remote patient monitoring. Hospital visits for regular check-ups are also minimized. Patient health parameters are stored in the cloud. So it is more beneficial than maintaining the records in printed paper in separated files or in digital computer, laptops, pen drives or specific memory location. In such cases there may be a chance of losing the data. Whereas in case of IoT, the data is stored in the cloud and has minimal chance of data loss [1]. Cure can be provided at starting stage. Notification to doctor is sent in case of critical conditions even though the patient is unable to provide any details

4.1 Arduino Uno

Microcontroller is the most important unit of the entire system. It is actually responsible for all the process being preceded. It will access and control all the peripheral devices or omponents, connected in the system. Arduino UNO is a free source microcontroller based on the microchip at mega 328p. This has some valuable facilities like they can easily convey the required information with a computer or with other microcontroller. In short, we say that complete success of the project depends on the software code in the microcontroller. The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter

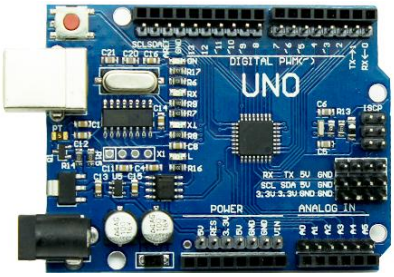

Figure 3: Arduino Uno

4.2 Humidity Sensor

A humidity sensor is an electronic device that measures the humidity in its environment and converts its findings into a corresponding electrical signal. Humidity sensors vary widely in size and functionality; some humidity sensors can be found in handheld devices (such as smartphones), while others are integrated into larger embedded systems (such as air quality monitoring systems). Humidity sensors are commonly used in the meteorology, medical, automobile, HVAC andmanufacturing industries. DHT22 capacitive humidity sensing digital temperature and humidity module is one that contains the compound has been calibrated digital signal output of the temperature and humidity sensors. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability.

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The sensor includes a capacitive sensor wet components and a high-precision temperature measurement devices, and connected with a high-performance 8-bit microcontroller. The product has excellent quality, fast response, strong anti-jamming capability, and high cost. Standard single-bus interface, system integration quick and easy. Small size, low power consumption, signal transmission distance up to 20 meters, making it the best choice of all kinds of applications and even the most demanding applications.

Figure 4: Humidity Sensor

4.3 LM35 Temp Sensor

LM35 is an integrated analog temperature sensor whose electrical output is proportional to Degree Centigrade. LM35 Sensor does not require any external calibration or trimming to provide typical accuracies. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.
Features of LM35 Temperature Sensor

- Calibrated directly in Degree Celsius (Centigrade)
- Linear at 10.0 mV/°C scale factor
- 0.5°C accuracy guarantee-able (at a25°C)
- Rated for full -55°C to a 150°C range
- Suitable for remote applications
- Low cost due to wafer-level trimming
- Operates from 4 to 30 volts
- Less than 60 mA current drain
- Low self-heating, 0.08°C instill air
- Non-linearity only 0.25°C typical
- Low impedance output, 0.1Ωfor 1 mA load

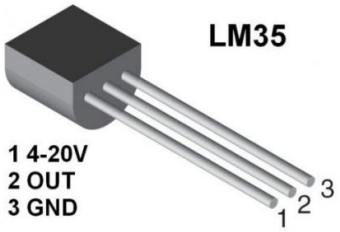

Figure 5: LM35 Temp Sensor

4.4 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

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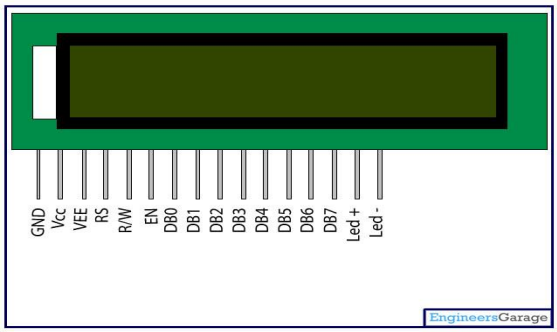

Figure 6: LCD Display

4.5 GSM

GSM modem has a SIM800A chip and RS232 interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open an connection to that COM port at 9600 baud rate, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. When you send AT commands for example: "AT\r" you should receive back a reply from the SIM800 modem saying "OK" or other response depending on the command send.

Figure 7: GSM Module

V. CONCLUSION

With the wide use of internet, this work is concentrated to execute the internet technology to establish a system which would communicate through internet for better health. Internet of Things rules the whole world in various fields, mainly in health care sectors. Hence the present work is done to design an Internet of Things based smart patient health tracking system using an Arduino microcontroller. In this, pulse rate sensor is used to detect the heart beat and temperature sensor to read the temperature and sends the data to the cloud using internet. This information is also sent to the LCD display, so patient can easily know their health status. During critical situations to alert the doctor, the warning message is sent to the doctor's phone and at the same time buzzer turns to alert the care taker. The doctor can view the sent data by logging the specific website or IP address. Hence continuous patient monitoring system is designed.

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