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Remote Patient Monitoring and Health Care Equipment

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***Abstract*: The main objective of this project is to bring fully automated device to diagnose the patient for certain common diseases and dispense the medicines through the smart medicine dispenser. A current scenario in self testing is like temperature monitoring, pulse monitoring, blood pressure. Moreover, the medical facility is less for those who live in remote areas and most of the experts and advanced facilities are available in urban areas. The scope of this project is to design and implement a reliable, cheap, low powered, non-intrusive, and accurate system that can reduce human effort in measuring the vital signs and diagnose with required medications in case of abnormality. This project deals with signal conditioning and data acquisition of vital signs: heart rate, body temperature, heart beat and also prescribed medicines including fever, cold, headache, stroke pain, etc. All the parameters that are measured can be directly seen through the LCD display. The report is sent to the doctor through the bridge called IOT. The smart medicine dispenser dispenses the medicine when any measured parameters varies above or beyond the threshold value. Thus it provides a quick treatment and latest trend in health care communication method using IOT is adopted. It dispenses the corresponding medicine automatically.**

***Keywords*: Smart medicine dispenser, IOT, Heart beat sensor, Temperature sensor, Arduino mega256, Cost effective.**

1. Introduction

As we are moving towards a modern world, the necessity for a smarter and intelligent health monitoring system is becoming very important both in rural and urban hospitals. The growth of technology is witnessed everywhere and the use of technology in medical field is increased in recent times. A scenario where a person is in need of proper medical attention but is not able to afford the medical care is not a new one. This is seen especially in villages and slums. The objective of this project is to provide a solution for this situation by equipping patients with sensors that would gather basic vital parameters from them and subsequently transfer them to an expert wirelessly. A patient monitoring system is a process in which a doctor can constantly supervise more than one person, in excess of one parameter at a time in a remote area. Therefore, an automated system for continuous measuring of heart rate, body temperature, ECG is very much essential. The process is that, when the determined output value from the sensors is different from the predefined value, it takes as an abnormal value or a disease and offers treatment that it prescribes the medicines. The output value can be directly viewed through the LCD display where the LCD act as a medical practitioner which is capable of finding out disease. Patient's physiological data is used by doctors and specialists to better understand their health condition. The data are transferred in wireless networks and the transmitted data will be monitored and analyzed by the expert and will be alerted if any abnormal condition arises within the patient's parameters hence allowing to take prompt actions. The Atmega16 microcontroller is used to process the data, of various signal conditioning and patient's samples are gathered and recorded for experts to view and give a quick treatment through the smart medicine dispenser.

2. Objective

As the name speaks for itself, the idea is to monitor one's health wirelessly and keep track of the patient's condition or send this information wirelessly to a physician or doctor. This way the patient may feel more comfortable as they wound not have to be hooked up to a machine and on other hand the doctor or nurse can keep updated records of the patient. And also quick treatment can be provided to the patient through the smart medicine dispenser at the right time to save the patient life. The aim of this project is to build a wireless device to upload the readings wirelessly to a nearby server and to afford the right treatment to save the life of our beloved ones.

3. Literature survey

There are number of approaches existing and developed for measuring heartbeat, body temperature. At present, the recent technologies for measuring heart rate as consisting of several methods using electrical and optical methods. W. Pratiksha (2017) designed an GSM based wireless health monitoring system for patients where the system monitors the patient's heart rate, temperature, saline level, and if any of the above parameters goes beyond the threshold value, this device informs the doctor or care taker and ask for corrective actions to save patients life. In this project the heart rate sensor works on the principle of light modulation. When heart pumps the blood, the volume changes inside finger so, this volume change is converted into pulse through pulse detection unit. Saline level sensor uses ultrasonic transducer it is piezoelectric type of

sensor which as propagation velocity approximately 340m/s in air or atmospheric temperature. In this project a wireless technology is used which is the GSM module where it is used as an alerting system by sending an SMS through the GSM module.

Ahmed, Salman, et al. developed a system in which patient's body temperature, heart rate and electrocardiography (ECG) are transferred wirelessly through an agent such as Bluetooth technology. In this project the body temperature sensor works on the principle of heat transfer, physiologic processes that distribute body heat, and also the principle of thermometer. The temperature sensor used in this project is LM35 which use detection method by detecting the changes in resistance of the thermistor attached inside it. As it is based on the wireless technology by making use of the Bluetooth module which could cover only a fewer distance between the experts and the patient.

Elhoussaine BABA as proposed a Health remote monitoring application based on Wireless Body Area Network (WBAN).This project has aimed to develop a wearable WBAN application for health remote monitoring ,that monitor patient's health through the continuous detection, process and communicate of human physiological parameters .This application use four biomedical sensor nodes that are able to measure physiological signal (ECG,SPO2,heart rate and breathing) and convert to a useful data. Then the data are processed by a processor and transmitted to a central node using a transceiver. Thus the central node collect the data and send it in real-time to the monitoring PC, which displays and records the physiological parameters on a graphical interface.

An IOT based patient health monitoring system was designed by Shiva Rama Krishnan which is specially designed for monitoring the old age patients and informing the doctors and loved ones. It was an innovative project to dodge such sudden death rates by using patient health monitoring that uses sensor technology and uses internet to communicate to the loved ones in case of emergency. This system uses temperature and heartbeat sensor for tracking patient's health. In case of any abrupt changes in patient heart-rate or body temperature alert is sent about the patient through IOT.

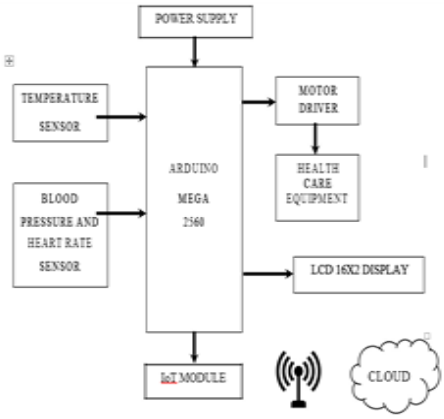

Fig. 1. Block diagram of system

Kazi Abu Zilani approached an Remote Reliable and Real-time Health Monitoring System known as R3HMS.The system measures patients physiological signals like ECG, respiratory airflow and SPO2 and sends these extracted data to a remote server .ESP8266 is used as WIFI module with an MQTT messaging protocol. Zaosheng Zhang designed an Intelligent patient monitoring system for home application to improve the current medical services for the population in the bottom of pyramid(BOP) has been proposed.

Fig. 2. Doctor side system

4. Methodology

This proposed systems, we have used an Arduino mega 2560 (development board) as a principle controller of our proposed monitoring system. The Arduino board collects the information about patient health parameter from various sensors, which were directly connected with principle controller. The Iotclouds.in platform is used as an IoT cloud. The proposed system allows patients to be monitored in their homes with mobile medical devices that collect data about blood pressure levels, body temperature and heart rate. The collected data are sent to the cloud. Remote caregivers can review these data instantly by logging in to the link. If any of the values falls above or below the threshold, then doctors advises the patients about the illness. The comments from the doctors can be seen by the patients through the created link. The patients can further treat themselves by taking the tablets that are stored in the care equipment. The care equipment can also be controlled by the doctors.

5. Components

Microcontroller: Arduino Mega 2560 is a Microcontroller board based on Atmega2560. It comes with more memory space and I/O pins as compared to other boards available in the market. There are 54 digital I/O pins and 16 analog pins incorporated on the board that make this device unique and stand out from others. Out of 54 digital I/O, 15 are used for PWM (pulse width modulation). A crystal oscillator of 16MHz frequency is added on the board. This board comes with USB cable port that is used to connect and transfer code from computer to the board. DC power jack is coupled with the board that is used to power the board. Some version of Arduino board lacks this feature like Arduino Pro Mini doesn't come with DC power jack. ICSP header is a remarkable addition to Arduino Mega which is used for programming the Arduino and uploading the code from the computer.

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This board comes with two voltage regulator i.e. 5V and 3.3V which provides the flexibility to regulate the voltage as per requirements as compared to Arduino Pro Mini which comes with only one voltage regulator. There is no much difference between Arduino Uno and Arduino Mega except later comes with more memory space, bigger size and more I/O pins. Arduino software called Arduino IDE is used to program the board which is a common software used for all boards belonged to Arduino family. Availability of Atmega16 on the board makes it different than Arduino Pro Mini which uses USB to serial converter to program the board. There is a reset button and 4 hardware serial port called USART which produces a maximum speed for setting up communication. Arduino Mega is specially designed for the projects requiring complex circuitry and more memory space. Most of the electronic projects can be done pretty well by other boards available in the market which make Arduino Mega uncommon for regular projects.

Temperature sensor: The LM35 is one kind of commonly used temperature sensor that can be used to measure temperature with an electrical o/p comparative to the temperature (in °C). It can measure temperature more correctly compare with a thermistor. This sensor generates a high output voltage than thermocouples and may not need that the output voltage is amplified. This LM35 temperature sensor circuit amplifies the difference between its input terminals. The advantages of temperature sensor include It has no effect on the medium, more accurate, it has an easily conditioned output and It responds instantly.

BP and Heart rate sensor: CK101 is a personal hand held blood pressure monitor powered by 2xAAA batteries. CK101 has a built-in LCD display and an inflatable wristband. User can wear CK101 at his wrist, and then press the power switch to start the blood pressure measurement. CK101 has a semiconductor pressure sensor to measure the high pressure (SYS), the low pressure (DIA), and the heart rate, pulse. CK101 have built-in memory space to record the measurement readings. User can press the memory button to retrieve the previous readings. Small in size, light in weight are other additional features of CK101. The following is the simplified specification of CK101, the personal hand held device.

- *Power supply:* Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.
- *Voltage regulator:* Voltage regulator ICs are available with fixed or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current and overheating.

The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications.

IOT module: The shield GSM/GPS V3 is with a Quad-band GSM/GPRS engine works on frequencies EGSM 900MHz/DCS 1800MHz and GSM850 MHz/PCS 1900MH

It also supports GPS technology for satellite navigation. It's possible for your robot and control system to send messages and use the GSM network. It is controlled via AT commands (GSM07.07, 07.05 and SIMCOM enhanced AT Commands). And the design of this shield allows you to drive the GSM & GPS function directly with the computer and the Arduino Board. It includes a high-gain SMD antenna for GPS & GSM. This GPS/GPRS/GSM shield uses an embedded SIM908 chip from SIMCom. Featuring an industry-standard interface and GPS function.

6. Advantages

- This system is cost beneficial and only takes a minute to compute the heart rate, pressure levels etc.
- Reduce travel and wait time.
- Timely and proper treatment at early stage.

7. Conclusion

The system for remote patient monitoring that can not only relocate the monitoring process to free hospital occupancies and reduce medical costs, but also under certain conditions make the monitoring results more reliable. Health monitoring system is the enhanced technology as compared to the existing technology because it sends the result easily and can work in longer distances at a very low cost. It sends measured heart rate (heart beat), body temperature and pressure level to the doctor so if any critical situation happens in patient's biomedical parameters then doctors can easily take action.

8. Conclusion

In future many sensor modules with advanced microcontroller can be added to get more bio signals from the patient. The data can also be made available in different

regional languages. Many sections in the care equipment dispenser could be made such that the patient can be availed with all kinds of medicines.

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