A DESIGN OF INTELLIGENT WEARABLE HEALTH MONITORING SYSTEM BASED ON IOT

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Abstract: Health has prime importance in our day-to-day life. Sound health is necessary to do the daily work properly. This project aims at developing a system which gives body temperature and heart rate using LM35 and pulse sensor respectively. These sensors are interfaced with controller Arduino uno board. Wireless data transmission done by Arduino through wifi module.ESP8266 is used for wireless data transmission on IoT platform i.e. thing speak. Data visualization is done on Thing speak. So that record of data can be stored over period of time .This data stored on web server so that it can seen to who logged.

I. INTRODUCTION

Capturing and sharing of vital data of the network connected devices through secure service layer is what defines IOT. In simple terms, Internet of Things (IOT) can be defined as the wireless network of devices which are connected to each other to share information and data in order to communicate and produce new information so as to record and analyze it for future use. Internet of Things gains its full potential by utilizing the key role playing objects i.e. "Smart" objects which use various sensors and actuators that are able to perceive their context, and via built in networking capabilities they could communicate to each other, access the open source Internet services and interact with the human world. This not only makes the world connected but also robust and comfortable. The Internet of things in the field of healthcare also plays a major role in providing ease to patients and doctors. It consists of a system that communicates between network connected systems, apps and devices that can help patients and doctors to monitor, track and record patients' vital data and medical information. Some of the devices include smart meters, wearable health bands, fitness shoes, RFID based smart watches and smart video

cameras. Also, apps for smartphones also help in keeping a medical record with real time alert and emergency services. These interconnected IoT devices produce large amounts of information and data that should be dealt efficiently by the providers and so is a big challenge. To overcome this challenge of storing and analyzing large data, the technique of Internet of Things Analytics (IoTA) is implemented. The raw data is converted into a useful and medically relevant data using the techniques like data extraction and data analytics. In fact, it has been predicted that by 2020, more than 50-55 percent of techniques used to analyze raw data will make a better use of this influx of data which is generated from instrumented machines and applications.In order to make our health care services robust and vast, the IOT relies on several enabling technologies. Collection of real-time data from various sources, in this case, unlimited number of patients for a large period of time has become very easy and fast using the potential of IOT.The power of IOT for health and medical services are harnessed by smart sensors (sensor and a microcontroller) which accurately measures, monitors and analyze a variety of health status indicators. These can include basic vital health signs such as pulse rate and blood pressure, oxygen and glucose level in blood and heart rate. Smart sensors can be incorporated into medicines and pill bottles that are connected to a network and can generate alerts about whether the patient has taken a scheduled dose of medication. A lot of advancement and significant changes are occurring in the field of IOT healthcare. The way of interacting and communicating with humans and other devices is changing and getting better day by day. Management of healthcare results and reduction of healthcare costs is enabled by the ever growing information and communication solutions. The healthcare services are getting better and less costly by

collecting, recording, analyzing and sharing new data packets in real time and efficiently. Also, as the world is adopting this ever growing technology of IOT, many of the inefficiencies in healthcare will be reduced. For example, various medical devices like fitness bands, health monitoring systems, medication boxes has smart sensors embedded into them that allows to collect the raw data, store it, analyze it, and conduct tests which are further used by medical experts to take proper decisions. To take the full advantage of revolutionizing IOT in healthcare, the consumers, patients and other health experts need to think of some innovative and more reliable methods. And with the help of IoT's potential they are now able to collect realtime raw data from unlimited number of patients for a continuous period of time through smart devices connected on an interconnected network. It will take time to fully realize the technology's capabilities. We will be able to see medical experts carrying out diagnosis and critical tasks in a more better and reliable way. This will ensure them not only with reliable results but also time saving which will be of maximum benefit. The possibilities of IOT are truly unlimited and ever growing. This paper proposes an IoT based health monitoring system which would collect all the medical data of a patient including his heart rate, blood pressure and ECG and would send alerts to the patient's doctor regarding his/her full medical information, providing a fast and reliable healthcare service. Moreover, in today's world everyone is busy neglecting their small healthcare problems like high blood pressure, low pulse rate etc. The paper helps to find a better and robust solution to this challenge.

In today's era, health problems are increasing day-by-day at a high pace. The death rate of 55.3 million people dying each year or 151,600 people dying each day or 6316 people dying each hour is a big issue for all over the world. Hence it is the need of hour to overcome such problems. We, therefore, proposing a change in wireless sensors technology by designing a system which included different wireless sensors to receive information with respective human body temperature, blood pressure, saline level, heart rate etc. that will be undoubtedly further transmitted on an IoT platform which is accessible by the user via internet.

An accessible database is created about patient's health history which can be further monitored & analyzed by the doctor if necessary. The data storage can be saved on the server permanently or can be reset via the software. This project proposes a health monitoring system which is capable of detecting multiple parameters of our body such as blood pressure, temperature, heart rate, ECG & further transmitting this information on an IoT server through 2G/3G/4G GSM technologies. Also in case of emergency, automatically generating alerts will be sent to doctors and family members if any unusual activity is detected by or near the patient. A continuous record of body health parameters can be used to detect the disease in a more efficient manner. Now-a-days, people pay more attention towards prevention & early recognition of disease.

In addition to it, new generation mobile phones technologies & their services provides an important impact on the development of network varieties (3G, Bluetooth, wireless LAN, GSM) etc. Various sensors have been used like AD8232 ECG sensor for remote ECG monitoring, blood pressure sensor (4811) is used to measure systolic pressure and diastolic pressure & pulse rate for few seconds. LM35 temperature sensor is used to measure surface temperature of skin. Satisfactory work is done in health monitoring by using raspberry pi as well as IoT, but this project gives embedded concept of both the platform. By using combination of these, the proposed structure will be more effective. In this project, we investigated recent projects related to health monitoring systems & IoT. IoT is nothing but an advanced concept of ICT (Information Communication Technology).

IoT is the interconnecting of devices and services that reduces human intervention to live a better life. This project as showing the advancements in health care management technology, it would save patients from the future health problems that would arise and would also help doctors to take an appropriate

measure or action at a proper time regarding patient's health.

II. LITERATURE REVIEW

Many researchers did their work on health monitoring system using IOT.M. Wcislik et al [2] monitors patient's body temperature, pulse rate, ECG wave and patient's body position using AR cortex M4F micro controller. Android app is created for monitor these values. Bluetooth connection is used for connecting microcontroller and Android phone. In my project monitor patient's body temperature, Respiration rate, heart rate and body movements using Raspberry Pi board and sensors. Android app is support only android phones.

Bluetooth is very short distance for communication. It supports only within 100 meters. In my project webpage is created. Using IP address anybody can monitor patient's health status anywhere in the world.

Amir-Mohammad Rahmani et al [3] monitor ECG wave using panda board. Ethernet connection is used for connecting internet to the panda board. In my project monitor body temperature, Respiration rate, heart rate and body movements using Raspberry Pi board. Panda board is very difficult to operate compare to Raspberry Pi board. Ethernet connection is also very short distance. So i use USB modem for connecting internet to the Raspberry Pi board. Hoi Yan Tung [3] et al monitors body temperature, ECG, heart rate using DRZHG micro controller. A Dual Radio ZigBee Homecare Gateway (DRZHG) has been proposed and implemented to support remote patient monitoring. The idea of remote patient monitoring is to simultaneously track the status of long-termpatients at home by using mobile medical sensors. The sensorscollect medical data from patients and feedback the data to thedoctors. Zigbee module is used for connected to the micro controller. Zigbee module is used for transfer the values to the receiver side. It is send data to only nearest place. But my project internet is connected to the Raspberry Pi board. So using IP address anybody can monitor patients health status anywhere in the world. Joao Martinhoa [4] et al describe the design and

successful implementation of a remotely operated physiological monitoring device.

The prototype performs acquisition of three types of physiological measurements electrocardiography, finger photoplethysmography, and blood pressure plethysmography. Atmega 328 microcontroller is used for connecting these sensors. Wifi connection is used for connecting internet to the atmega 328 microcontroller. After connecting Wifi connection it will transfer the values. If wifi hotspot is no means it is not transfer the values. Wifi is also works on short distance. In my project USB modem is used for connecting internet to the Raspberry Pi board. So it is easily connect to the internet in any place.

III.DESIGN OF HARDWARE

This chapter briefly explains about the Hardware. It discuss the circuit diagram of each module in detail.

ARDUINO UNO

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 ceramic resonator, 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 Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Arduino board has the following new features:

• 1.0 pin out: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

•   Stronger RESET circuit.

•   Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.
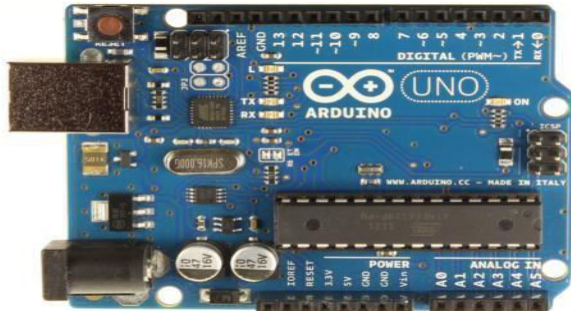

Fig: ARDUINO UNO

POWER SUPPLY:

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A d.c power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations is known as "Regulated D.C Power Supply".
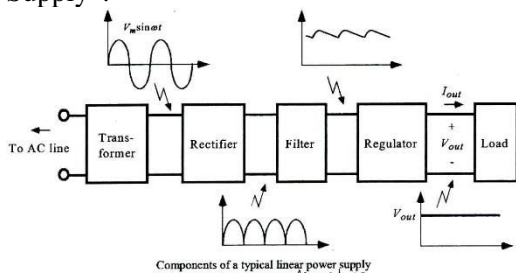

Fig: Block Diagram of Power Supply

LCD DISPLAY

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (Hitachi) and can display messages in two lines with 16 characters each. It displays all the alphabets, Greek letters,

punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own. Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.
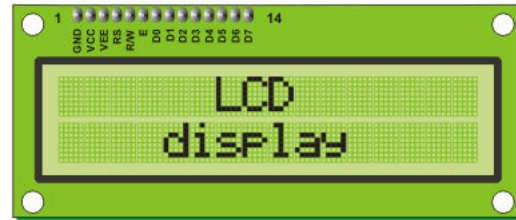

Fig: LCD

BUZZER

Digital systems and microcontroller pins lack sufficient current to drive the circuits like relays, buzzer circuits etc. While these circuits require around 10milli amps to be operated, the microcontroller's pin can provide a maximum of 1-2milli amps current. For this reason, a driver such as a power transistor is placed in between the microcontroller and the buzzer circuit.
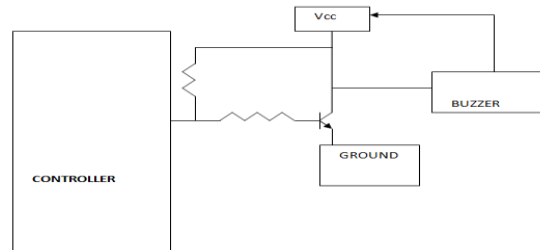
WIFI MODULE:

The **ESP8266** is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif Systems.[1]

The chip first came to the attention of western makers in August 2014 with the **ESP-01** module, made by a third-party manufacturer, Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted.[2] The very low price and the fact that there were very few external components on the

module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.[3]

The **ESP8285** is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.[4]
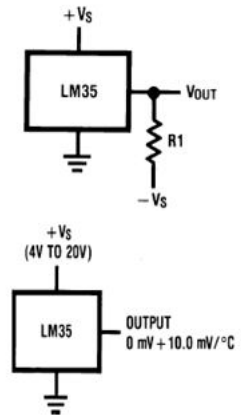
The successor to these microcontroller chips is the ESP32.

TEMPERATURE SENSOR (LM35):

In order to monitor the temperature continuously and compare this with the set temperature preprogrammed in the microcontroller, initially this temperature value has to be read and fed to the microcontroller. This temperature value has to be sensed. Thus a sensor has to be used and the sensor used in this project is LM35. It converts temperature value into electrical signals.

LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. . The LM35 does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4°C$ at room temperature and $\pm 3/4°C$ over a full -55 to $+150°C$ temperature range.

The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than $0.1°C$ in still air.

The characteristic of this LM35 sensor is:
For each degree of centigrade temperature it outputs 10milli volts.

ROLE OF LM35:

In this project, the temperature is to be monitored continuously and if the temperature exceeds the set value preprogrammed in the microcontroller, a buzzer indication is provided in the circuit to alert the people in the industry to stop the process immediately. Thus the temperature sensor LM35 has to read the temperature continuously and the microcontroller has to compare this temperature value with the set temperature preprogrammed in it. When this temperature exceeds the set value, the microcontroller sends an indication to the buzzer which gives a loud noise.

Heart Beat Sensor

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.
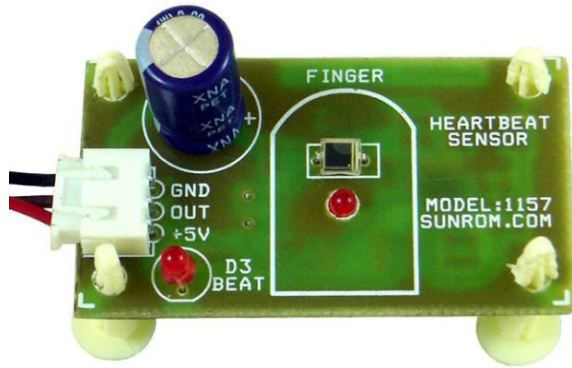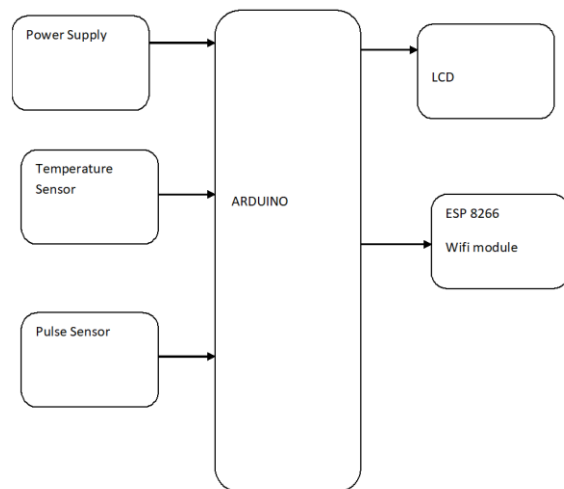
Working:

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated by a LED which blinks on each heart beat.

IV. PROJECT DESCRIPTION

This chapter deals with working and circuits of "**HEALTH MONITORING SYSTEMS USING IOT BASED ON ARDUINO**". It can be simply understood by its block diagram &circuit diagram.

BLOCK DIAGRAM:

Fig 6.1 block diagram

6.4. WORKING:

We have proposed a robust health monitoring system that is intelligent enough to monitor the patient automatically using IOT that collects the status information through these systems which would include patient's heart rate, temp, ECG, Vibration sends an emergency alert to patient's doctor with his current status and full medical information. This would help the doctor to monitor his patient from anywhere and also to the patient to send his health status directly without visiting to the hospital. Our model can be deployed at various hospitals and medical institutes. The system uses smart sensors that generates raw data information collected from each sensor and send it to a database server where the data can be further analyzed and statistically maintained to be used by the medical experts. Maintaining a database server is a must so that there is even track of previous medical record of the patient providing a better and improved examining.
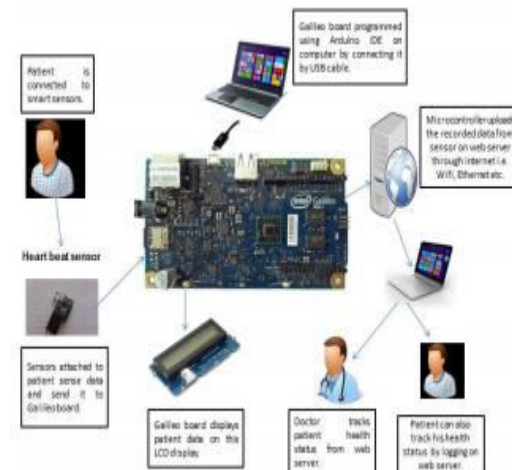

Fig: System Architecture

V.CONCLUSION

In this project, The main idea of the proposed system is to provide better and

efficient health services to the patients by implementing a networked information cloud so that the experts and doctors could make use of this data and provide a fast and an efficient solution. The final model will be well equipped with the features where doctor can examine his patient from anywhere and anytime. Emergency scenario to send an emergency mail or message to the doctor with patient's current status and full medical information can also be worked on.

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