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INTEGRATING WITH IOT AND CLOUD FOR REAL TIME ECG MONITORING SYSTEM

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ABSTRACT

As there was a tremendous growth of unstructured data, cloud storage technology gets more attention and better development. In recent days health care organizations are increasing more and more to meet the growing population needs. It is a known fact that country like india has become heart disease capital of the world. There is an urgent need to develop an effective health monitoring system that can detect abnormalities of health conditions in time and make diagnoses according to the gleaned data. As we all know that ECG monitoring is one of the most effective method to diagnose heart diseases. In this proposed thesis we try to propose a novel method by integrating Iot and Cloud for ECG monitoring on node mcu for Embedded Devices with Internet of Things (IoT) platform. ECG data are gathered using a wearable monitoring node and are transmitted directly to the IoT cloud using Internet.

I. INTRODUCTION

Cloud computing is the utilization of processing assets (equipment and programming) that are conveyed as an administration over a system (normally the Internet). The name originates from the regular utilization of a cloud-formed image as a deliberation [1] for the perplexing foundation it contains in framework outlines. Distributed computing endows remote administrations with a client's information, programming and calculation[2]. Distributed computing comprises of equipment and programming assets made accessible on the Internet as oversaw outsider administrations. These administrations regularly give access to cutting edge programming applications and top of the line systems of server PCs[3].

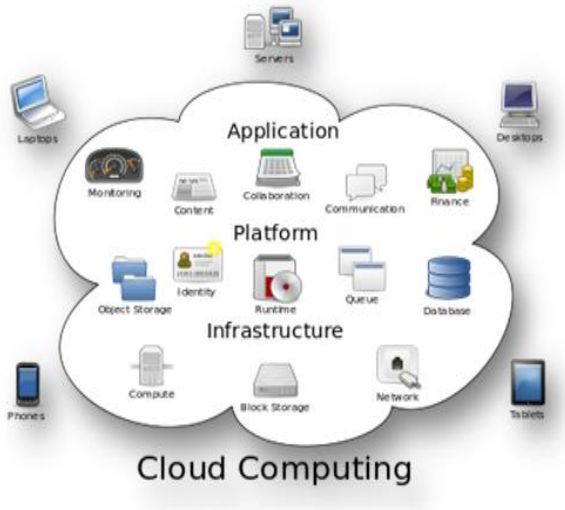


Figure.1 Denotes the Architecture of Cloud Computing.

A Remote health monitoring system is an extension of a hospital medical system where a patient's vital body state can be monitored remotely. Traditionally the detection systems were only found in hospitals and were characterized by huge and complex circuitry which required high power consumption. Continuous advances in the semiconductor technology industry have led to sensors and microcontrollers that are smaller in size, faster in operation, low in power consumption and affordable in cost. This has further seen development in the remote monitoring of vital life signs of patients especially the elderly. A patient is known to have a medical condition with unstable regulatory body system. This is in

cases where a new drug is being introduced to a patient.

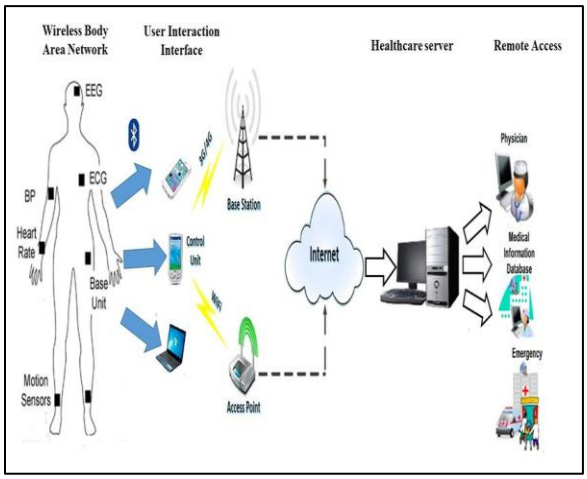


Figure.2 Denotes the Sample Architecture of Remote Health Monitoring Systems Using Internet and IOT

A patient is prone to heart attacks or may have suffered one before. The vitals may be monitored to predict and alert in advance any indication of the body status. Critical body organ situation.The situation leading to the development of a risky life-threatening condition[1]. This is for people at an advanced age and maybe having failing health conditions.Many of the systems were introduced in the developed countries where the infrastructure is working perfectly. In most cases, the systems are adapted to work in developing countries. To reduce some of these problems there is need to approach the remote detection from a ground-up approach to suit the basic minimal conditions presently available in developing countries. From the above figure 2,we can clearly identify that a patient who is having some inadequate changes in his heart rate,ECG,BP and Motion sensor is immediately updated to access point which is connected with internet and that information is passed to the hospital or physician or emergency unit. This type of mechanism helps a lot for the patient to get immediate first aid at the time of any emergency situation.

II. LITERATURE SURVEY

S. J. Jung and W. Y. Chung studied the Flexible and scalable patient's health monitoring system in 6LoWPAN . The main advantage of this enabling factor is the combination of some technologies and communications solution. The results of Internet of Things are synergetic activities gathered in various fields of knowledge like telecommunications, informatics and electronics[2].

K. S. Shin and M. J. Mao Kaiver studied a cell phone based health monitoring system with self analysis which incorporates IoT [13] a new paradigm that uses smart objects which are not only capable of collecting the information from the environment and interacting the physical world, but also to be interconnected with each other through internet to exchange data as well as information[3].

Gennarotartarisco and TabiloPaniclo had studied a Maintaining sensing coverage and connectivity in large sensor networks mainly includes the information about how to build or develop a new computational technology based on clinical decision support systems, information processing, wireless communication and also data mining kept in new premises in the field of personal health care[4].

Cristina Elena Turcua studied Health care applications a solution based on the Internet of Things survey aims to present a detailed information about how radio frequency identification, multi-agent and Internet of Things technologies can be used to develop and improve people's access to quality and health care services and to optimize the health care process[5].

Gubbi, Jayavardhana, Buyya, Rajkumar, Marusic, Slaven, Palaniswami, Marimuth studied the Internet of Things (IoT): A vision, architectural elements, and future direction which proposes on demand positioning and tracking system[6]. It is based on Global Positioning enabled devices and suitable for large environments. Smart phones between two terminals are used for making initial communication. The initial communication is

performed by synchronization phase.Loren Schwiebert, Sandeep K.S. Gupta and Jennifer Weinmann studied the strength of smart sensors which are developed from the combination of sensing materials along with combined circuitry for other biomedical applications[7] .

III. OBJECTIVE

The main objective is to monitor various parameters of the patient using internet of things. In the patient monitoring system based on Internet of things project, the real-time parameters of patient's health are sent to cloud using Internet connectivity. These parameters are sent to a remote Internet location so that user can view these details from anywhere in the world. The proposed method of patient monitoring system monitors patient's health parameters. After connecting internet to the Arduino NodeMCU, it is connected to cloud database system which acts as a server. Then the server automatically sends data to the receiver system. Hence, it enables continuous monitoring of the patient's health parameters by the doctor. Any abrupt increase or decrease in these parameter values can be detected at the earliest and hence necessary medications can be implemented by the doctor immediately.

IV. EXISTING SYSTEM

In the Existing system ECG monitoring system architecture not based on the Internet-of-Things (IoT) cloud is proposed. A low power wearable ECG monitoring system using PSoC is used to sense the ECG signal from the human body. ECG monitoring system is connected to low power, high speed [10] WICED which has not sent to cloud directly. Compared with Bluetooth or Zigbee, Wi-Fi can provide higher data rates and wider coverage areas. Due to the power limitations of transmitting device, most of the processing is pushed to the server side. IoT lets RFID, BLE, Wi-Fi and other sensor networks empower computers to perceive the world for themselves .IoT Cloud In order to provide convenient and timely access to ECG data for users, both the HTTP and MQTT servers are deployed in the AWS IoT cloud. AWS IoT is a managed cloud platform that lets connected devices easily and securely interacts with cloud applications and other devices. AWS IoT can support billions of devices and trillions of messages, and can process and route those messages to AWS endpoints and to other devices reliably and securely. With AWS IoT, ECG monitoring system can keep track of and communicate with doctors all the time, even when they aren't connected[8].

LIMITATION OF EXISTING SYSTEM

The following are the limitation of existing system. They is as follows:

1. The system is very complex
2. It is not reliable to run such type of sensors over that module.
3. It is Very inaccurate
4. It is Very expensive to implement it.

V. PROPOSED SYSTEM

In this proposed work the vital parameters such as ECG and heart beat readings which are monitored using ARM7 LPC2148. These sensors signals are send to LPC2148 via amplifier circuit and signal conditioning unit (SCU), because the signals level are low (gain), so amplifier circuit is used to gain up the signals and transmit the signals to the Arduino NodeMCU and updated to the cloud. Here patients body ECG and heart rate is measured using respective sensors and it can be monitored in the screen of computer using and over the cloud database system as well as monitored anywhere in the world using internet source by Android APP.

ADVANTAGES OF THE PROPOSED SYSTEM

The following are the advantages of the proposed system. They are as follows:

1. The system is very robust and less complex.
2. It is very reliable to run sensors
3. It is Very accurate
4. It is less expensive and can be easily deployed.

VI. PROPOSED BLOCK DIAGRAM

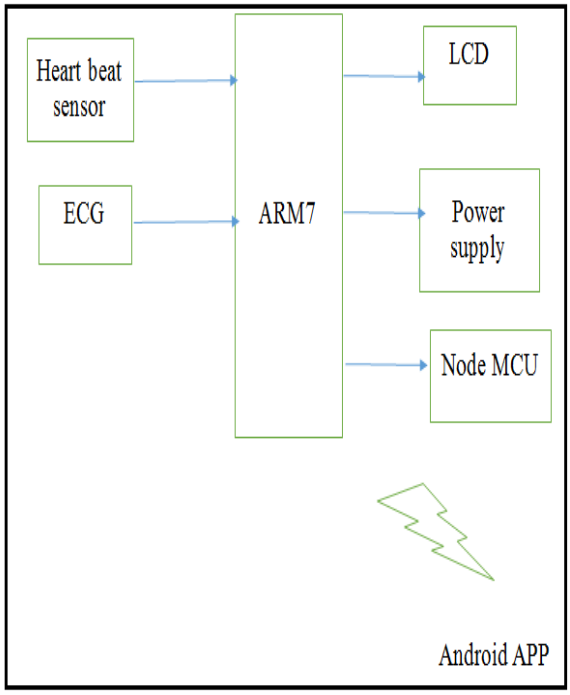


Figure.3 Denotes the Proposed Block Diagram

From the above figure 3,we can clearly identify that proposed method of patient monitoring system monitors patient's health parameters. After connecting internet to the Arduino NodeMCU, it is connected to cloud database system which acts as a server. Then the server automatically sends data to the receiver system. Hence, it enables continuous monitoring of the patient's health parameters by the doctor. Any abrupt increase or decrease in these parameter values can be detected at the earliest and hence necessary medications can be implemented by the doctor immediately. In this section we try to discuss about each and every components in detail[9].

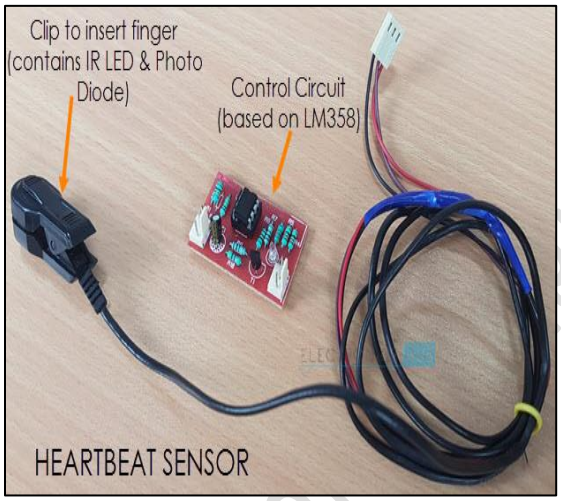
ECG DEVICE

The ECG device detects and amplifies the tiny electrical changes on the skin that are caused when the heart muscle depolarizes during each heartbeat. At rest, each heart muscle cell

has a negative charge, called the membrane potential, across its cell membrane. Decreasing this negative charge toward zero, via the influx of the positive cations, Na^{+} and Ca^{++}, is called depolarization, which activates the mechanisms in the cell that cause it to contract. During each heartbeat, a healthy heart will have an orderly progression of a wave of depolarisation that is triggered by the cells in the sinoatrial node, spreads out through the atrium, passes through the atrioventricular node and then spreads all over the ventricles. This is detected as tiny rises and falls in the voltage between two electrodes placed either side of the heart, which is displayed as a wavy line either on a screen or on paper.

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 heartbeat. 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 a teach pulse. 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.



FEATURES

• Heat beat indication by LED

• Instant output digital signal for directly connecting to microcontroller

• Compact Size

• Working Voltage +5V DC

Applications

• Digital Heart Rate monitor

• Patient Monitoring System

• Bio-Feedback control of robotics and applications using the Sensor

• Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply. These wires are also marked on PCB.

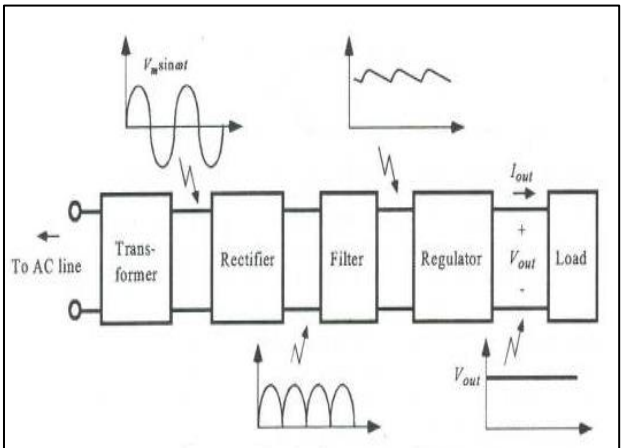
• To test sensor you only need power the sensor by connect two wires +5V and GND. You can leave the output wire as it is. When Beat LED is off the output is at 0V.

• Put finger on the marked position, and you can view the beat LED blinking on each heart beat.

• The output is active high for each beat and can be given directly to microcontroller for interfacing applications.

POWER SUPPLY

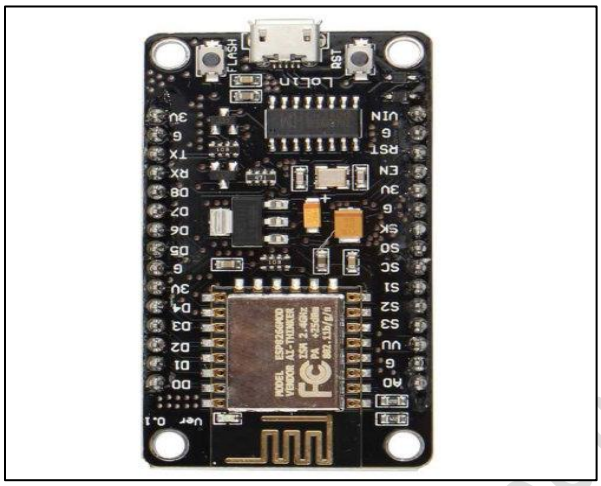
The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.



Components of a regulated power supply

NODE MCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the DevKit. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.

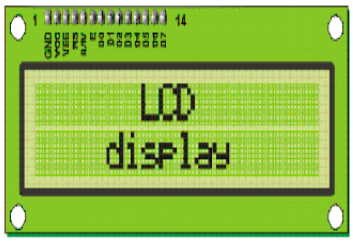


LIQUID CRYSTAL DISPLAY

LCD stands for **L**iquid **C**rystal **D**isplay. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.

These components are "specialized" for being used with the microcontrollers, which

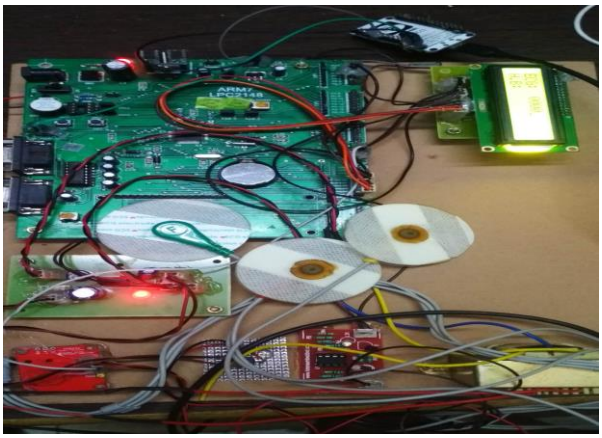


means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (*Hitachi*) and can display messages 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.

VII. EXPERIMENTAL RESULTS

In this section we try to implement the proposed concept on hardware and software components.

Hardware Assembly

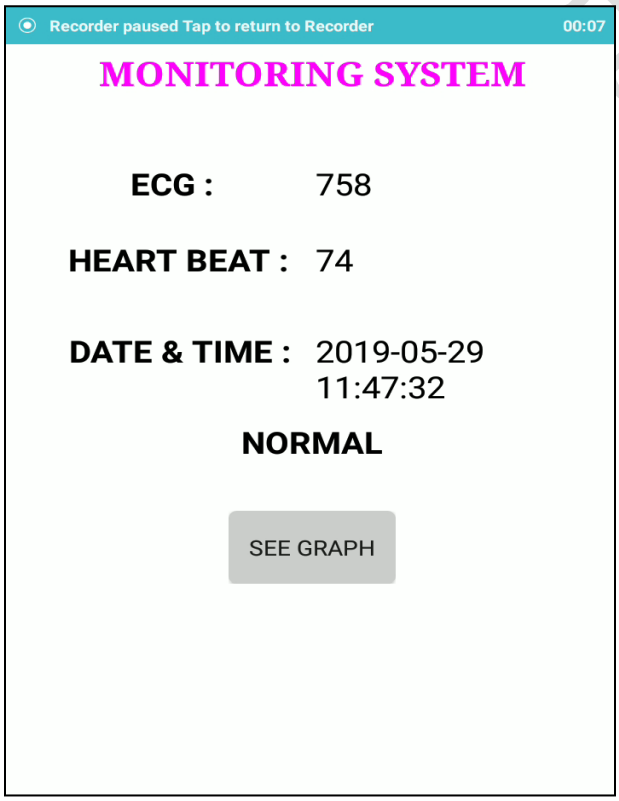


From the above figure we can clearly see the device is connected with ARM 7 LPC 2148, 16x2 LCD, ECG Sensor, Heart Beat Sensor and Power Supply

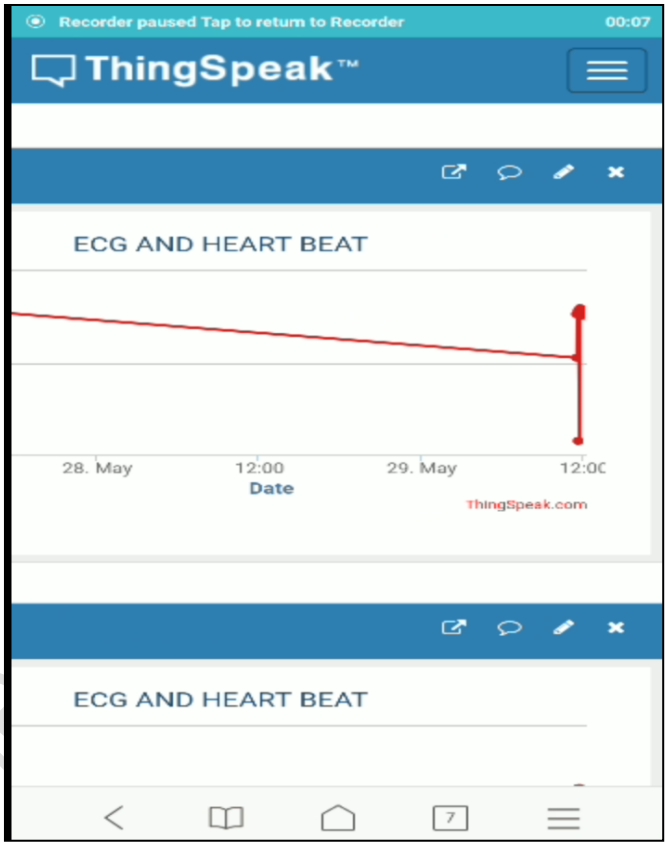
VALUES ON LCD

The sensor values of the ECG and Heart Heat of the patient are shown on the 16x2 LCD.

ECG & HEART BEAT MONITORING SYSTEM



ECG & HEART BEAT GRAPH



VIII. CONCLUSION

The proposed system of patient health monitoring can be highly used in emergency situations as it can be daily monitored, recorded and stored as a database. In future the IOT device can be combined with the cloud computing so that the database can be shared in all the hospitals for the intensive care and treatment

FUTURE WORK

IoT has enabled medical monitoring to become more widespread and effective. In the past, patients could only be monitored in a medical facility or under the care of family or home nurses. If a patient decided to heal in a hospital, their vital signs - blood pressure, blood sugar levels, and heart levels - could be

monitored by healthcare professionals. But if a patient decided to heal at home in the care of family, they risked not being able to immediately detect complications from illness and disease.

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