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Healthcare Monitoring System using IoT

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Abstract*: Medication has become a very necessary factor for the survival of human species and many scientists are continuously working on improving our medical advancements, as a tribute to those scientists, our team is working on a device which will monitor heartbeat, temperature, blood pressure, glucose levels and invasive blood group identification using heartbeat sensor, temperature sensor, node mcu and Mems. As we are using invasive blood group identification there is no need to puncture human body to identify blood group. It sends notification to the nearest doctor and family members in case of any emergency or abnormal situations. It stores all the data in cloud which helps to access the data from anywhere by family members or doctors to analyse the situation and past medical history. The add on advantage of this application is we can store past medical prescriptions and all other health details of medicines being used by patients which might be needed during his visit to other hospitals or in emergency conditions.

Keywords*: IoT, Mems, Sensors, healthcare, temperature monitoring, heartbeat monitoring, blood group identification.

I. INTRODUCTION

Now-a-days we are using smart technologies and gadgets everywhere like home automation parking system automation, security systems etc, we are making things automated and monitored using our smart phones and Internet of Things in the same way we can monitor health status of a person using these technologies which can play a crucial role in the upcoming days. Using a single device, we can capture the complete health report of a person without any huge efforts and we can store the entire data, which can be used for further medical diagnosis. We can just look into data through smart phones or in cloud instead of carrying all the past medical documents. It is easy to access for everyone and from anywhere. This device is portable and less in weight so there will be no trouble to handle it at anywhere. It is a single device which consists of all the basic medical diagnosis equipment. We can check blood group, disease identification also can be done by mems till now there is no such device.

II. LITERATURE SURVEY

Many researchers proposed various healthcare systems and prediction on several diseases using various methods. Almotiri et al. [1] proposed a system of health that uses mobile devices to collect real-time data from patients and store it on servers connected to internet enabling access only to a certain specific client. This data can be used for the medical diagnosis of patients and is achieved by using a number of wearable devices and body sensor network. Dwivedi et al. [2] developed a framework in order to secure the clinical information that has to be transmitted over the internet for Electronic Patient Record (EPR) systems in which they propose a multi-layered healthcare information system framework which is a combination of Public Key Infrastructure, Smartcard and Biometrics technologies. Gupta et al. [3] proposed a model which measures and records ECG and other vital health parameters of the patient using Raspberry Pi and can be of a great use for the hospitals and patients as well as their family members. Gupta et al. [4] present an approach using Intel Galeleo development board that collects the various data and uploads it to the database from where it can be used by the doctors and also reduce the pain to the patients to visit hospital each and every time to check their health parameters.

III. SYSTEM ARCHITECTURE

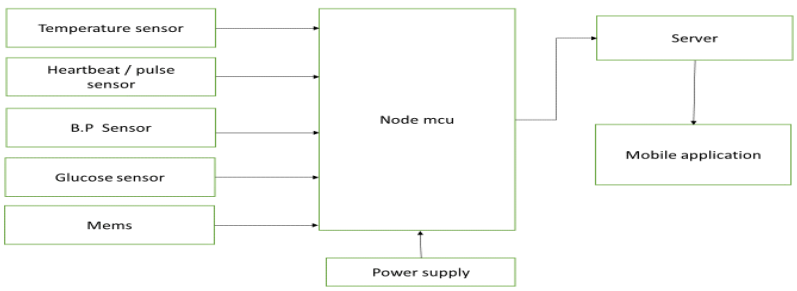

Figure 1 Architecture

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A. Temperature Sensor

Figure 2 LM35 Temperature sensor

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). With LM35, the temperature can be measured more accurately than compared to the thermistor.

B. Heartbeat / Pulse Sensor

Figure 3 Pulse sensor

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Heart Rate can be monitored in two ways: one way is to manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor [5].

C. Node MCU

Figure 4 NodeMCU

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 development kits [6].

D. B.P Sensor

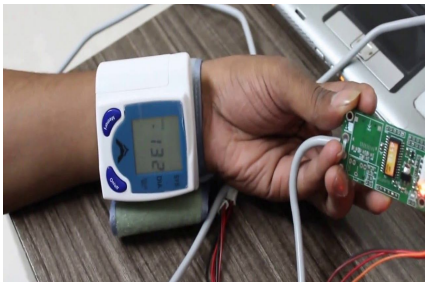

Figure 5 B.P Sensor module

Blood Pressure readings are shown on display with serial out for external projects of embedded circuit processing and display. Shows Systolic, Diastolic readings. Compact design fits over your wrist like a watch. Easy to use wrist style eliminates pumping.

E. Glucose Sensor

Figure 6 Glucose meter

Glucometer is a medical device for determining the approximate concentration of glucose in the blood. A small drop of blood, obtained by pricking the skin with a lancet, is placed on a disposable test strip that the meter reads and uses to calculate the blood glucose level. The meter then displays the level in mg/dl or mmol/l.

F. ADC

ADC provide an isolated measurement such as an electronic device that converts an input analog voltage or current to a digital number representing the magnitude of the voltage or current. Typically the digital output is a two's complement binary number that is proportional to the input, but there are other possibilities[7].

G. Mems

Bio-MEMS is an abbreviation for biomedical (or biological) microelectromechanical systems. Bio-MEMS have considerable overlap, and is sometimes considered synonymous, with lab-on-a-chip (LOC) and micro total analysis systems (μTAS). Bio-MEMS is typically more focused on mechanical parts and microfabrication technologies made suitable for biological applications. On the other hand, lab-on-a-chip is concerned with miniaturization and integration of laboratory processes and experiments into single (often microfluidic) chips. In this definition, lab-on-a-chip devices do not strictly have biological applications, although most do or are amenable to be adapted for biological purposes. Similarly, micro total analysis systems may not have biological applications in mind, and are usually dedicated to chemical analysis. A broad definition for bio-MEMS can be used to refer to the science and technology of operating at the microscale for biological and biomedical applications, which may or may not include any electronic or mechanical functions. The interdisciplinary nature of bio-MEMS combines material sciences, clinical sciences, medicine, surgery, electrical engineering, mechanical engineering, optical engineering, chemical engineering, and biomedical engineering. Some of its major applications include genomics, proteomics, molecular diagnostics, point-of-care diagnostics, tissue engineering, single cell analysis and implantable microdevices [8].

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IV. WORKING

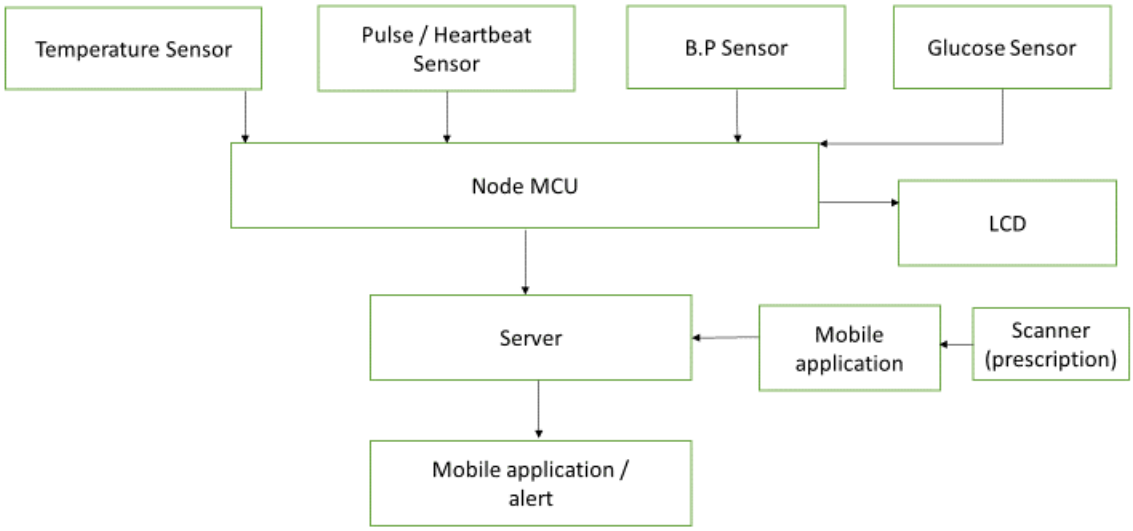

Figure 7 Workflow

The working of Smart Health Care device is as follows: This device will take the values of temperature, blood pressure, glucose levels and pulse rate once the device and the patient or individual is ready, the values are processed by the microcontroller (here we use Node MCU, we can also use some other microcontrollers also). All these values are sent to cloud through wi-fi module ESP8266 we can retrieve back all those values through mobile application or web access. The obtained values from the sensors are compared with the pre-defined threshold values which are stored in microcontroller, if the obtained values are greater than the threshold values it sends immediate alert to nearby doctors and family members. The add on advantage of this device is, it stores all the scanned copy of prescriptions. We can scan and store all the past prescriptions and medical history of a person in the mobile application. It can be useful when a person visits a new hospital it is easy to analyse the past medical history of a person or in emergency conditions.

Figure 8 App welcome page

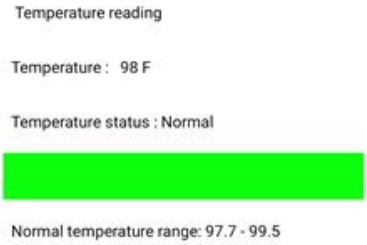

Figure 9 Temperature readings

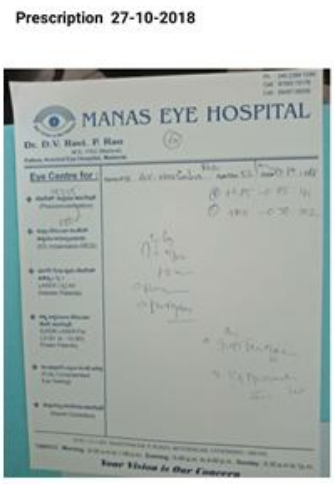

Figure 10 Scanned Prescription copy

V. FUTURE WORK

Presently we are working on Invasive blood group identification method. As of today, we are finding blood group by olden methods of non-invasive method it may take some time to confirm blood group. By using invasive method of finding blood group we can reduce the time taken to find the blood group and it reduces the usage of medical equipment's like syringe needles, etc. Mems sensors are used in this invasive blood group identification. These sensors will detect the blood group of a person without taking the blood samples.

VI. CONCLUSION

Advancements in the latest medical technologies day by day are reducing the extent of damage done to human life but the thing is to identify the problem at the right time. Where there is immediate response, immediate medication will be provided. Small problem is leading to a great loss. In this paper, we provided prototype of our system which assures to continuously monitor health status of a person and update details to the cloud and to mobile application. It sends alert message to nearby doctors and family members when there is a drastic change in health conditions. It also consists of all the previous medical diagnosis data of the person which makes doctor to give medical treatment easily.

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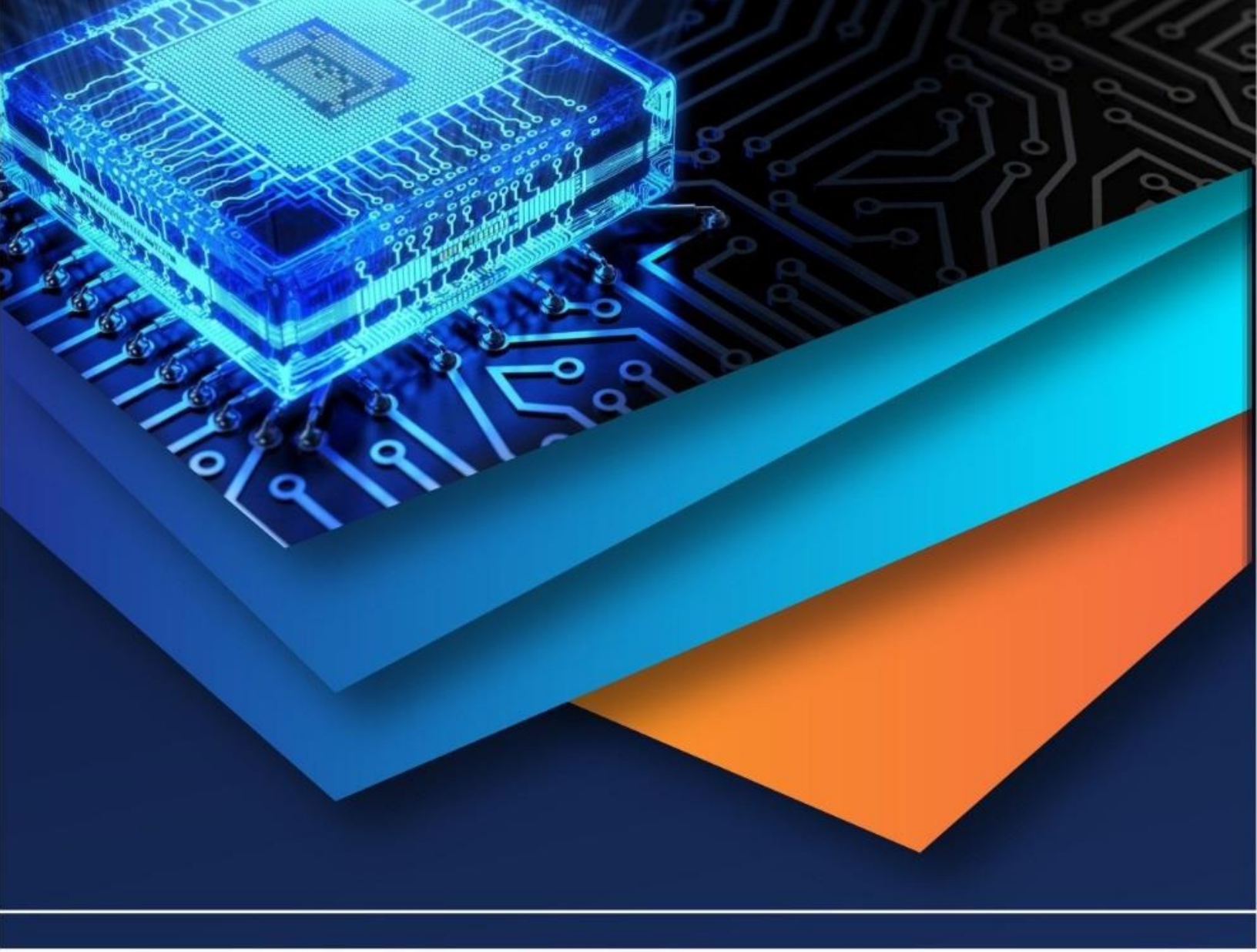
[7] https://en.wikipedia.org/wiki/Analog-to-digital_converter
[8] https://en.wikipedia.org/wiki/Bio-MEMS



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