An IoT with Cloud Computing to Monitor the Anesthetic Patient by Non-Invasive Method

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Abstract- *The Internet of things(IOT) is that which interconnects all the object in the recent days and makes very good technical revolution in upcoming days. The applications of IOT includes in smart home, smart irrigation, smart traffic control system, smart parking and even in smart healthcare monitoring system it plays a vital role. In health monitoring it gives information about a patient health parameters periodically or real time monitoring of health status where sensors are used to get the data of patient which mainly reduces human error. In this patient's health status will get transmitted through different medical devices i.e gateway and data can be monitored, stored, analyzed and viewed from different places through the application of cloud computing to IOT. In healthcare field it mainly helps in disease management and trade-off between patient outcome which can be done at reduced cost. In this we mainly design a non-invasive platform where different sensors are used which acquires the current patient health status and is sent to Raspberry Pi where data is stored. The stored data can be viewed from different doctor's from different places in smart watch or mobile application through cloud computing.*

Key words-**: Raspberry Pi, Arduino Nano, sensors, TFT display, Internet of Things and Cloud Computing.**

1. INTRODUCTION

There is good growth in the "Internet of Things" which is rising now-a-days and price is decreasing so that IOT components can be accomplished in home, agriculture, healthcare etc. It attracts the public with new innovative things. If an unexpected change in health occurs then that problem can be solved using IOT. In this mainly we make use of the different non invasive sensors like temperature sensor, PH sensor, gas sensor, spo2 sensor which acquires patient's health data. The one of main platform which we are using here is Raspberry Pi which one of the popular platform which works entirely on Linux server and is available to us at reduced cost. It has a in-built wi-fi and Bluetooth mobile and is used by the students for learning purpose as it is available in the market at low cost.

The Raspberry Pi helps in interfacing of different components to it through General Purpose Input and Output Pins(GPIO). Raspberry Pi along with IOT places a significant role in advanced technology in healthcare system. The Raspberry Pi works as a small clinic in monitoring temperature, ph, blood glucose level, spo2 level and gas detection inside the patient room which gives quick health status information. The application of cloud computing to the IOT is added advantage to it. The sensed data now can be transferred to the IOT website where every doctor can view and monitor the patient health condition. Doctor's can view the data either through smart watch or mobile application. This is one of the core idea in monitoring of patient health in online.

General Anesthesia is a condition where drug will be induced into the patient's body and patient is unresponsive to external stimuli[7]. Anesthesia is usually given before any surgical operation. The correct balance at this time is required which is non invasive and is done through IOT and even you can know the depth of the drug induced so that recovery of the patient is pleasant. The drug levels monitored here includes blood glucose level, spo2 level, temperature level, ph level etc.

2. LITERATURE REVIEW

In this we work on the research on the online monitoring of the patient simultaneous health status. Dohr et al [1] where which monitors the blood pressure level in the blood using KIT(Keep In Touch) method. In this KIT is connected to the java based mobile phones. Whenever a patient touches KIT, data is sent to this mobile phone through magnetic coupling by near field communication. In this whatever the data transferred is in a short distance type of communication. By using a closed loop system data is sent through secure website. Junaid mohammed et al [2] which monitors the heart rate i.e ECG wave from anywhere in world with the use of IOIO-OTG microcontroller. Then this microcontroller is connected to mobile phone. An android application is developed to view and monitor the ECG wave of the patient's health. The data about the patient ECG wave is being stored and analyzed.

Mohammed S. Jasses et al [3] in this mainly it focused on the monitoring of the temperature of body by use of Raspberry Pi board and with the application of cloud computing to it. In this wireless sensors are being used and the data is sent to this secure websites so that only particular person who knew login ID and password can have access to it. Hasmah Mansor et al in [4] helps to monitor the temperature of the body using LM35 temperature sensor which is connected to Arduino Uno microcontroller. Then later they created a SQL database

to store the patient's data so whenever a request for particular patient data is made, then a quick response can be given by referring to SQL database. Nithin P. Jain et al [5] helps in the heart rate, pressure of the patient's. In this sensors are connected to the microcontroller and GSM module is connected in turn so that it connects the websites. After collecting data by GSM module then alert message is given to the doctor.

3. BLOCK DIAGRAM

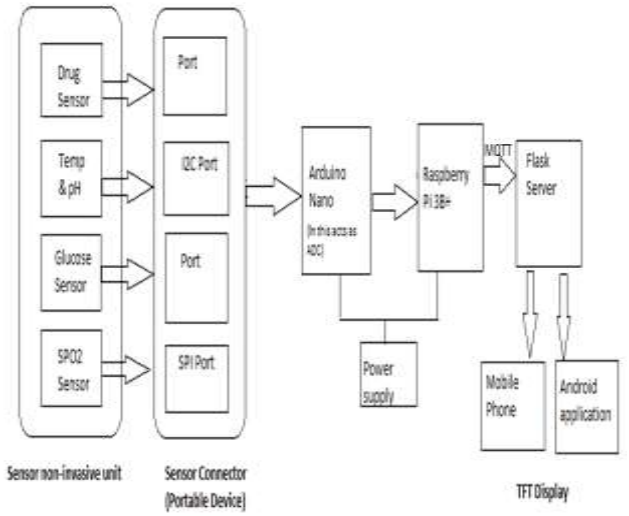


Fig 1. Block Diagram for online of health status

In this a non-invasive sensor unit is used which has Drug sensor, Temperature Sensor, Glucose and spo2 sensor which is a portable device i.e can be carried from one place to other which connected to Arduino Nano. The Arduino Nano here acts as Analog to Digital converter and all the processing activities is done through Raspberry Pi 3B+ Module[4]. Only the temperature sensor here is connected directly to Rapberry Pi because it gives digital output whereas other sensors give analog output. By using MQTT protocol the analyzed and stored data in Raspberry Pi can be sent to Flask server. This a local host server which runs on your own local PC. Later this data can be viewed through TFT display here or in medical field it can be seen through mobile phones or android application.

In this data is sent in a secured way where only the accessable person can only view and monitor the data.

3.1 FLOW CHART

The below figure shows the work flow how it is done.

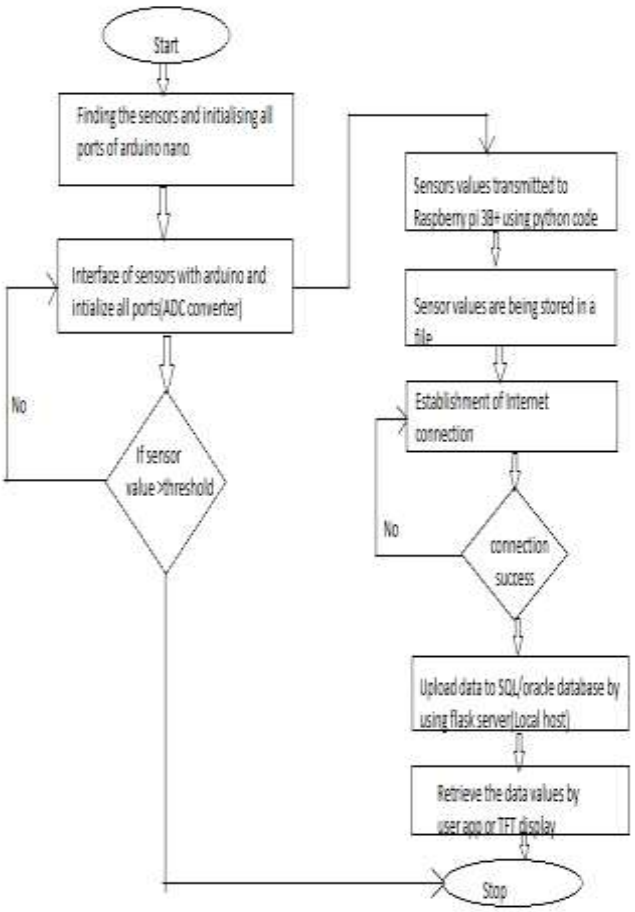


Fig 2. Flow Chart

In this first the power supply of about 5 volts is given, firstly the task is to find out which all the sensors present and the testing of the sensors is done to check whether they are working properly or not. Then interfacing of all the sensors with arduino nano and Raspberry Pi is done. The threshold value is set for the sensors suppose if sensors value is greater than threshold then entire device stops working[6]. If acquired data is less than threshold then sensors value will get transmitted to Raspberry Pi where data is being analyzed and stored. If internet connection is given then this patient's details can be uploaded to the specific website where patient's data can be viewed from different places and each doctor can monitor the data. In hospitals in case of emergency the alert sms can be given to the doctor but in this TFT display is used to view.

3.2 COMPONENTS USED

Raspberry Pi is small sized card microcontroller and a bank which works good in Linux server and very popular platform for development and for the education purpose.

It has a inbuilt wifi and Bluetooth module and connecting to internet is easier when compared to other boards. It is available at low cost as it is easily affordable so it is used for education and for the development purpose. It has input/ output 40 GPIO pins and it can be

programmed as per the need. The latest version is Raspberry Pi 3B+.

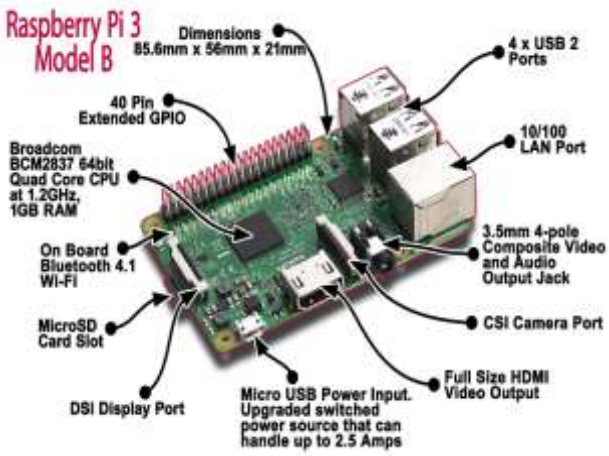


Fig 3. Raspberry Pi 3B+ Module

3.3 ARDUINO NANO

Arduino Nano is user friendly microcontroller type board which has all the processing activities same like the other boards. In this board is used for the Analog to digital converter. The output from spo2 sensor, glucose sensor, gas sensor is given to the Arduino Nano before giving to Raspberry Pi. The analog output from those sensors is converted to digital ouput and given to Raspberry Pi. The temperature sensor gives analog output so it is connected directly to Raspberry Pi

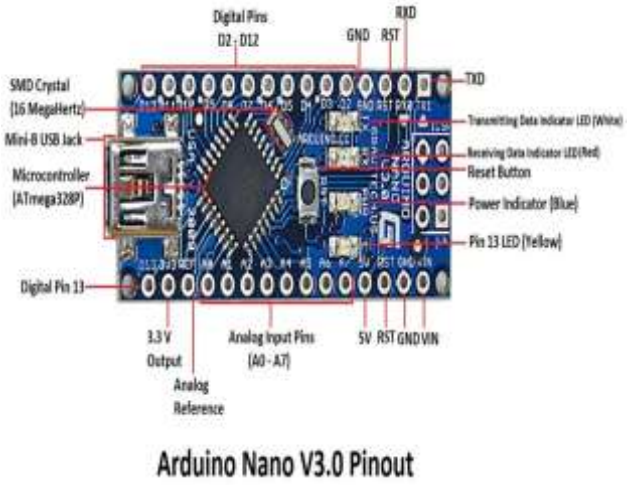
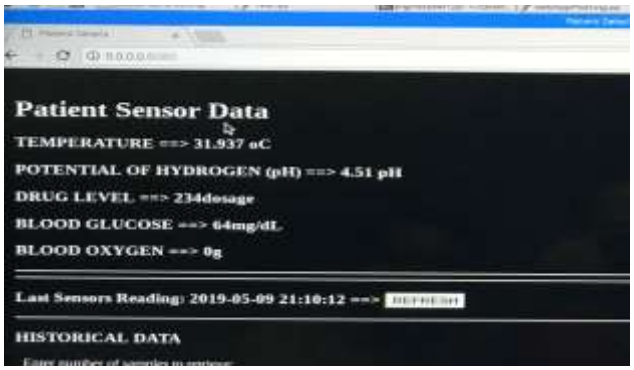
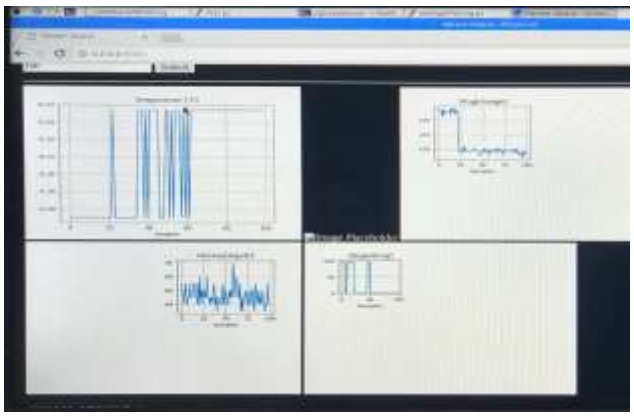


Fig 4. Arduino Nano

The Arduino Nano has inbuilt ATmega328P microcontroller. Comparing Arduino Uno with this, where Arduino Uno has 6 ADC pins whereas Arduino Nano has 8 Analog to Digital converter pins. Addition to this there is extra two pins in Arduino Nano which serve as Analog to Digital converter. The spo2 sensor output, PH output, gas detector output is given to the Arduino Nano whereas temperature output given to the Raspberry Pi where digital output is given directly to it.

4. RESULTS





5. CONCLUSION

In this it improves the work routines of the patients and the life quality of patients by monitoring the patient's health periodically. To reduce POPI effects if anesthesiais given and one of the alternative to help patients who are suffering from chronic diseases. It helps in simultaneous detection of health status of patients during anesthesia and gives alert message to the doctors if emergency case occurs. The patient health parameters is shared among different doctors.

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