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IoT Based Patient Health Monitoring System

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Abstract: ***An IoT based health monitoring system records the patient's heart beat, body temperature, oxygen levels of blood etc. It can also be used to inform the timing of medication and provides live monitoring of health condition of patient to the doctor available in his chamber. It also sends an SMS alert whenever the health parameter readings go beyond critical values.***
Keywords: Heart beat, Temperature, Oxygen Levels, Medication timing, SMS alert.

I. INTRODUCTION

All of us are very much familiar with the proverb "Health is wealth". Good Health is one of the boons and blessings of god. We all know the pandemic situation, COVID – 19. During the phase-I of Covid-19, some people lost their lives on the hospital beds due to lack of oxygen and sudden pulse drop problems etc. However, the doctors worked relentlessly 24/7 to save the infectants. Unfortunately, some doctors also got affected by Corona and lost their lives. It is always not possible for a doctor to monitor the patient continuously. In fact, it is our primary responsibility to save the lives of frontline workers like doctors. So, we as a team designed an IoT Based Patient Monitoring System to monitor the patient health parameters virtually by a doctor sitting in his chamber.

II. BLOCK DIAGRAM

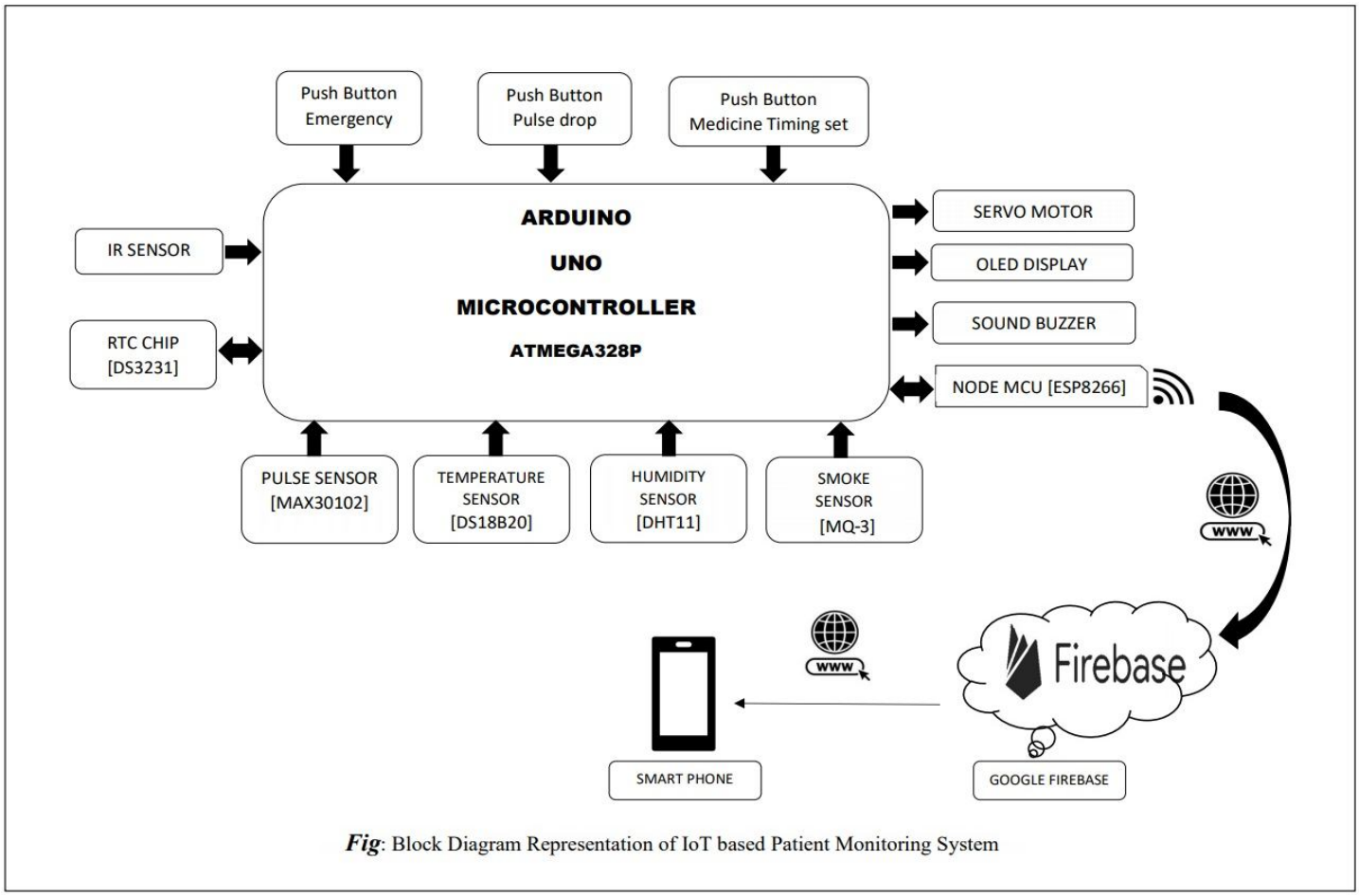


Fig: Block Diagram Representation of IoT based Patient Monitoring System

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1) *Pulse Sensor (MAX30102)*: pulse sensor is an electronic device that is used to measure the heart rate, i.e., speed of the heartbeat. Heart beat is measured in beats per minute.
2) *Humidity Sensor (DHT11):* It is a low cost digital sensor commonly used for temperature and humidity measurement. This sensor can be easily interfaced with any microcontroller such as arduino etc. to measure humidity and temperature.
3) *Temperature Sensor (DS18B20):* It is a 1-wire programmable temperature sensor which is used to measure temperature in hard environments like chemical solutions, mines or soil etc. It is a water-proof sensor which can measure a wide range of temperature from -55^0C to $+125^0$C.
4) *Smoke Sensor (MQ-3):* It consists of a grove-gas module which is useful for gas leakage detection. Thus helps in preventing the damage caused by fire accidents or any other poisonous gases.
5) *Real Time Clock Chip (DS3231):* It is an integrated temperature compensated crystal oscillator. It is simply a time and date remembering system. It keeps date and time up to date by maintaining seconds, minutes, hours, day, date, month & year.
6) *Organic LED Display (SSD1306):* OLED displays are electronic visual panels that harness organic light emitting diodes for their core illumination power. They have good view angle and pixel density which make it reliable for displaying small level graphics. The SSD1306 driver has a built-in 1KB Graphic Display Data RAM for the screen which holds the bit pattern to be displayed.
7) *Buzzer:* A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a pre-set time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.
8) *ATMEGA328P:* Arduino UNO is an open source microcontroller board that is based on the microchip ATMEGA328P. The board is equipped with set of digital to analog input/output pins that may be interfaced to various expansion boards and other circuits.
9) *NodeMCU (ESP8266):* It is an open source software and hardware development environment that is built around a very inexpensive system-on-a-chip (SoC) called the ESP8266, which is a microcontroller with Wi-Fi capability. It is a very user friendly and low cost device to provide internet connectivity to the projects.
10) *Push Button:* A Push-Button is a simple switch mechanism to control some aspect of machine or a process.
11) *Firebase :* Google Firebase is a Google backed application development software which allows developers to develop Android, IOS and web apps. It has three main services i.e., real-time database, user authentication and hosting. It can store and sync data with our NoSQL database. Data is synced across all clients in real-time and remains available when the app goes offline. Google Firebase database is a real-time, high speed and free database provided by Google.

III. WORKING

Since our project deals with real time monitoring of health parameters of a patient, we used some integrated circuit components that are interfaced to the Arduino UNO microcontroller like ESP8266 Node MCU Wi-Fi module and DS3231 Real Time Clock Chip module etc to bring it under IoT category.

This Node MCU is used to transmit patient's data to the doctor and as well as patient relatives via internet. The Node MCU sends the data to the google firebase. The google firebase cloud store the patients' data and synchronize that data to the doctor by means of an android application via internet.

Another chip we are using is DS3231 real time clock chip. Since our project involves the indication of medicine timing to the patient, it is necessary to track the standard time of patient's location. A real time clock chip module will provide timing of particular location by using clock pulses. At the assigned medical timings, it gives an medication alert that can be displayed on the OLED Screen.

To track health parameters, we included some health parameter monitoring sensors to our project. The external stimuli provided by the patient are fed to the Arduino Uno microcontroller through various components like

- MAX30102 pulse sensor that reads the pulse rate and oxygen levels from the patient
- DS18B20 Temperature sensor that reads the temperature of the patient
- DHT11 Humidity sensor that reads the room humidity level.
- MQ-3 Smoke sensor that detects the smoke and alcohol levels and the corresponding outputs are display on SSD1306 Organic LED display

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If there is an emergency to patient like either if oxygen levels may be dropped or else pulse rate is dropping i.e., whenever the Arduino UNO Microcontroller reads beyond the threshold levels, then the sound buzzer will make an alert to the surroundings. Immediately an SMS alert will be sent to the doctor as well as the relatives indicating the severity of the patient condition.

IV. RESULT

The following are the resulting images of our project.

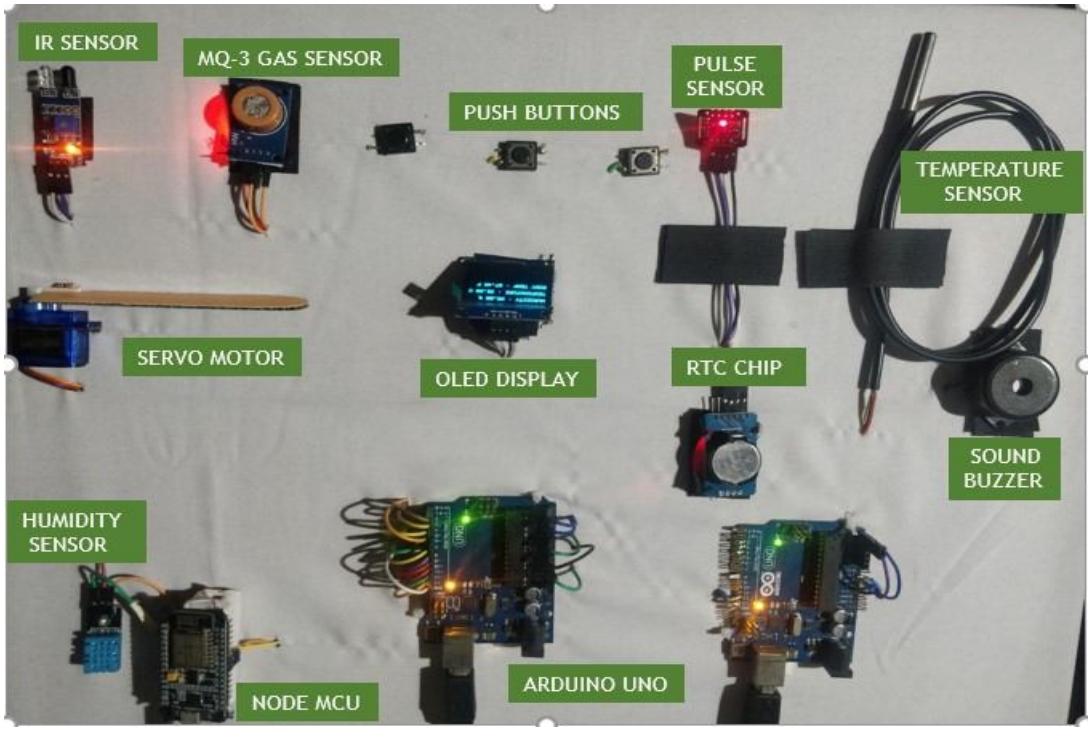


Fig 2 : Project Kit

When the power supply is turned ON the display shows the project name as shown below

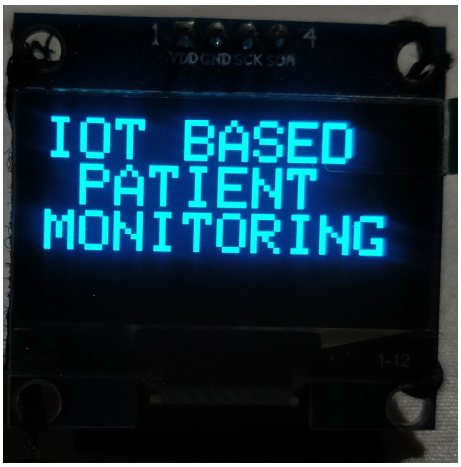


Fig 3

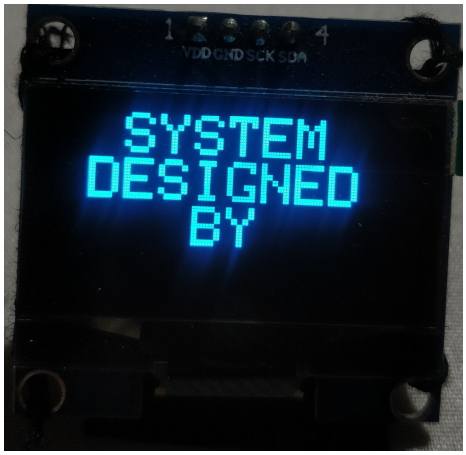


Fig 4

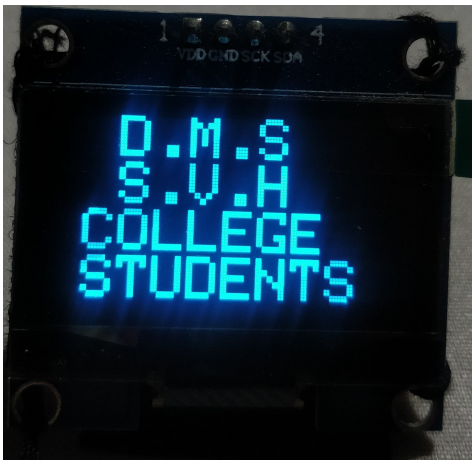


Fig 5

Fig 3 – 5 : Title of the Project

Displaying of Pulse rate, Temperature, Oxygen levels on the OLED Display and Doctor's Mobile:

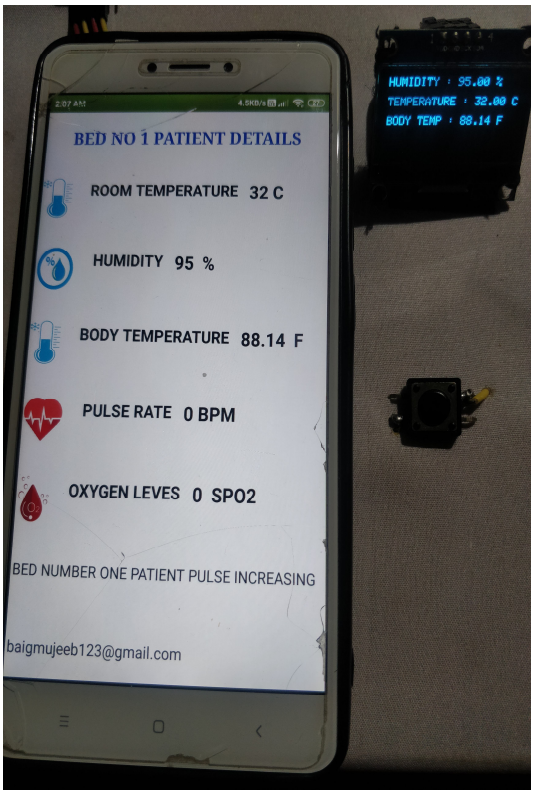


Fig – 6 : Displaying Humidity & Temperature readings

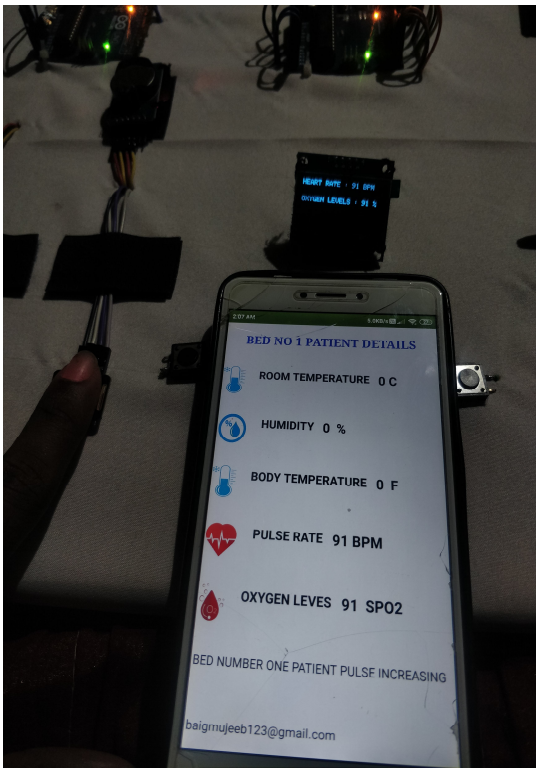


Fig – 7 : Displaying Pulse rate & Oxygen Levels

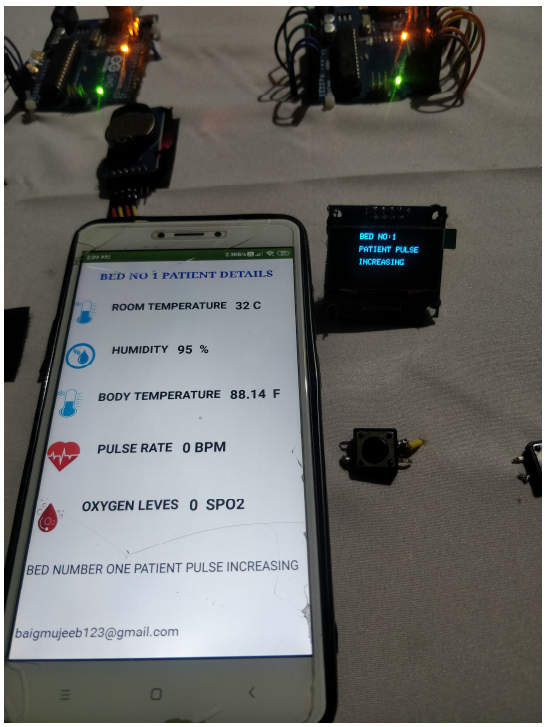


Fig – 8 : Indicating Pulse rate Drop of the patient



Fig – 9 : Indicating Emergency to doctor & relatives via SMS

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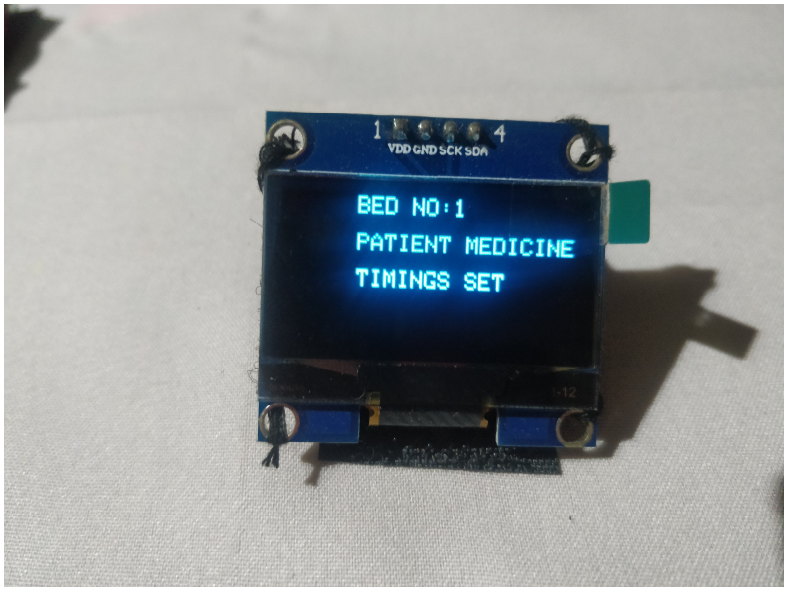


Fig – 10 : Setting Up the Medication Timing



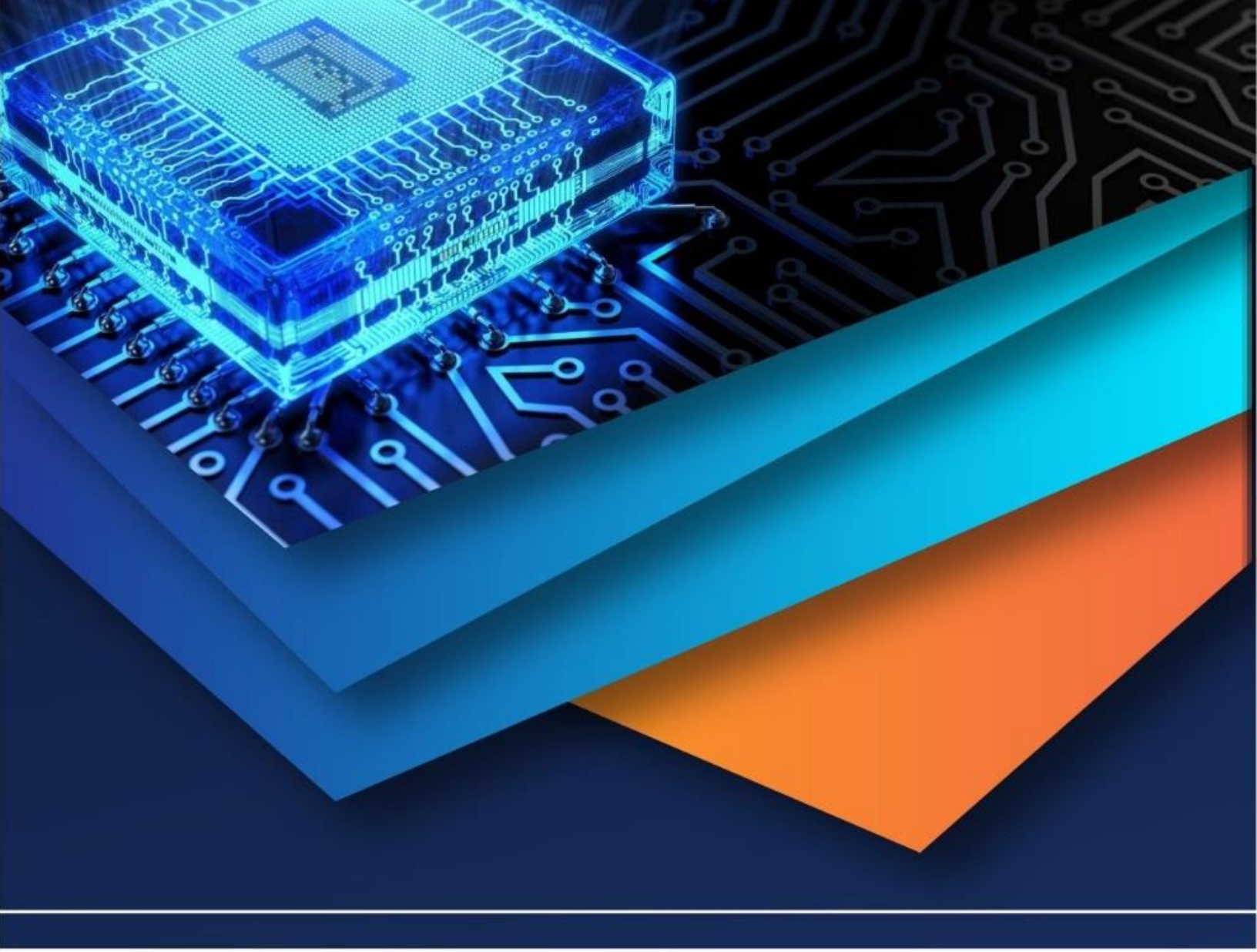
Fig – 11 : Alcohol Detection by MQ-3

V. CONCLUSIONS

Our project IoT based Patient Monitoring System also comes under the category of multi-parameter measurement. Besides multi-parameter tracking, it will alert the doctor as well as relatives through an SMS alert. When the patient's vital data reached above the limited pre-determined value, then our project alerts the patient and his near surroundings by means of a sound buzzer which indicates emergency and an emergency SMS alert is sent to the doctor as well as the relatives of the patient through mobile application over the internet. Moreover, our project is also used for improving the treatment process and helps to monitor patient even more remotely. It enables healthcare professionals to be more watchful and helps to connect patients actively and virtually.

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