SAVITRIBAI PHULE PUNE UNIVERSITY

A PROJECT PHASE II REPORT ON

"IOT BASED AUTOMATIC SALINE LEVEL MONITORING SYSTEM"

SUBMITTED TOWARDS THE
PARTIAL FULFILMENT OF THE REQUIREMENTS OF

BACHELOR OF ENGINEERING

(Electronics & Telecommunication Engineering)

BY

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Maratha Vidya Prasarak Samaj's
Karmaveer Adv. Baburao Ganpatrao Thakare College of Engineering, Nashik-13

Academic Year : 2021-2022

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Department of Electronics & Telecommunication Engineering

Certificate

This is to certify that the Project Entitled

"IOT BASED AUTOMATIC SALINE LEVEL MONITORING SYSTEM"

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Ms. Sarika M Jagtap	Dr. V. M. Birari	Dr. S. R. Devane
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ABSTRACT

As the world's population is increasing, the need of health prevention is also increasing day by day. Hence, it is mandatory for everyone in this world to take care of their health properly. Among the various treatments, saline therapy is the most important treatment that many patients receive from the hospitals.

In the hospitals, whenever a saline is fed to the patients, the patient needs to be continuously administered by a nurse or a care-taker. But unfortunately, there are some critical situations, i.e., Blood clotting can occur due to the negligence towards the saline completion and busy schedules of the responsible doctors, nurses, or the care-takers, so a huge number of patients are dying or are being harmed in the hospitals. Hence, to prevent the patient's health and to provide maximum health safety during saline feeding hours, the saline level monitoring and automatic alert system has been developed.

The proposed system facilitates a sophisticated method of controlling saline drop rate by monitoring the saline system remotely by using Internet Of Things (IOT) platform. This proposed system consists of a sensor used for monitoring the critical level of the saline liquid in the saline bottle and a mechanism that will stop the saline flow automatically after the saline bottle is completely empty.

Keywords:

Intravenous, Internet of Things (IOT) ,Node MCU, Saline ,Servomotor, Arduino Microcontroller.

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ABBREVATIONS

- ✓ IOT : Internet Of Things
- ✓ LED : Light Emitting Diode
- ✓ LCD : Liquid Crystal Display
- ✓ ECG : Electro Cardio Gram
- ✓ RTOS : Real Time Operating System
- ✓ SPI : Serial Peripheral Interface
- ✓ I2C : Inter-Integrated Circuit
- ✓ SDK : Software Development Kit
- ✓ GSM : Global System for Mobile communication
- ✓ NODE MCU : Node Microcontroller Unit
- ✓ IDE : Integrated Development Environment
- ✓ VSP : Virtual Serial Ports Emulator
- ✓ RISC : Reduced Instruction Set Computer
- ✓ RTD : Resistance Temperature Detector
- ✓ SoC : System-on-a-Chip
- ✓ UART : Universal Asynchronous Receiver Transmitter
- ✓ PID : Proportional-Integral-Derivative
- ✓ PCB : Printed Circuit Board

CHAPTER 01

INTRODUCTION

CHAPTER 1. INTRODUCTION

1.1 NECESSITY/NEED OF PROJECT

- The system is reliable, cost effective and convenient for nurses.
- It can be reused for the next saline bottle.
- The system helps nurses to monitor the saline flow from a distance.
- It is mainly advantageous at night timing as there is no need for nurses to go to patient's bed to check the level of saline in the bottle.

1.2 MOTIVATION

As we discussed with the doctors, we came up with this solution of making an automatic saline monitoring system which would help the doctors, nurses/caretakers by checking the patient’s health status and by monitoring the level of saline present in the bottle by sitting at one place.

1.3 PROBLEM STATEMENT

A failure of a person, inattentiveness, and a greater number of patients, the saline is totally consumed. Initially, this might be inferred as an event. But the consequences are harmful. Just after the saline finishes, blood rushes back to the saline bottle due to the difference in blood pressure and pressure in the empty bottle. Thus, unique health monitoring systems have been developed with less human interference which will be available at low cost in rural as well as urban areas.

The system objective is to troubleshoot the above-mentioned problem efficiently. By means of this, the nurse can monitor the amount of saline even in the control room. An automatic saline level monitoring consists of Level sensors that recognize the status of liquid in the bottle whether it is normal or warning status. The recognition of saline drop rate is quite accurate. The output obtained from the sensor is processed to check whether the saline bottle is empty. When the saline bottle goes below a threshold level, the alarm sound will be produced. So, the system reduces continuous monitoring of the patient by nurses.

1.4 OBJECTIVES

The main objectives of this system are listed below as follows:

- To provide greater accuracy than manual saline flow rate control system.

- To provide at most safety to patient’s health.
- To make automatic saline monitoring system with additional features of Blood-Oximeter and Temperature Sensor.

1.5 ADVANTAGES AND LIMITATIONS

1.5.1 ADVANTAGES:

- The system is reliable, cost effective and convenient for nurses.
- It can be reused for the next saline bottle.
- The system helps nurses to monitor the saline flow from a distance.
- It is mainly advantageous at night timing as there is no need for nurses to go to patient's bed to check the level of saline in the bottle.
- The proposed system consists of a sensor used for monitoring the critical level of the saline liquid in the saline bottle and a mechanism that will stop the saline flow automatically after the saline bottle is completely empty.
- This proposed system can be utilized efficiently in homes as well as hospitals.

1.5.2 LIMITATIONS:

- We cannot use it for more than one device at a time.

1.6 APPLICATIONS

- By using this system, the patient can be analyzed by doctors in any part of the hospital.
- The whole health monitoring system, which we have proposed can be integrated into a small compact unit as small as a cell phone.
- This proposed system can be utilized efficiently in homes as well as hospitals.

1.7 ORGANIZATION OF REPORT:

- In this project report, in first chapter there is information about Project topic, Introduction, Objectives, Applications and Advantages & Limitations.
- In second chapter Literature Review of project and their needs are given.
- Third chapter gives the Analysis and Design approach of the System.
- Fourth chapter gives the explanation of Hardware Design.

- Fifth chapter gives Implementation, Test and Performance of the System.
- Sixth chapter gives the Conclusion and Future Scope of this System.
- Seventh chapter gives the Bibliography of the project.
- Eight chapter consists of Certificates of the project competition and paper presented.

CHAPTER 02

LITERATURE REVIEW

CHAPTER 2. LITERATURE REVIEW

2.1]“Mansi G. Chidgopkar, Aruna P. Phatale” Automatic And Low Cost Saline Level Monitoring System Using Wireless Bluetooth Module And Cc2500 Trans receiver “International Journal of Research in Engineering and Technology; Volume:04 Issue: 09 — September-2015”

Traditional methods used for health care are becoming obsolete due to increase in population. Current health care system requires manual care takers and their continuous monitoring duties which is very time-consuming job. Unique health monitoring systems are required with less human interference which will be available at low cost in rural as well as urban areas. Engineering technologies are getting combined with medical field to overcome this problem. So, health monitoring systems are getting developed with the help of electronic components such as sensors, PLC, microcontrollers etc. with easy interfacing. This paper mainly focuses on providing advanced saline level monitoring system.

2.2] “C.C. Gavimath, Krishnamurthy Bhat, C. L. Chayalakshmi, R. S. Hooli and B. E. Ravishankera” Design And Development Of Versatile Saline Flow Rate Measuring System And GSM Based Remote Monitoring Device” International Journal of Pharmaceutical ApplicationsVol3,Issue1,2012.”

As the world population grows, the need for health care increases. In early years, improvements in medical care have been rapid due to the advancements in the field of sensors, microcontrollers and computers. A major reason for this is the fusion of the two important disciplines namely medical and engineering. This paper describes the development of an automatic saline monitoring system using a low cost indigenously developed sensor and GSM (Global system for mobile communication) modem. This enables the doctor or nurse on duty to monitor the saline flow rate from a distance. The 8051 microcontroller is used for providing co-ordination action. An IR sensor is used at the neck of the saline bottle to know the flow rate of the liquid. The detection of saline drop rate is quite faithful. The output obtained from the sensor is processed to check whether the flow rate is slow, medium, or fast and the same is transmitted through GSM technology to a distant mobile cell for future actions.

2.3] "Pattarakamon Rangsee, Paweena Suebsombut, Phakphoom Boonyanant" Low-Cost Saline Droplet Measurement System using for Common Patient in Rural Public Hospital. "The 4th Joint International Conference on Information and Communication Technology, Electronic and Electrical Engineering (JICTEE) 978-1-4799-3855-1/14 2014"

The system can be used to check saline droplet of patients in each patient's bed in rural public hospital. By installing the measuring modules in all patients' beds, the system will show saline droplet status of each patient. So, nurses can accurately check saline droplet status of their patients on a computer including saline droplet statuses, saline droplet rate (drops per minute), and remaining time. The saline droplet statuses include four statuses that are Normal status (the system is working, the green light is shown on monitor), Warning status (sensor at critical point cannot detect saline, the yellow light is shown on monitor), Error status (droplet sensor cannot detect saline droplet, the red light is shown on monitor), and Chang New Bag (the blue light is shown on monitor). So, nurses do not need to go to patient's bed every time because they can check saline drop let status of each patient via this system. This system is a low-cost system and convenient for a nurses. Therefore, in rural public hospital can use this system in common patient's room.

2.4] "P. Kalaivani, T. Thamaraiselvi, P. Sindhuja and G. Vegha" Saline Level Monitoring System Using Arduino UNO Processor "Asian Journal of Applied Science and Technology (AJAST) Volume1,March2017."

The epidemic growth of wireless technology and mobile services in this epoch is creating a great impact on our lifestyle. Some recent efforts have been taken to utilize these technologies in medical industry. In this field, ECG sensor based advanced wireless patient monitoring system concept is a new unique idea. The saline level is indicated by LCD. The major output ECG analog signal is displayed on serial plotter. The outputs are displayed through mobile application.

2.5] "Priyadharshini R, Mithuna S, Vasanth Kumar U, Kalpana Devi S, Dr. Suthanthira Vanitha N." Automatic Intravenous Fluid Level Indication System for Hospitals "International Journal for Research in Applied Science &Engineering Technology; Volume 3 Issue VIII, August 2015."

During last some years due to the technological growth in many sophisticated techniques has been evolved for assuring fast recovery of the patients in hospitals. For good patient care in hospitals, assessment and management of patient’s fluid and electrolyte need is the most fundamental thing required. Most in all hospital, an assist/nurse is responsible for monitoring the fluid level continuously. But unluckily, during most of the time, the observer may forget to change the saline bottle at correct time due to their busy schedule. This may lead to several problems to the patients such as backflow of blood, blood loss etc.

CHAPTER 03

ANALYSIS AND DESIGN APPROACH

CHAPTER 3. ANALYSIS AND DESIGN APPROACH

3.1 SYSTEM CONCEPT

Using our proposed system, the nurse can monitor the amount of saline even in the control room using an application i. e. Blynk app. We have used a load sensor to determine the status of liquid in the bottle whether it is normal or warning status. The output obtained from the sensor is processed to check whether the saline bottle is empty or not. When the level of saline dips below a certain level, a red LED will glow.

The HX711 sensor with load cell is used to measure the saline level. The content of saline in a normal saline bag is 500 ml. The saline bag is replaced by another when the saline falls below 50 to 100 ml. The critical level of saline is set to 70 ml which is between 50 to 100 ml so the nurse can change the saline bag when the liquid reaches the critical point.

The system proposed is electrolyte independent and can be used with all sizes of electrolyte bottles. The system is electrically powered and a voltage of 9V is required to power the system. As soon as the electrolyte bottle is hung on the stand and attached to the sensor via a specially designed 3-d printed hook, an initial weight reading of the bottle is recorded in the database designed by the microcontroller. The load sensor senses the weight at regular intervals. The same is updated in the database regularly. As soon as the read value of the load reaches 30% of its initial value recorded in the database, a notification is sent to the respective authorities' nurses/control room admins with the details of the patient.

The sensor keeps reading the weight of the bottle and the red LED starts blinking as soon as the weight of the bottle further decreases to 30 percent of its initial weight. If further no one attends to the patient, and the electrolyte gets fully consumed without being disconnected or refilled manually, the microcontroller powers the DC motor. The motor actuates the screw-powered clamp, which disconnects the patient with the electrolyte bottle.

Two more extra parameters added to this system is a Temperature Sensor which detects the temperature of the patient and a Blood-Oxy Sensor which detects the blood pressure and the oxygen level of the patient.

3.2 FLOWCHART

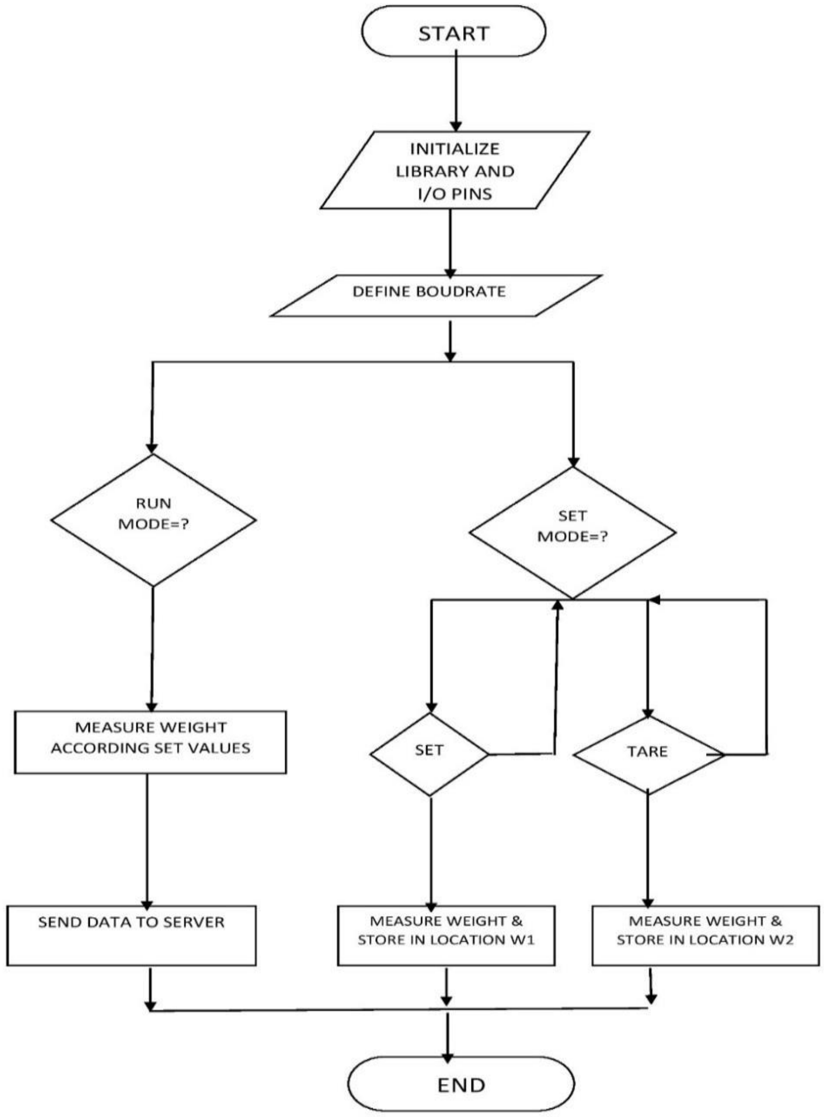

Fig.3.2 Flow Chart of the System

3.3 BLOCK DIAGRAM, CIRCUIT DIAGRAM AND WORKING OF THE SYSTEM

3.3.1 BLOCK DIAGRAM

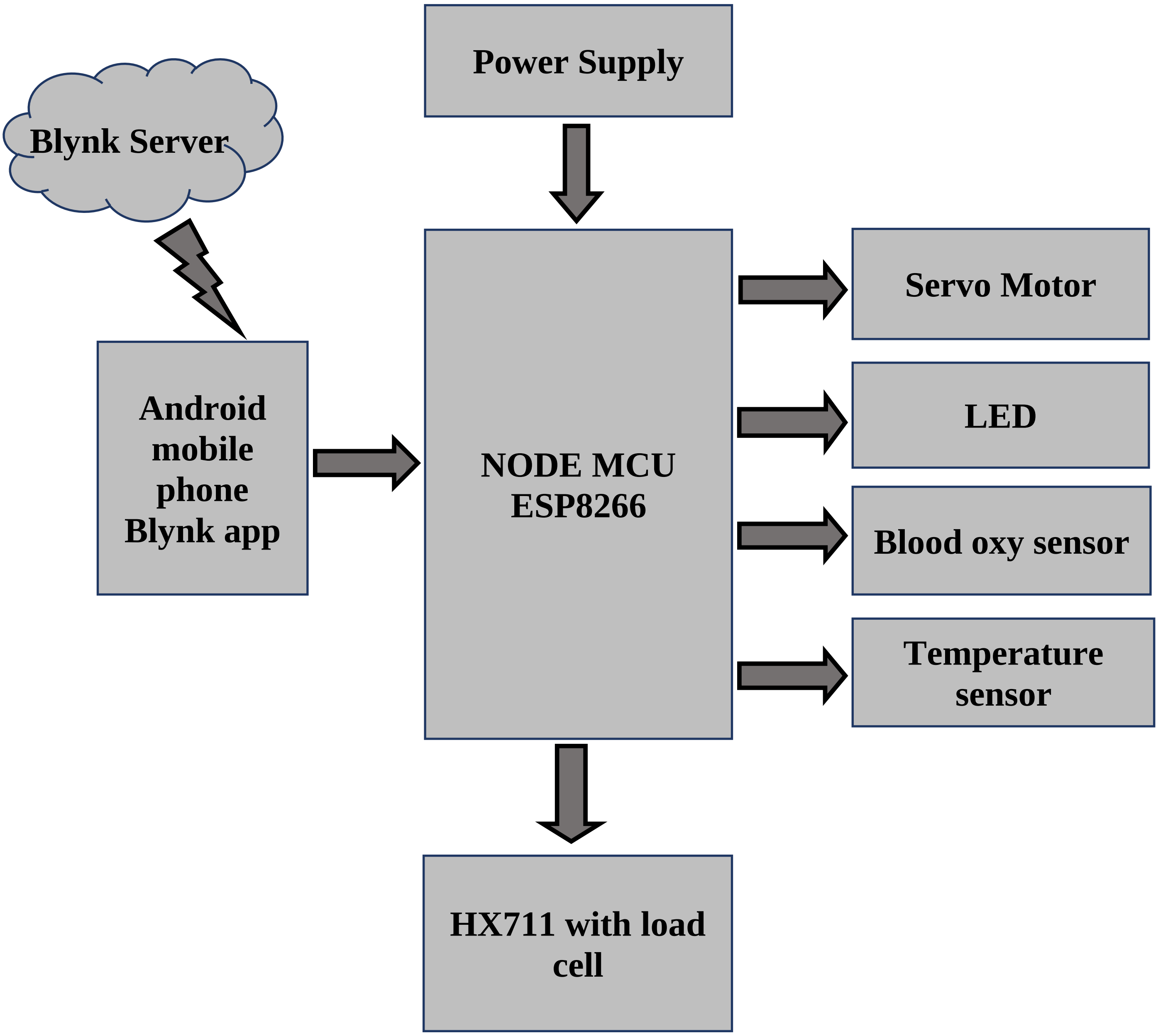

Fig 3.3.1 Block Diagram of the System

3.3.2 CIRCUIT DIAGRAM

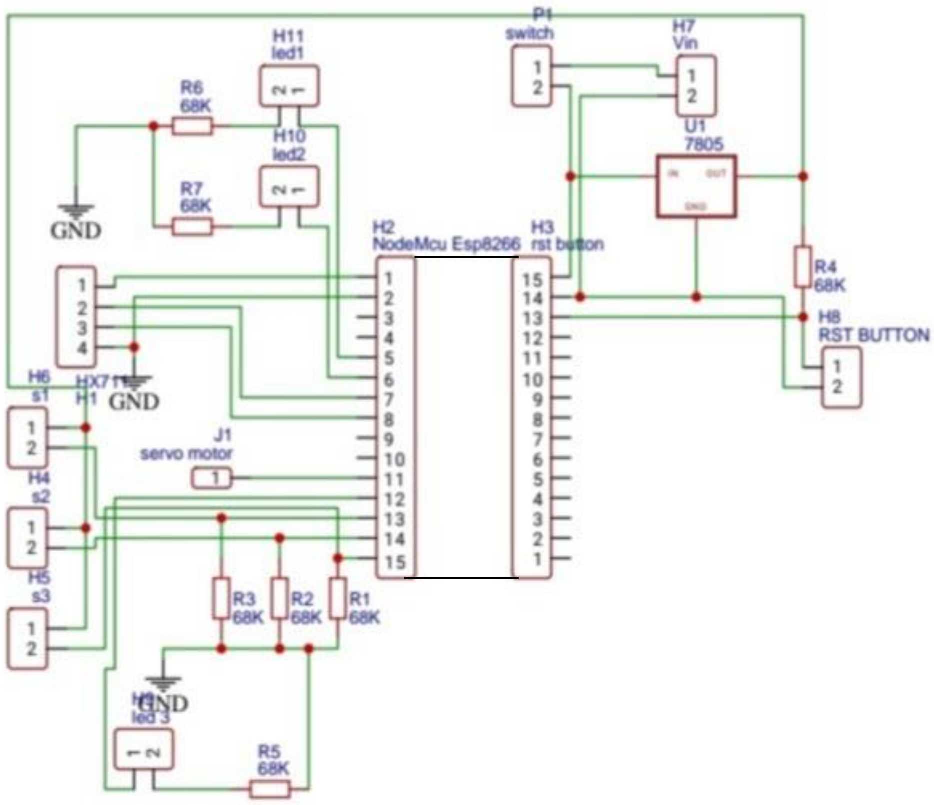

Fig 3.3.2 Circuit Diagram of the System

3.3.3 WORKING

- This automatic saline level monitoring consists of level sensors that are used to determine the status of liquid in the bottle whether it is normal or warning status. The detection of saline drop rate is quite faithful. The output obtained from the sensor is processed to check whether the saline bottle is empty. When the level of saline dips below a certain level, a red LED will glow. In our project, a load cell sensor is used to measure the saline level. The content of saline in the normal saline bag is 500 ml. The saline bag is replaced by another when the saline falls below 50 to 100 ml.The critical level of saline is set to 70 ml which is between 50 to 100 ml so the nurse can change the saline bag when the liquid reaches a critical point. The system proposed is electrolyte independent and can be used with all sizes of electrolyte bottles.
- The system is electrically powered and a voltage of 9V is required to power the system. As soon as the electrolyte bottle is hung on the stand and attached to the sensor via a specially designed 3-d printed hook, an initial weight reading of the bottle is recorded in the database designed by the microcontroller. The database stores records of the electrolyte bottles with a reference number to each microcontroller used with them. The load sensor senses the weight at regular intervals. The same is updated in the database regularly. As soon as the read value of the load reaches 30% of its initial value recorded in the database, a notification is sent to the respective authorities that are nurses/doctors/control room admins with the details of the patient.
- The sensor keeps reading the weight of the bottle and the green LED starts blinking as soon as the weight of the bottle further decreases to 30 percent of its initial weight. In this way, any person present in that room might be able to identify the light and inform the attending doctor. If further no one switches off the LED or attends to the customer, a notification is again sent with a danger alert to the control room nurses/doctor concerned and the status is updated in the database.
- As soon as the electrolyte gets fully consumed without being disconnected or refilled manually, the microcontroller powers the DC motor. The motor actuates the screw-powered clamp, which disconnects the patient with the electrolyte bottle.An arrangement of a Servomotor is also done which controls the speed of the saline.

3.4 MODERN TOOLS / SOFTWARE

- Blynk application
- Proteus (version 8.9)
- VSP (Virtual Serial Ports Emulator)
- Arduino IDE (version 1.8.16)

3.5 CODE

```
#include "HX711.h"
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <SoftwareSerial.h>
#include <Servo.h>
#include <DallasTemperature.h>
#include <OneWire.h>

#definecalibration_factor -7050.0  //This value is obtained using the SparkFun_HX711_Calibration sketch
#define REPORTING_PERIOD_MS     300        //refreshing rate
#define LOADCELL_DOUT_PIN  D5
#define LOADCELL_SCK_PIN  D6
#define ONE_WIRE_BUS 9                          //SD2 pin of NodeMCU temp

int red = 0;           // LED pin
int gre1 = 13;        // LED pin
int gre2 = 15;        // LED pin
int mode1 = 16;    // push button is connected
int tare1 = 5;         // push button is connected
int set1 = 4;           // push button is connected
float w1=0,w2=10;
HX711 scale;
Servo myservo;     // create servo object to control a servo
OneWireoneWire(ONE_WIRE_BUS);
```

```
DallasTemperature sensors(&oneWire);        // Pass the oneWire reference to Dallas Temperature.

char auth[] = "8VKPbPNQ5tJkZiosPzClsev-24MKu1AX";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "JioFiber-ak 5";
char pass[] = "Indianarmyparasf21";

int sensorValue = 0;              // value read from the pot
void setup() {
Serial.begin(9600);
pinMode(red, OUTPUT);      // declare LED as output
pinMode(gre1, OUTPUT);     // declare LED as output
pinMode(gre2, OUTPUT);     // declare LED as output
pinMode(mode1, INPUT);     // declare push button as input
pinMode(tare1, INPUT);     // declare push button as input
pinMode(set1, INPUT);      // declare push button as input

Blynk.begin(auth, ssid, pass);

Serial.println("HX711 scale demo");
myservo.attach(2);                // attaches the servo on pin 2  to the servo object( gpio pin no. 2 and not digital pin no. )
scale.begin(LOADCELL_DOUT_PIN, LOADCELL_SCK_PIN); //SCK - S clk
scale.set_scale(calibration_factor);        //This value is obtained by using the SparkFun_HX711_Calibration sketch
scale.tare();          //Assuming there is no weight on the scale at start up, reset the scale to 0
// Initialize the PulseOximeter instance
// Failures are generally due to an improper I2C wiring, missing power supply
// or wrong target chip
//  myservo.write(param.asInt());
Serial.println("Readings:");
}
```

```
BLYNK_WRITE(V4) //Button Widget is writing to pin V1. virtual pin
{
int pinValue = param.asInt();
int val;
val = map(pinValue, 0, 50, 0, 80);          // scale it to use it with the servo (value between 0 and 180)
myservo.write(param.asInt());               // sets the servo position according to the scaled value
delay(1);                                   // waits for the servo to get there
}
void loop() {
Blynk.run();
Serial.print("Reading: ");
Serial.print(scale.get_units(), 1);         //scale.get_units() returns a float
  float wet=scale.get_units();
  wet= map(wet,w1,w2,0,100);
Serial.print(" lbs");     //You can change this to kg but you'll need to refactor the calibration_factor
Serial.println(wet);
Blynk.virtualWrite(V3, wet);
  (wet<6)? digitalWrite(red, HIGH):digitalWrite(red, LOW);

  while(digitalRead(mode1)==HIGH)
  {
    if (digitalRead(tare1) == HIGH) {
digitalWrite(gre1, HIGH);
       w1=scale.get_units();
Serial.println("TARED");
Serial.println(w1); //hx711 current o/p goes to w1
digitalWrite(gre1, LOW);
delay(200);
      }
    else if (digitalRead(set1) == HIGH) {
digitalWrite(gre2, HIGH);
       w2=(scale.get_units());
Serial.println("SET");
Serial.println(w2);
```

```
digitalWrite(gre2, LOW);
delay(200);
      }
      else
      {
delay(10);

      }
  }

sensors.requestTemperatures();                    // Send the command to get temperatures
Serial.println("Temperature is: ");
Serial.println(sensors.getTempCByIndex(0));    // Why "byIndex"? You can have more than one IC
on the same bus. 0 refers to the first IC on the wire
 float tem=sensors.getTempCByIndex(0);
Blynk.virtualWrite(V2, tem);
Serial.println();

    }

// CODE OF MAX30100
#include <Wire.h>
#include "MAX30100_PulseOximeter.h"
#define BLYNK_PRINT Serial
#include <Blynk.h>
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

#include "Wire.h"

#define REPORTING_PERIOD_MS 1000

char auth[] = "8VKPbPNQ5tJkZiosPzClsev-24MKu1AX";  // You should get Auth Token in the
```

```
Blynk App.
char ssid[] = "JioFiber-ak 5";                    // Your WiFi credentials.
char pass[] = "Indianarmyparasf21";

// Connections : SCL PIN - D1 , SDA PIN - D2 , INT PIN - D0
PulseOximeterpox;

float BPM, SpO2;
uint32_t tsLastReport = 0;



void onBeatDetected()
{
Serial.println("Beat Detected!");

}

void setup()
{
Serial.begin(115200);



pinMode(16, OUTPUT);
Blynk.begin(auth, ssid, pass);

Serial.print("Initializing Pulse Oximeter..");

   if (!pox.begin())
   {
Serial.println("FAILED");
for(;;);
   }
   else
   {
```

```
Serial.println("SUCCESS");
pox.setOnBeatDetectedCallback(onBeatDetected);
    }

    // The default current for the IR LED is 50mA and it could be changed by uncommenting the following line.
     //pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);

}

void loop()
{
pox.update();
Blynk.run();

    BPM = pox.getHeartRate();
    SpO2 = pox.getSpO2();
     if (millis() - tsLastReport> REPORTING_PERIOD_MS)
    {
Serial.print("Heart rate:");
Serial.print(BPM);
Serial.print(" bpm / SpO2:");
Serial.print(SpO2);
Serial.println(" %");

Blynk.virtualWrite(V0, BPM);
Blynk.virtualWrite(V1, SpO2);
tsLastReport = millis();
    }
}
```

3.6 SPECIFICATIONS AND COMPONENTS

3.6.1 SPECIFICATIONS

COMPONENTS	SPECIFICATIONS
1] Node MCU ESP8266	Microcontroller: Ten Silica 32-bit RISC CPU Xtensa LX106 Operating voltage: 3.3 V Input voltage: 7-12 V
2] Load Cell	Capacity: 5kg / 11 lbs Max excitation voltage: 10V DC Rated o/p: 1.2 +/- o.1mV/V
3] Temperature Sensor	Temperature range: -40 to 85 C Temperature accuracy: +/- 1 C
4] Hx711	Output sensitivity: 1.0 +/- 0.1 mV/ V Measurement resolution : 24 bit.
5] Servomotor	Operating voltage: +5 V Operating speed: 0.17 s

3.6.1 Specifications of all components

3.6.2 COMPONENTS

1. Node MCU ESP8266
2. Power supply
3. MAX30100 Blood-Oxy Sensor
4. RTD Temperature sensor
5. Load Cell
6. Hx711 Sensor
7. 2 Green and 1 Red LED’s
8. Servomotor

CHAPTER 04

HARDWARE DESIGN

CHAPTER 4. HARDWARE DESIGN

4.1 DESIGN CRITERIA OF EACH COMPONENT

1. Node MCU ESP8266

The NodeMCU(Node Micro Controller Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266.The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (Wi-Fi),and even a modern operating system and SDK that makes it an excellent choice for Internet of Things (IOT) projects of all kinds.

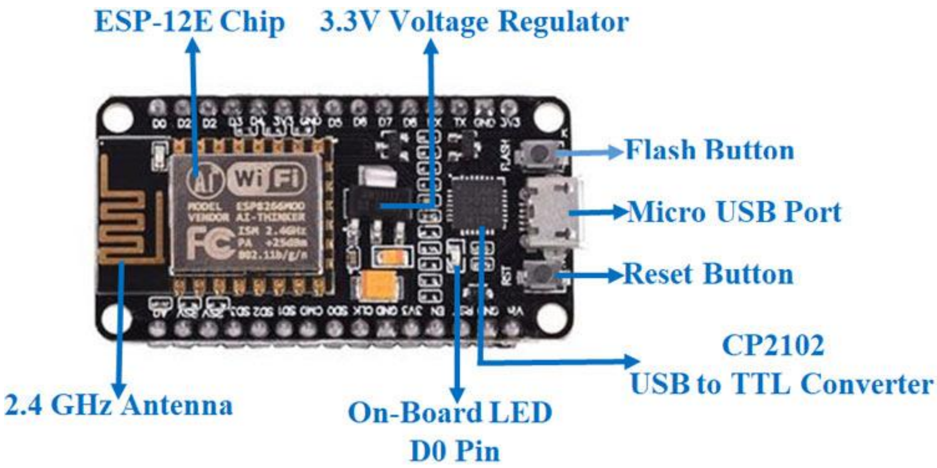

Fig.4.1.1 NodeMCU ESP8266

The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.NodeMCU is a low-cost open source IoT platform so we have used it in our system. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module.

Specifications:

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IOT projects

2.Power supply

A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment,while others are built into the load appliances that they power.

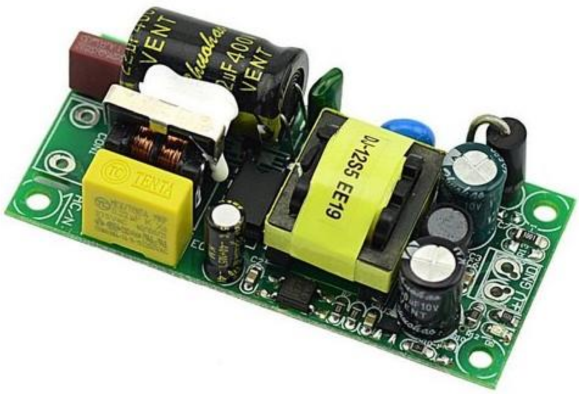

Fig.4.1.2 Power Supply

Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

Specifications:

- Input voltage: 110~240V AC
- Rated Frequency: 50~60Hz
- Output Voltage: 9V
- Max Output Current: 1A
- Adapter Standard: US Standard

Power Supply Calculations:

For 5V Power supply we need,

5+3V = 8V input at 7805

As, we need to consider 1.4 V diode drop.

Therefore,

$$5 + 3 + 1.4 = 9.4 \text{ V}$$

Since, $V_{ldc} = 10V$ &

$I_{ldc} = 0.5 \text{ A}$

$$V_{ldc} = 2V_m/3.14$$

$$(10*3.14)/2 = V_m$$

Therefore, $V_m = 15.70 \text{ V}$

3. MAX30100 Blood-Oxy Sensor

The MAX30100 is an integrated pulse oximetry and heart-rate monitor module. It includes internal LEDs, photo detectors, optical elements, and low-noise electronics with ambient light rejection. The MAX30100 provides a complete system solution to ease the design-in process for mobile and wearable devices. The MAX30100 operates on a single 1.8V power supply and a separate 3.3V power supply for the internal LEDs. Communication is through a standard I2C-compatible interface. The module can be shut down through software with zero standby current, allowing the power rails to remain powered at all times.

Applications:

- Wearable Devices
- Fitness Assistant Devices
- Smartphones
- Tablets

Fig.4.1.3 MAX30100 Blood-Oxy Sensor

Specifications:

Some of the main specifications found in MAX30100 sensor datasheet include:

- Input power: 1.7 to 2.0 V
- Temperature range: -40 to +85 °C
- LED Current: 0mA to 50mA
- LED pulse width: 200µs to 1.6ms
- Supply current in shutdown: 0.7-10µA
- Package: 5.6mm x 2.8mm x 1.2mm 14-Pin SiP

4.RTD Temperature Sensor

An RTD (Resistance Temperature Detector) is a sensor whose resistance changes as its temperature changes. The resistance increases as the temperature of the sensor increases. The resistance vs temperature relationship is well known and is repeatable over time. An RTD is a passive device. It does not produce an output on its own. External electronic devices are used to measure the resistance of the sensor by passing a small electrical current through the sensor to generate a voltage. Typically 1 mA or less measuring current, 5 mA maximum without the risk of self-heating.

Fig.4.1.4 RTD Temperature Sensor

Specifications:

SPECIFICATIONS OF STANDARD 100 OHM PLATINUM ELEMENTS		
Accuracy : ±.1OHM(±3°C)@0°C Repeatability : ±.1°C over Temperature Range Interchangability:		
TEMPERATURE	**TOLERANCE**	
°C	**±°C**	**±Ohms**
-200	1.2	.50
-100	.7	.30
0	.3	.10
100	.7	.25
200	1.2	.45
300	1.8	.65
400	2.5	.85
500	3.0	1.00
600	3.7	1.20
700	4.4	1.35

4.1.4 Specifications of RTD Temperature Sensor

5. Load Cell

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The various types of load cells include hydraulic load cells, pneumatic load cells and strain gauge load cells.This is a standard load cell for measuring weight upto 5 Kg. The output of the load cell is in mili-volts and cannot be directly measured by a micro-controller. So an ADC with high resolution or an instrumentation amplifier is required to make the output of the load cell readable to a micro-controller.

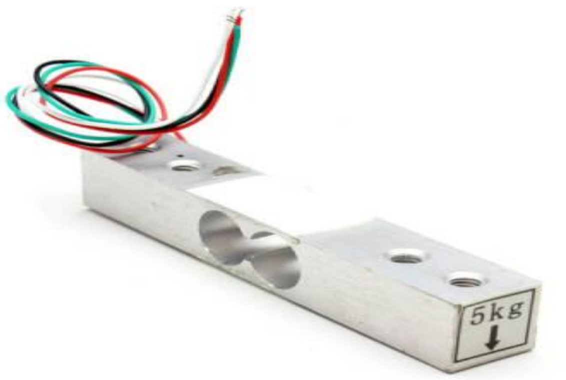

Fig.4.1.5 Load Cell

Specifications:-

- Capacity : 5KG
- Rated output(MV/V) : 2.0±0.15
- Accuracy class : C2
- Maximum number of load cell verification intervals(N max) : 2000
- Minimum number of load cell verification intervals(Vmin) : EMax/5000
- Combined error(%RO) : <±0.030
- Creep(%RO/30min): 0.03
- Temperature effect on sensitivity(%RO/°C): 0.0016
- Temperature effect on zero(%RO/°C): 0.003
- Zerobalance(%RO): 1.0

6. HX711 Sensor

HX711 module is a Load Cell Amplifier breakout board for the HX711 IC that allows you to easily read load cells to measure weight. This module uses 24 high precision A/D converter chip HX711. It is a specially designed for the high precision electronic scale design, with two analog input channel, the internal integration of 128 times the programmable gain amplifier.

The input circuit can be configured to provide a bridge type pressure bridge (such as pressure, weighing sensor mode), is of high precision, low cost is an ideal sampling front-end module. HX711 is an IC that allows you to easily integrate load cell into your project. No need of any amplifiers or dual power supply just use this board and you can easily interface it to any micro-controller to measure weight. The HX711 uses a two wire interface (Clock and Data) for communication. Compared with other chips, HX711 has added advantages such as high integration, fast response, immunity, and other features improving the total performance and reliability.

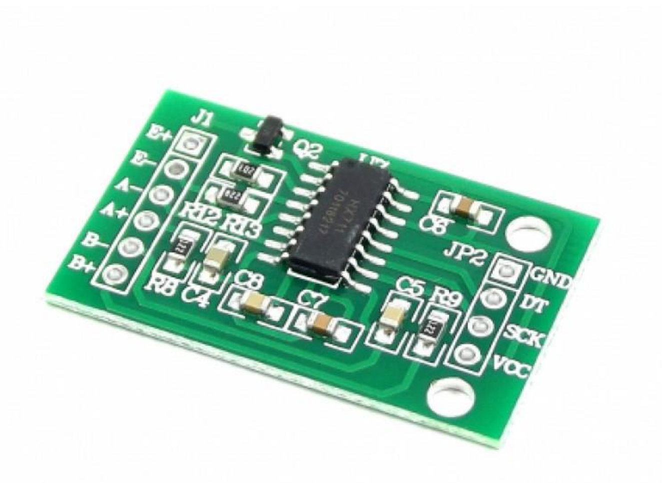

Fig.4.1.6 H711 Sensor

Specifications:

- Differential input voltage : ±40mV (Full-scale differential input voltage is ± 40mV)
- Data accuracy : 24 bit (24 bit A / D converter chip.)
- Refresh frequency : 10/80 Hz
- Operating Voltage : 2.7V to 5VDC

7.2 Green and 1 Red LED's

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device. Appearing as practical electronic components in 1962, the earliest LEDs emitted low- used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Early LEDs were often used as indicator lamps, replacing intensity infrared (IR) light. Infrared LEDs are used in remote-control circuits, such as those small incandescent bulbs, and in seven-segment displays. Later developments produced LEDs available in visible, ultraviolet (UV), and infrared wavelengths, with high, low, or intermediate light output, for instance white LEDs suitable for room and outdoor area lighting. Led's have also given rise to new types of displays and sensors, while their high switching rates are useful in advanced communications technology with applications as diverse as aviation lighting, fairy lights, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper, horticultural grow lights, and medical devices.

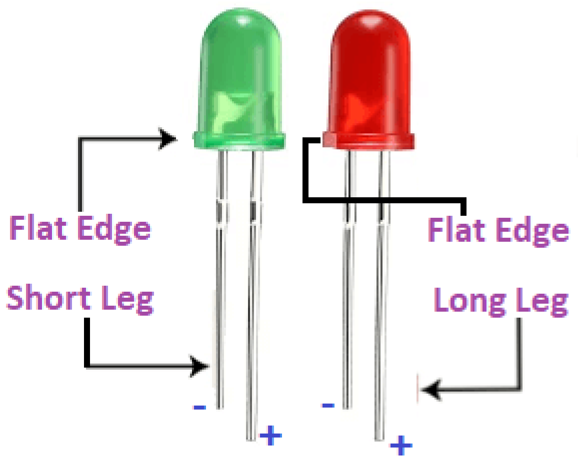

Fig.4.1.7 Green & Red LED

Specifications:

- 1.8-2.2VDC forward drop
- Max current: 20mA
- Suggested using current: 16-18mA
- Luminous Intensity: 150-200mcd

LED-Resistor Calculations :

R= Vs – Vf/ If ……………………..equation (i)

Vs = Source Vtg = 5 V, If = 20 mA

Vf Range – For Red LED is 1.8 – 2.1 V

For Green LED is 2 – 2.1 V

So, we choose Vf = 2.1 V

Putting values in equation (i), we get

R = 5-2.1/20

R = 145 ohm X 2

8. Servomotor

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for models. More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

Fig.4.1.8 Servomotor

Specifications:

- Operating Voltage is +5V typically
- Current: 2.5A (6V)
- Stall Torque: 9.4 kg/cm (at 4.8V)
- Maximum Stall Torque: 11 kg/cm (6V)
- Operating speed is 0.17 s/60°
- Gear Type: Metal
- Rotation : 0°-180°
- Weight of motor : 55gm
- Package includes gear horns and screws

4.2 PCB DESIGN

4.2.1 INTRODUCTION TO PCB

Printed circuit boards may be covered in two topics; technology and design. Printed circuit boards are called PCB in short. Printed circuit consists of conductive circuit pattern applied to one or both sides of an insulation base, depending upon that ,it is called single side

PCB or double sided PCB (SSB and DSB).Conductor materials like silver, brass, aluminium and copper are most widely used. The thickness of the conducting material depends upon the current carrying capacity of circuit. Thus a thicker copper layer will have more current carrying capacity.

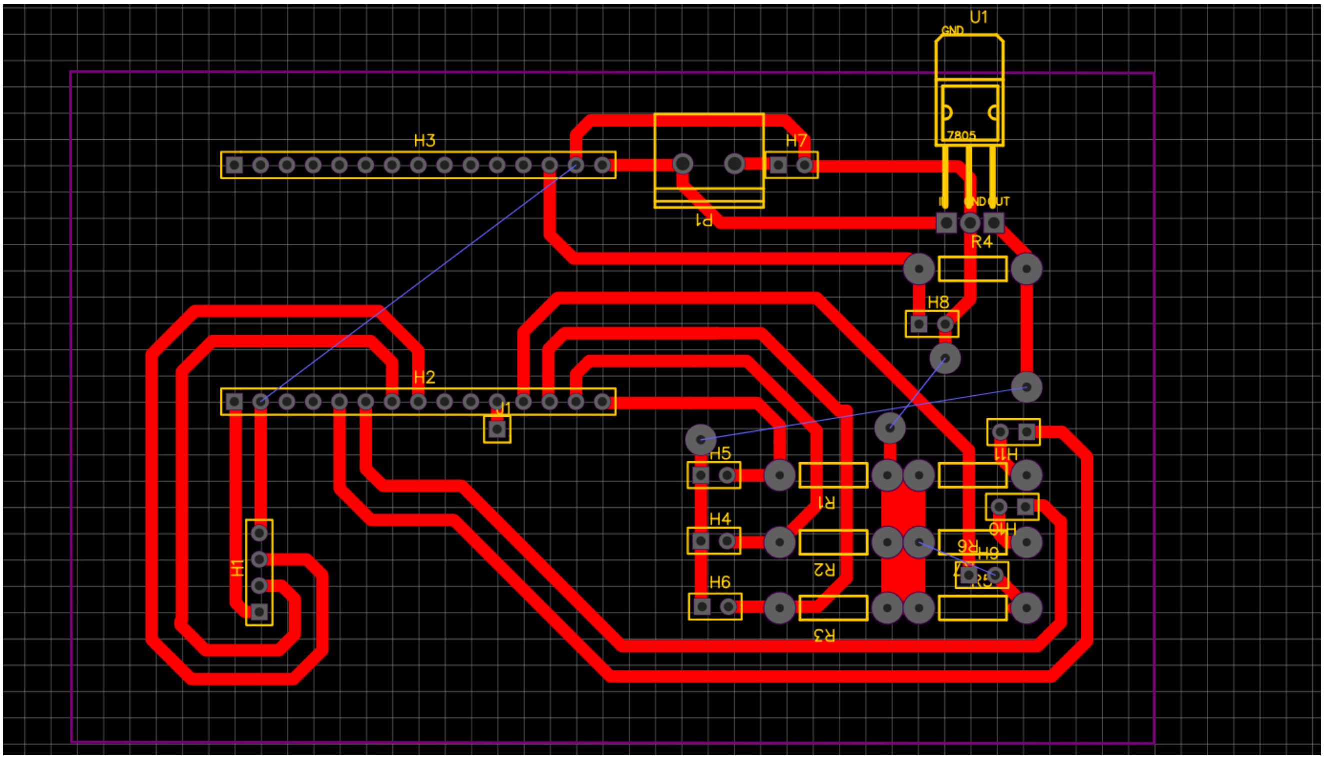

Fig.4.2.1 PCB Layout

The printed circuit board usually serves three distinct functions:

1) It provides mechanical support for the components mounted on it.
2) It provides necessary electrical interconnections.
3) It acts as a heat sink that is it provides a conduction path leading to removal of most of the heat generated in the circuit.

4.2.2 PROPERTIES OF PCB

- Insulation resistance
- Volume resistivity
- Dielectric strength
- Dielectric constant
- Dielectric factor
- Arc resistance
- Flexural strength

4.2.3 ADVANTAGES OF PCB

- Good moisture resistance
- Good electric properties
- No effect of weak acid
- Slight effect of strong acid
- Slight effect of organic solvent
- Provides mechanical support
- Occupies less space
- Good electrical property

CHAPTER 05

IMPLEMENTATION, TEST AND PERFORMANCE OF SYSTEM

CHAPTER 5. IMPLEMENTATION, TEST AND PERFORMANCE OF SYSTEM

5.1 SIMULATION:

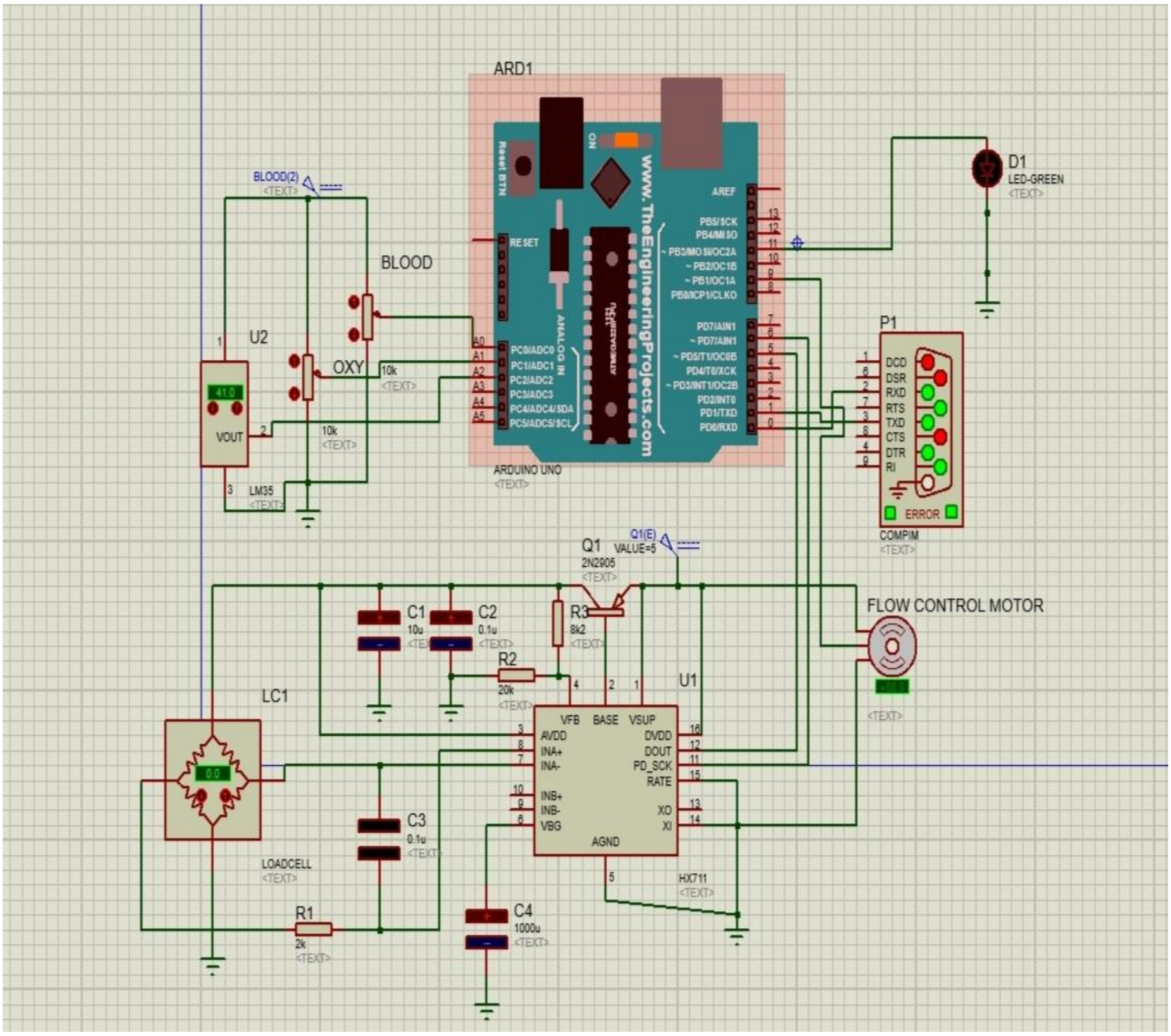

Fig.5.1 Simulation

5.2 RESULT AND DISCUSSION

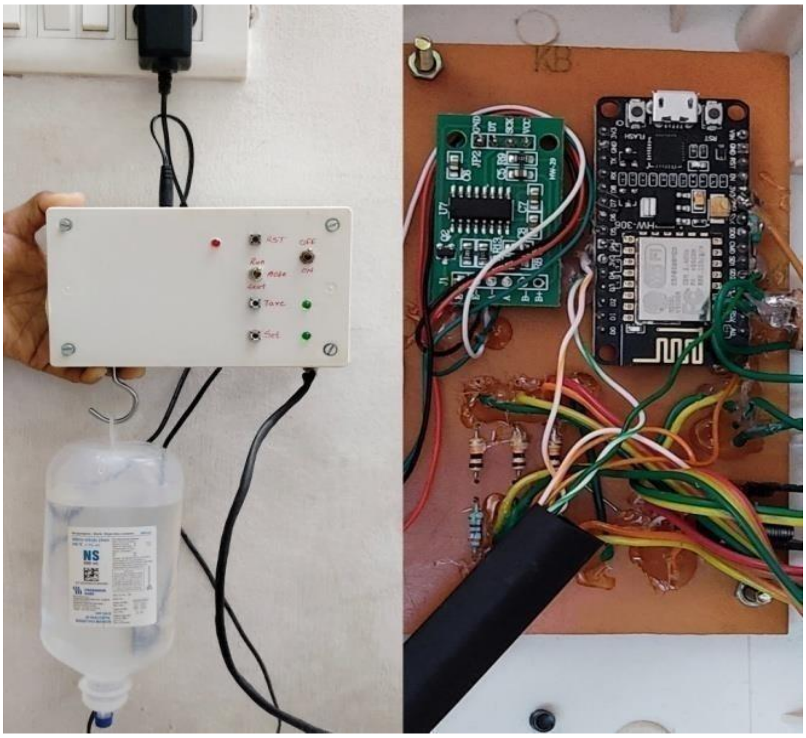

Fig.5.2.1 NodeMCU ESP8266 with Hx711 & Load Cell

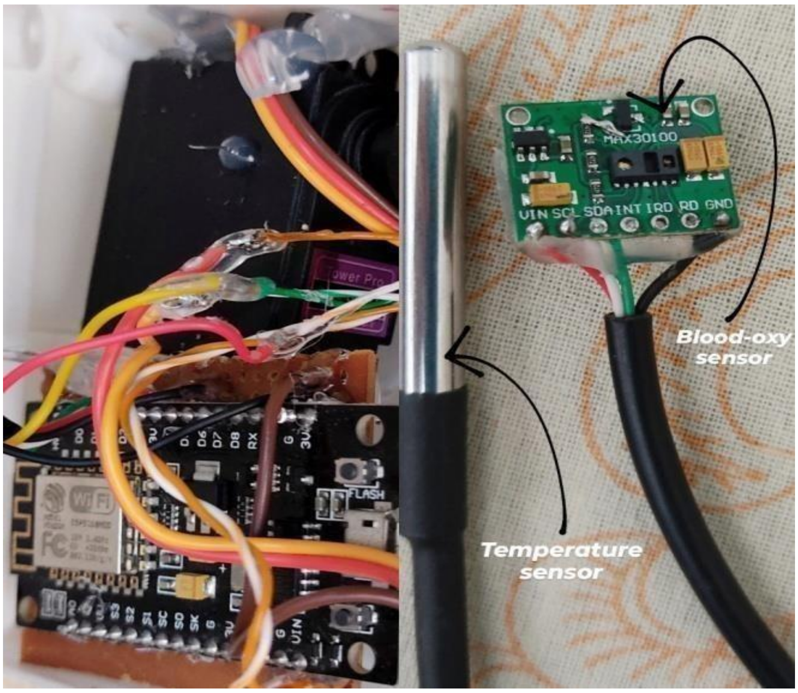

Fig.5.2.2 NodeMCU ESP8266 with Temperature & Blood-Oxy Sensor

5.3 BILL OF COMPONENTS

Sr. No.	Item	Cost	Quantity	Total Cost
1	NodeMCU ESP8266	400	2	800
2	Temperature Sensor	110	1	110
3	MAX30100 Blood-Oxy Sensor	325	1	325
4	HX711 with Load cell	359	1	359
5	MG996R Servomotor	293	1	293
6	9V 1A Adapter	149	1	149
7	10K Resistors	4	3	12
8	330R Resistors	3	3	9
		TOTAL : 2057		

5.3 Bill of Components

CHAPTER 06

CONCLUSION AND FUTURE SCOPE

CHAPTER 6. CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

- As the entire proposed system is automated, it requires very less human intervention. With this automatic system, the manual effort on the part of the nurses is saved.
- It will be advantageous at night as there will be no such requirement for the nurses to visit the patient’s bed every time to check the level of saline in the bottle since an alert notification will be sent to the nurses, doctors, and caretakers when saline reaches the critical level.
- This automatic saline level monitoring system provides more flexibility to doctors, thereby the patient’s care is enhanced. Hence it saves lots of time for the doctor or nurse who is on duty.
- It also proposes a system that can automatically monitor the saline flow by using a servomotor.
- This system helps nurses to monitor the saline flow from a distance.

6.2 FUTURE SCOPE

- In the future, this project can also be added to the smart card attendance system so that the controller gets the detail of the absence of a faculty and can send messages to doctors about the absence of faculty and alert another faculty to take the position of that absented faculty.
- In the future, the system can be extended to a distributed wireless network system.
- The sending and receiving speed of a security alert message is high, so this can be used to give more kinds of applications in the future.

CHAPTER 07

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CHAPTER 7. BIBLIOGRAPHY

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CHAPTER 08

CERTIFICATES

CHAPTER 8. CERTIFICATES

ATTACHED COPY OF:

A. <u>Project Participation Certificates :</u>

Maratha Vidya Prasarak Samaj's
Karmaveer Adv Baburao Ganpatrao Thakare College of Engineering, Nashik
Permanently Affiliated to Savitribai Phule Pune University, Pune and Approved by AICTE, New Delhi

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OF EXCELLENCE

IS PRESENTED TO :

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has participated in the **Project Hunt** competition in
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