Walchand College Of Engineering, Sangli

(An Autonomous Institute)

Department

Of

Electronics Engineering

A Project Report
On

HEALTH MONITORING SYSTEM

Submitted by

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Under the Guidance of
Prof. S.G. Tamhankar

Year 2022-2023

CERTIFICATE
Walchand College of Engineering, Sangli

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DEPARTMENT OF ELECTRONICS ENGINEERING

This is to certify that, the project report entitled

"HEALTH MONITORING SYSTEM"

Submitted by

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is a record of student's own work carried out under my supervision and guidance during the academic year

2022-2023

Prof. S.G. Tamhankar
(Project Guide)

External Examine

Declaration

We hereby declare that the work which is being presented in the project entitled, “Health Monitoring System " is an authentic record of our own work during a period of one semester 2022, under the guidance of Prof. S.G. Tamhankar in the partial fulfillment of the requirements for completing mini project lab in Electronics Engineering at Walchand college of Engineering, Sangli. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed. We have not submitted the matter embodied in this dissertation for the award of any other degree or diploma.

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Acknowledgement

To turn our idea of “Health Monitoring System” into reality we took several efforts. These efforts would have been meaningless if our guide Prof. S.G. Tamhankar hadn’t guided us during difficulties and problems. We express a deep sense of gratitude towards all the Asst. Professors of the Electronics Department as they provided good support and guidance during the project. We are also grateful to the non- teaching staff as they provided all the required equipment and tools useful for the project. Finally, we wish gratefulness to all those people who contributed to our project directly or indirectly.

1. Introduction

Health is characterized as a full state of physical, mental and social well-being and not merely a lack of illness. Health is a fundamental element for a better life. Unfortunately, the global health problem has created a dilemma because of lack of proper healthcare infrastructure.

Also, during covid pandemic we realized that there is a lack of basic healthcare facilities and India doesn't have adequate healthcare infrastructure to cater to the rising population levels. India has only 64 doctors for every 1 lakh people. That means there is unavailability of nurses and doctors especially during the hardest times. Also, there is a large gap in the healthcare facilities between rural and urban areas. This makes it even more crucial to focus more on preventive healthcare.

Nowadays people are adopting health monitoring systems at their home to assess their health.So considering the rapid increase in number of patients who require monitoring, we decided to propose *"Health Monitoring System"* which will also help to reduce the cost of hospitalization and patient care.

This system is compatible with the use of a variety of sensors such as MQ2, Max30100, Gsr, Lm35 to extract medical data that helps determine multiple parameters such as heartbeat rate, body temperature, SpO2, Skin Conductance and also the presence of toxic gasses in the room at the same time. Arduino uno board collects the analog input from these sensors. According to the input sensed, all the values will be displayed on LCD so that we can monitor the patient at any instance in home without any hospitalization. The buzzer beeps when it detects smoke or other harmful gasses.

2. Project Idea

2.1 Problem Statement

Design a system that will be able to detect various health parameters such as temperature, SpO2, skin conductance, heartbeat rate and also the presence of flammable gasses in the patient's room so as to assist for medication if required.

2.2 The solution we propose

This project looks into developing a Health Monitoring System. The idea behind developing such a system is to detect the various health parameters and to alert for medication help. This system proves to be helpful even for the people who have no prior knowledge of this domain. The feature of providing a fast alert mechanism for the critically ill people and timely medical help for the old people makes this a very subsidiary tool.

Different sensors like Max30100, GSR, LM35, MQ2 along with other devices like buzzer and lcd are used to design this system. The controller board used is Arduino Uno so as to connect different sensors at the same time. The Max30100 is a sensor used to measure the Spo2 (oxygen level) and the heartbeat rate. The GSR is a sensor used to detect the skin conductance of an individual. The other sensor LM35 is used to detect the temperature of the surroundings. Outcomes of both the sensors (GSR and LM35) will be considered for detecting the temperature of an individual. MQ2 is a gas sensor and is used to identify the presence of toxic or flammable gasses (CH4, CO, smoke) inside a patient's room. The buzzer is used to beep when flammable gasses are detected and the recorded reading will be displayed on the LCD to make the system more user friendly.

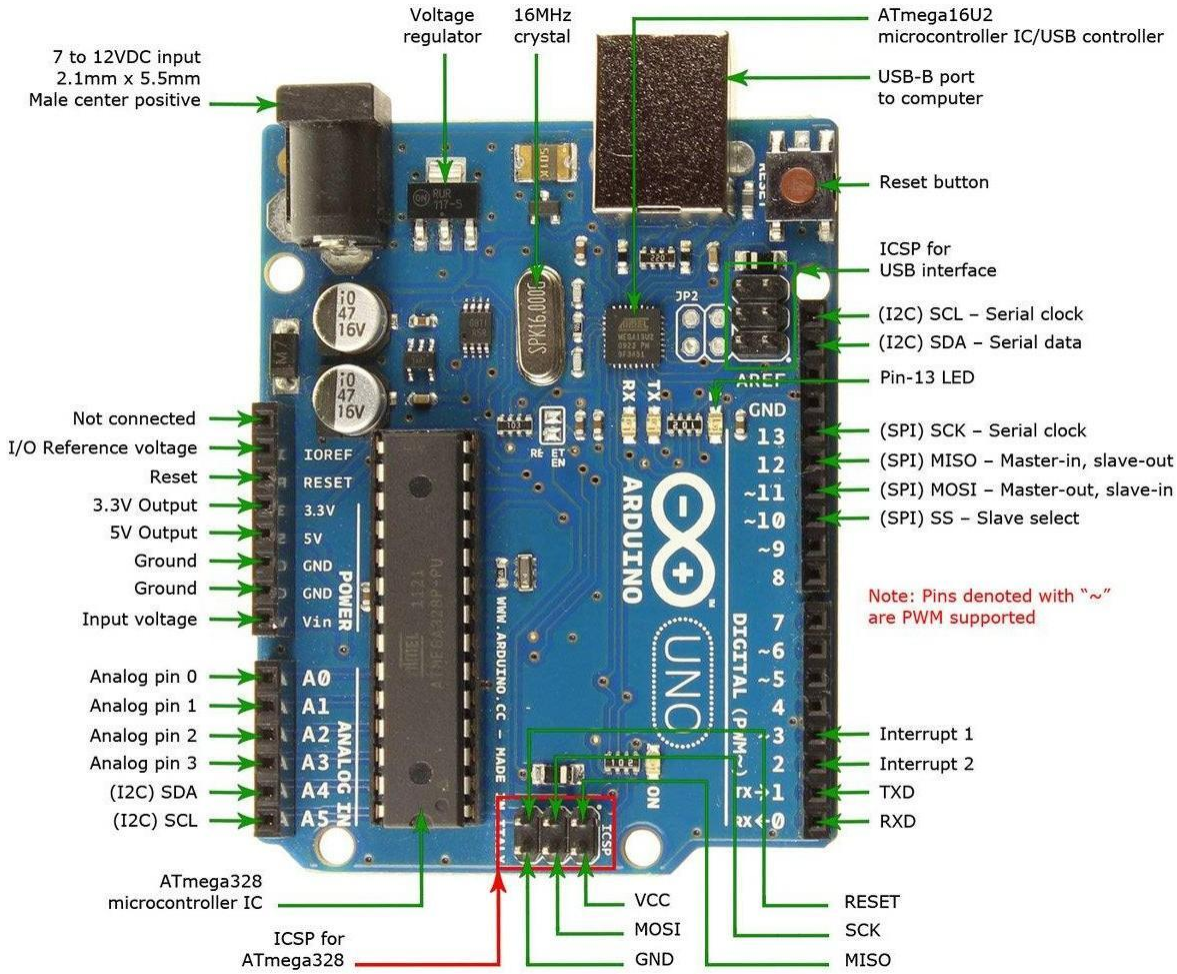
Thus, in this project we try to focus on maintaining good health parameters for an individual by alerting them.

3. Literature Review

1) A healthcare monitoring System using Wi-Fi module by Shrutika Gawali & Ruchita Jibhkate. In which they explained the health care system with the help of LM35, heart rate sensor, Arduino and Wi-Fi module.
2) Celal Bayar University Journal of Science. IOT based wearable smart health monitoring system using Arduino pro mini to monitor heart rate, its variability and body temperature using different sensors.
3) IoT based on human health monitoring system by Sohelkhan pathan and Vinay Konda. International research journal of engineering and technology. In which they explained the IOT healthcare system with different sensors like Ds18B20, heart rate sensor, pulse sensor & Arduino uno.

4. System Architecture

4.1. Arduino uno



Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

V: This pin of the board is used to provide a supply of 3.3V.

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pin of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

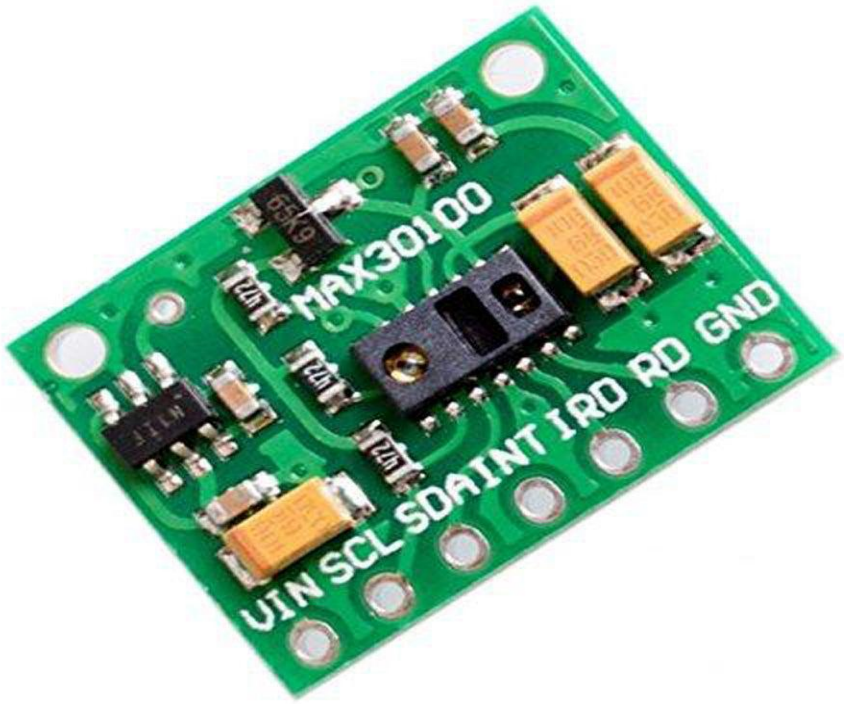
SPI Pins: This is the Serial Peripheral Interface pin; it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select
2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master in Slave Out
4. SCK: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

4.2. Max30100 Sensor:



The MAX30100 is an integrated pulse oximetry and heart rate monitor sensor solution. It combines two LED's, a photo-detector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals.

Some of the main specifications of MAX30100 sensor:

- 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

The sensor comes in the Sip package offering significant space and cost-saving advantages in reduced board area and board layers.

Pin Description:

Pin Name	Description
SCL	I2C Clock Input
SDA	I2C Clock Data, Bidirectional (Open-Drain)
INT	Active-Low Interrupt (Open-Drain)
IRD	IR LED Cathode and LED Driver Connection Point. Leave floating in the circuit.
RD	Red LED Cathode and LED Driver Connection Point. Leave floating in the circuit.
VIN	Analog Power Supply Input. Bypass to GND for best performance.
GND	Analog Ground

4.3. MQ2 Sensor:

Specification:

- Operating voltage - 5V
- Load resistance - 20 KΩ
- Heater resistance - 33Ω ± 5%
- Heating consumption - <800mw
- Sensing Resistance - 10 KΩ – 60 KΩ
- Concentration Range - 200 – 10000 ppm
- Preheat Time - Over 24 hours

Pin Description:

- **VCC:** This pin is used for a positive voltage supply connection of 5V to power up the module.

- **GND (Ground):** The module is connected to the ground using this pin.

- **Digital Out (DO):** This pin is used to generate the digital output of the module when the threshold value is set with the help of a potentiometer. It gives the digital output either High or Low based on the presence of gas.

- **Analog Out (AO):** This pin gives the analog output voltage in the range of 0V to 5V, which depends on the gas intensity.

4.4 DS18B20:

Specification of DS18B20 Temperature Sensor:

- Usable temperature range: -55 to 125 °C (-67 °F to +257 °F)
- 9-to-12-bit selectable resolution
- Uses 1-Wire interface- requires only one digital pin for communication
- Unique 64-bit ID burned into chip
- Multiple sensors can share one pin
- ±0.5 °C Accuracy from -10 °C to +85 °C
- Temperature-limit alarm system
- Query time is less than 750 ms
- Usable with 3.0 V to 5.5 V power/data

Pin Description:

- **VCC:** Supply Voltage (4V – 30V)
- **Vout:** It gives analog output voltage which is proportional to the temperature (in degree Celsius).
- **GND:** Ground

4.5. GSR Sensor:

Specification:

- Supply voltage: 3.3 V / 5 V
- Sensitivity: adjustable by potentiometer
- Interface: Analog
- Set includes:
  - GSR sensor
  - Finger bands required for measurement
  - Connection cable, Grove type
- Dimensions: 24 x 20 x 9.8 mm
- Weight: 29 g

Pin Description:

- **GND:** Ground
- **VCC:** The supply voltage of 5 V.
- **TP1 / NC:** Not connected.
- **SIG:** The control signal.

4.6. Buzzer:

The **specifications of the buzzer** include the following.

- Color is black
- The frequency range is 3,300Hz
- Operating Temperature ranges from – 20° C to +60°C
- Operating voltage ranges from 3V to 24V DC
- The sound pressure level is 85dBA or 10cm
- The supply current is below 15mA

Pin Configuration:

Pin	**Description**
+ve Terminal	powered through 6 Volts
-ve Terminal	connected to the ground

4.7. LCD :

The **specifications of the LCD** include the following.

- The operating voltage of this display ranges from 4.7V to 5.3V
- The display bezel is 72 x 25mm
- The operating current is 1mA without a backlight
- PCB size of the module is 80L x 36W x 10H mm
- HD47780 controller
- LED color for backlight is green or blue
- Number of columns – 16
- Number of rows – 2
- Number of LCD pins – 16
- Characters – 32
- It works in 4-bit and 8-bit modes
- Pixel box of each character is 5×8 pixel
- Font size of character is 0.125Width x 0.200height

Pin Configuration:

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.

- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among the command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute the Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller units like 0 to 7.
- Pin15 (+ve pin of the LED): This pin is connected to +5V
- Pin 16 (-ve pin of the LED): This pin is connected to GND.

4.8. Breadboard:

Breadboard is a plastic board for holding wires and electronic segments such as transistors and resistors.

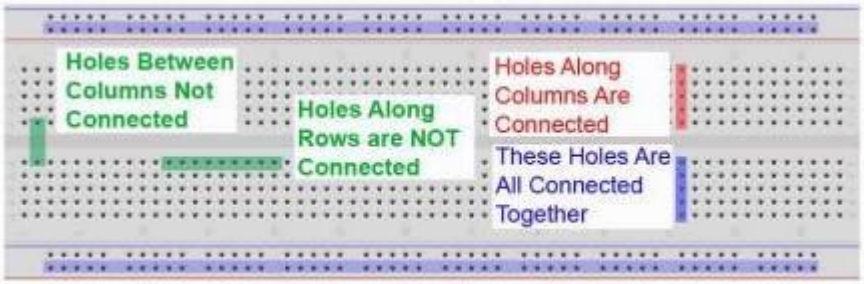


Figure 21: Breadboard [20]

5. Methodology

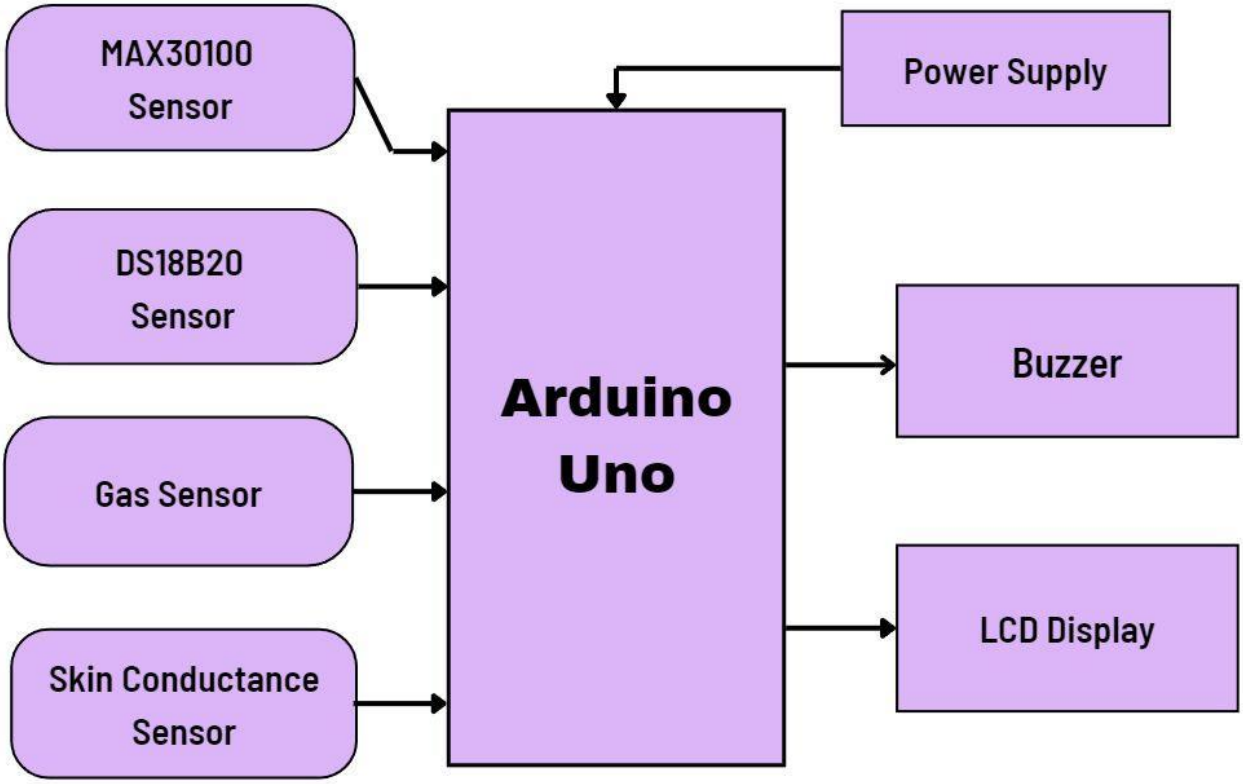
There are three main blocks of project namely input unit, processing unit, Output unit

a) **Input unit :** It consists of multiple sensors
   1) MAX30102: It is an integrated pulse oximetry and heart-rate monitor biosensor module with analog output.
   2) LM35 : The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature.
   3) MQ2: The MQ-2 is a smoke and combustible gas sensor from Winsen. It can detect flammable gas in a range of 300 - 10000 ppm. In our project, we are using it to detect the toxic gasses in the patient's room so that we can be able to treat patients more efficiently.
   4) GSR : It is a sensor that uses small electrical currents to detect changes in the level of skin conductivity, and this information is used to generate estimates of users emotional response.

b) **Control unit:**
   1) Control unit consists of Arduino uno board where input from the input unit will be collected using Analog pins of Arduino uno board.
   2) According to the input, all values will be displayed on LCD so that we can monitor the patient at any instance in home without any hospitalization.
   3) Priority for sensors:
      i)MQ2
      ii)Max30100
      iii)Gsr
      iv)Lm35

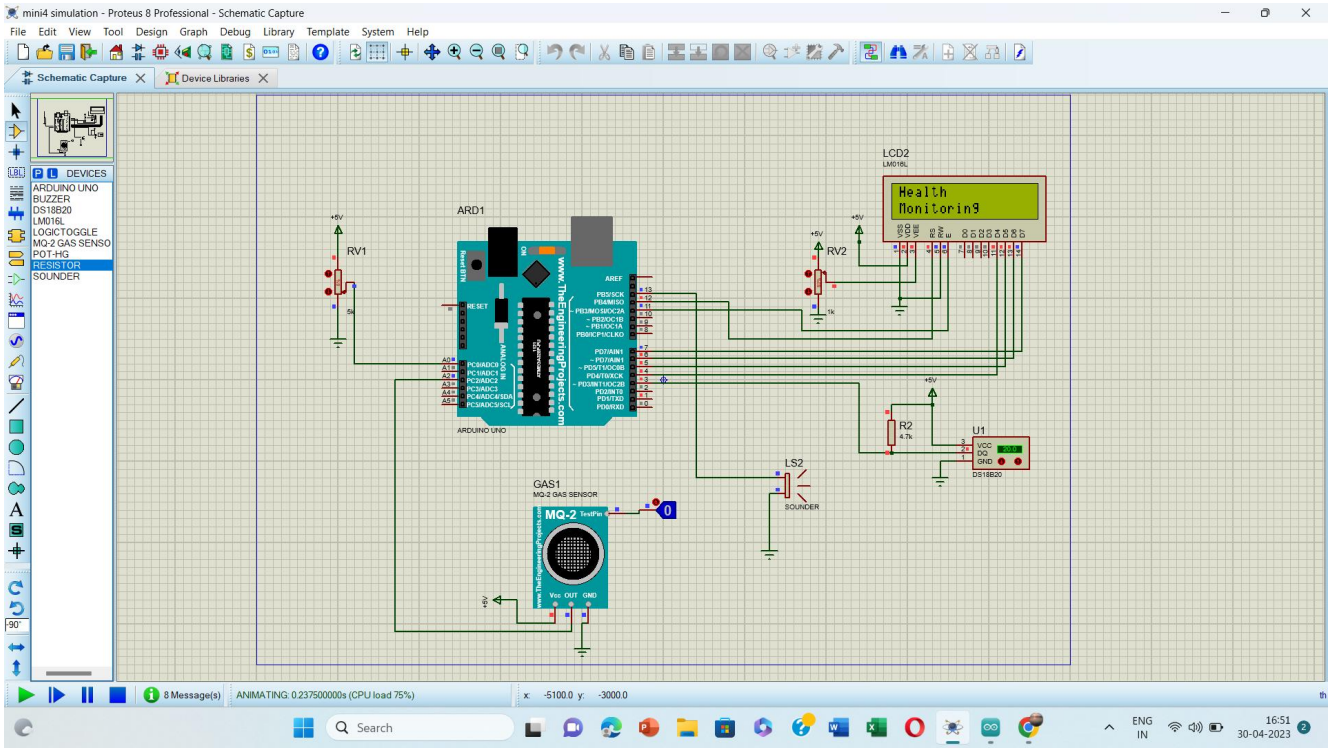
c) **Output unit:** There is only one output device.
   1) Liquid Crystal Display (LCD): After collecting all data from sensors all information will be displayed on LCD i.e., heart rate, SPO2 percentage, temperature, humidity, toxic gas percentage present in room and pressure for further analysis.
   2) Buzzer: Beep when detecting smoke.

6. Block Diagram :

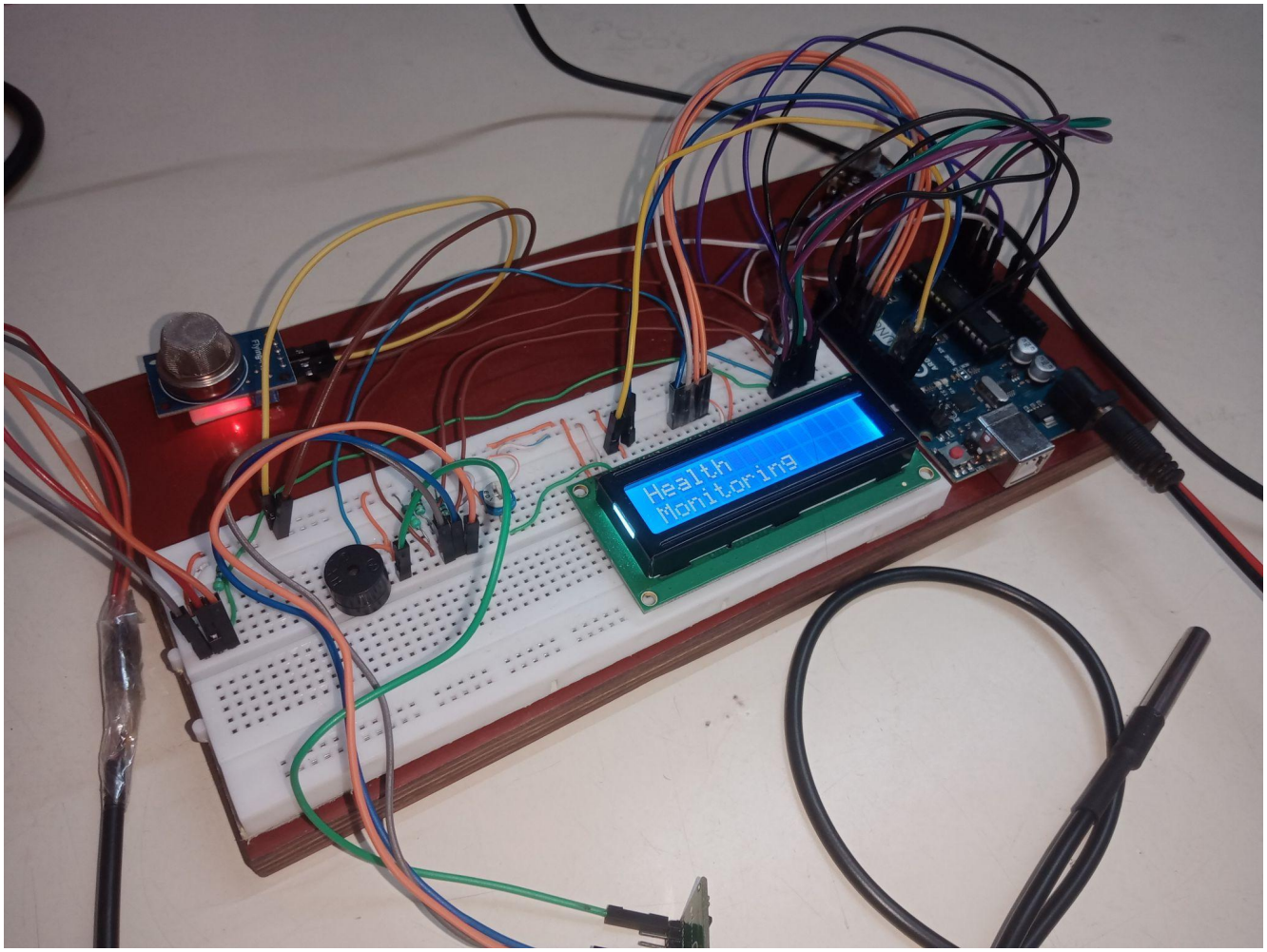


Smart Health Monitoring System

7. Circuit Diagram:



8. Experimental Setup :



9.Code:

9.1 For DS18B20,LCD,MQ2,POT

```
#include <Arduino.h>
#include <LiquidCrystal.h>
#include <Wire.h>
#include <OneWire.h>
#include <DallasTemperature.h>
// Data wire is plugged into digital pin 2 on the Arduino
#define ONE_WIRE_BUS 3

// Setup a oneWire instance to communicate with any OneWire device
OneWire oneWire(ONE_WIRE_BUS);
// Pass oneWire reference to DallasTemperature library
DallasTemperature sensors(&oneWire);
#define Buzzer 13
// Pin definitions
int MQ2pin = A2;
int potV = analogRead(A0);
const int rs = 12, en = 11, d4 = 4, d5 = 5, d6 = 6, d7 = 7;

// Initialize LCD display
LiquidCrystal lcd(12, 11, 4, 5, 6, 7);

void DS18B20()
{
   sensors.requestTemperatures();
  float T=sensors.getTempCByIndex(0);
```

```
  //print the temperature in Celsius
  float c=pot();
  lcd.setCursor(0, 0);
  lcd.print("Conductivity: ");
  lcd.setCursor(0,1);
  lcd.print(c);
  delay(2000); // delay in between reads for stability
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Temperature: ");
  lcd.setCursor(0, 1);
  lcd.print(T);
  lcd.print("\xDF""C");
  delay(2000);
  lcd.clear();
  if(T<=26 && c<20)
{
    lcd.setCursor(0, 0);
    lcd.print("Person");
    lcd.setCursor(0, 1);
        lcd.print("might be Dead");
    delay(2000);
    lcd.clear();
}
  if((T <= 37) && (c <=30) && (T>26) && (c>20))
  {
    lcd.setCursor(0, 0);
    lcd.print("Normal");
```

```
  lcd.setCursor(0, 1);
  lcd.print("body temperature");
  delay(2000);
  lcd.clear();
 }
 else if((T > 37) && (c>30))
 {
    lcd.setCursor(0, 0);
  lcd.print("You Have");
  lcd.setCursor(0, 1);
  lcd.print("fever");
  delay(2000);
  lcd.clear();
 }

 else if((T < 37) && (c>30) && (T>26))
 {
  lcd.setCursor(0, 0);
  lcd.print("Sweating");
  delay(2000);
  lcd.clear();
 }

else if((T > 37) && (c < 30))
  {
    lcd.setCursor(0, 0);
  lcd.print("DS18B20 is");
  lcd.setCursor(0, 1);
```

```
    lcd.print("defective");
    delay(2000);
    lcd.clear();
  }
}

void MQ()
{
  int MQ2Value; //variable to store sensor value
  MQ2Value = analogRead(MQ2pin);
  Serial.print(MQ2Value);
  Serial.print(" ");
  if (MQ2Value > 300)
  {
    lcd.setCursor(0, 0);
    lcd.print("Toxic Gas Alert");
    digitalWrite(Buzzer,HIGH);
    delay(2000);
    digitalWrite(Buzzer,LOW);
    lcd.clear();
  }

   else
  {
    lcd.setCursor(0, 0);
    lcd.print("Safe");
    lcd.setCursor(0, 1);
    lcd.print("Atmosphere");
```

```
    delay(2000);
    lcd.clear();
  }
}

float pot()
{
  int potV = analogRead(A0);
  int j=1024/potV;
  // print out the value you read:
  return j;

}



void setup() {
  // Initialize serial communication
  Serial.begin(9600);
  pinMode(Buzzer,OUTPUT);
  lcd.begin(16, 2);
  lcd.setCursor(0, 0);
  lcd.print("Health");
  lcd.setCursor(0, 1);
  lcd.print("Monitoring");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0, 0);
```

```
  lcd.print("System");
  lcd.setCursor(0, 1);
  lcd.print("Designed by");
  delay(1000);
  lcd.clear();

  lcd.setCursor(0, 0);
  lcd.print("2020BTEEN00080");
  lcd.setCursor(0, 1);
  lcd.print("2020BTEEN00060");
  delay(1000);
  lcd.clear();

  lcd.setCursor(0, 0);
  lcd.print("2020BTEEN00033");
  lcd.setCursor(0, 1);
  lcd.print("2020BTEEN00062");
  delay(1000);
  lcd.clear();

  lcd.setCursor(0, 0);
  lcd.print("2020BTEEN00073");
   delay(1000);
  lcd.clear();
}

void loop()
{
```

```
  // Read data from sensors
    MQ();
    pot();
    DS18B20();
    delay(1000);
}
```

9.2 Code for MAX30100 :

```
#include <LiquidCrystal.h>
#include <Wire.h>
#include "MAX30100_PulseOximeter.h"

LiquidCrystal lcd(12, 11, 4, 5, 6, 7);

#define REPORTING_PERIOD_MS     1000

PulseOximeter pox;
uint32_t tsLastReport = 0;
void onBeatDetected()
{
    Serial.println("Beat!");
}

void setup()
{
    Serial.begin(9600);
    Serial.print("Initializing pulse oximeter..");
    lcd.begin(16,2);
```

```
    lcd.print("Initializing...");
    delay(3000);
    lcd.clear();

    // Initialize the PulseOximeter instance
    // Failures are generally due to an improper I2C wiring, missing power supply
    // or wrong target chip
    if (!pox.begin()) {
        Serial.println("FAILED");
        for(;;);
    } else {
        Serial.println("SUCCESS");
    }
     pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);

    // Register a callback for the beat detection
    pox.setOnBeatDetectedCallback(onBeatDetected);
}

void loop()
{
    // Make sure to call update as fast as possible
    pox.update();

    if (millis() - tsLastReport > REPORTING_PERIOD_MS) {
        Serial.print("Heart rate:");
        Serial.print(pox.getHeartRate());
        Serial.print("bpm / SpO2:");
```

```
        Serial.print(pox.getSpO2());
        Serial.println("%");

        lcd.clear();
        lcd.setCursor(0,0);
        lcd.print("BPM : ");
        lcd.print(pox.getHeartRate());

        lcd.setCursor(0,1);
        lcd.print("SpO2: ");
        lcd.print(pox.getSpO2());
        lcd.print("%");

        tsLastReport = millis();
    }
}
```

10. Results :

- The system extracts medical data that helps determine multiple parameters such as heartbeat rate, body temperature, SpO2 and Skin Conductance at the same time.
- Displays system's recorded readings on LCD display.
- Helps the user to avail medication that needs to be taken without any delay.
- Provides a fast-responding alert mechanism and timely medical help for critically ill people.

11. Application :

- Measurement of patient's parameters.
- It is easy for patients and medical professionals to use the system.
- It can also be used in old age homes to monitor the various parameters of sick person.
- It can be used in daily life to maintain a healthy lifestyle.

12. Conclusion :

- It will help in tracking the health of patients in real time.
- Practical application of the system is superfine in rural areas as there would be no need for the patient to get their continuous follow-ups.
- The system can detect toxic gas and sensing the output levels of gas has been clearly observed by help of this system.

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13. Future Scope:

- To measure the blood pressure in addition to the present parameters.
- To alert and provide information about patients' health through voice commands.
- Apart from the hardware part we plan to create a database where the information from these sensors will be stored which can help in analyzing the history of patients more accurately.

14. References :

- Kumar, S. P., Samson, V. R. R., Sai, U. B., Rao, P. M., & Eswar, K. K. (2017, February). Smart health monitoring system of patients through IoT. In 2017 international conference on I-SMAC (IoT in social, mobile, analytics and cloud) (I-SMAC) (pp. 551-556) IEEE.
- Tran, V. (2012). Remote coach: a remote health sensor data monitoring system (Doctoral dissertation, California State University, Northridge).
- A report on an IOT based health monitoring system (temperature, heartbeats, skin conductance, SPO2 and ECG) by Chozhan.V Research Scholar, Department of Mechatronics, Jeppiaar Engineering College, Chennai, Tamil Nadu, India.