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## Introduction

A study conducted in Sri Lanka in the year 2018 showed that for every 1000 patients there is only a single physician available [1] This is barley the minimum amount which the World Health Organization has recommended[2]This creates a lot of complications in providing timely medical care. Further an analysis of the death scenarios in the world and in Sri Lanka show that many deaths occur due to neglect or not identifying Non Communicable Diseases and treating them on time [3] . If we could recognize patients with such complications without delay and give immediate treatment many side effects and deaths could be prevented.

With the increase in the number of patients in comparison to doctors, hospitals have faced a major crisis, especially with long queues. The queues in hospitals make patients wait for long periods of time before it is their turn and some of these patients may need immediate medical attention.

Many hospitals still continue to record essential details of patients such as heartbeat, pressure levels manually which are essential for diagnosing non-Communicable diseases.

We have considered all these issues and have decided to take steps to introduce a device which can identify the conditions of patients that require immediate medical attention and report such information to relevant medical personnel. In addition to this our device keeps record of essential results of patients via a Database which could be accessed by authorized medical officials. Our device seeks to save lives that could be lost due to unnecessary delays. We seek to produce a quality product which is affordable and easy to maintain.

Thus, we have put together the “Portable Health Companion”. Small and portable but measures blood pressure, oxygen saturation, heart rate and temperature. The components are readily available in the local market for reasonable prices making it easy to maintain. It also shares the results to a cloud which could be retrieved anytime via a mobile application. The device will notify medical staff immediately if any measured results are not normal.

The Portable Health Companion is a device that is capable of changing health care in Sri Lanka taking it a step further.

## Literature Survey

### ATmega32 Based System for Blood Oxygen Saturation and Temperature Monitoring device

This device was featured in the International Advanced Research Journal in Science, Engineering and Technology (IARJSET) in the third volume, the fifth issue of May 2016. This device measured the Blood Oxygen level using an SPO2 sensor and temperature of a person using an NTC thermistor and displayed in real-time on an LCD screen and passed the results to a doctor via SMS using a GSM.
[4]

### Limitations of the above device which the Portable health companion has overcome

The above device is only capable of measuring blood oxygen levels and body temperature.
The portable health companion in addition to the above can also measure blood pressure and heart rate which makes it possible to diagnose a wide range of health issues.

The above device does not have a mechanism of storing patient information but only displays it once while the portable health device can store and retrieving patient data via a database using a WiFi module in addition to sending SMS via a GSM.

The portable health companion is capable of alerting using a buzzer if a patient's vitals have cross thresholds.

The above device is not capable of recording patient data, but the portable health companion overcomes this by taking details via a keypad and storing it.

The Portable health companion lets doctors access patient information via an application.

### CheckMe Health Monitor [5]

CheckMe Health monitor is a new addition to the medical industry which serves as an all-in-one portable health monitoring device. This innovation, developed by Research, Development, and Sales for Medicine (RDSM) [6]has medically tested accuracy and is intuitive and simple to use.

CheckMe is small in size and comes with a 2.7 inch HD touch screen. It can check ECG, oxygen saturation, pulse rate and pulse strength, Sleep apnea screening and sleep monitoring, temperature, and blood pressure measurement with high accuracy. [7]

This versatile device comes with several handy applications, they are;

1. AIRBP
2. Holter
3. MiniMonitor

Why our product is better?

The above device is costly and aimed at the Global market and such a device is too costly to maintain as parts are not readily available.

Our goal is to make this device available in as many Hospitals as possible therefore we have kept the cost at a minimum level keeping this in mind. The above device has no such objective.

Also, our device is easy to repair and replace. The components we used are readily available in the market. As our primary target market is the local market, we have studied the local market and created this device in a way that will match the demands of the local market.

The above device is intended to be used in houses therefore it has ECG, Sleep apnea screening, and sleep monitoring which is of no use for Hospital usage.

How do you see your product in the future?

- Our device will be an important part of future medical care.
- Equipped with sensors for quick diagnosis and saving time and lives.
- It is a cost-effective solution as it is easy to maintain and replace parts.
- Doctors can access patients' data via an App which makes it easy for both patients and Doctors.
- The size makes it portable and easy to use.
- It contains sensors which are important for diagnosing NCD which is a growing issue today.

## Project Aim & Objectives

Aim:

To invent a portable, affordable, and effective device to help the hospitals to calibrate patient health status in real-time and identify the emergency patients and allocate hospital staff for the relevant patients and operate efficiently with the available hospital staff.

Objectives:

- Monitoring of patient vitals and immediate attention for critical patients through the sensors.
- Simultaneous patient management through allocating urgent patients for available physicians via the App.
- Real-time update on patient details for the hospital staff and the caretakers by sending information to the database.
- Allowing medical officers to re-evaluate through retrieving a patient's medical history which can be retrieved through the app.
- Alert medical officers about the emergency patients by ringing the buzzer and sending a message to the Doctor.
- Making the caretakers aware of the patients' status through instant SMS.
- A cost-effective product for domestic usage and medical centers/hospitals.

## BLOCK DIAGRAM AND 3D DIAGRAM

### Block Diagram

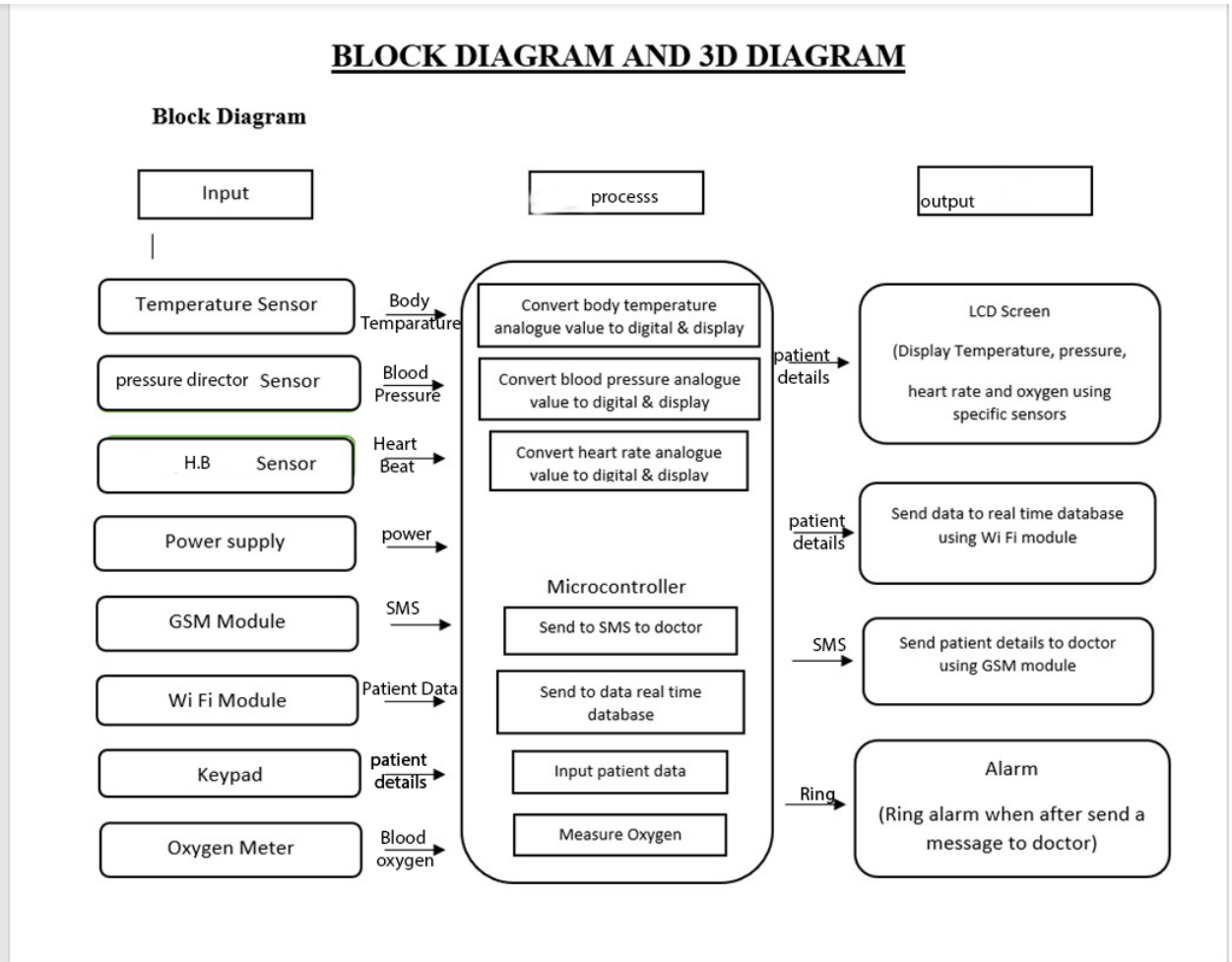
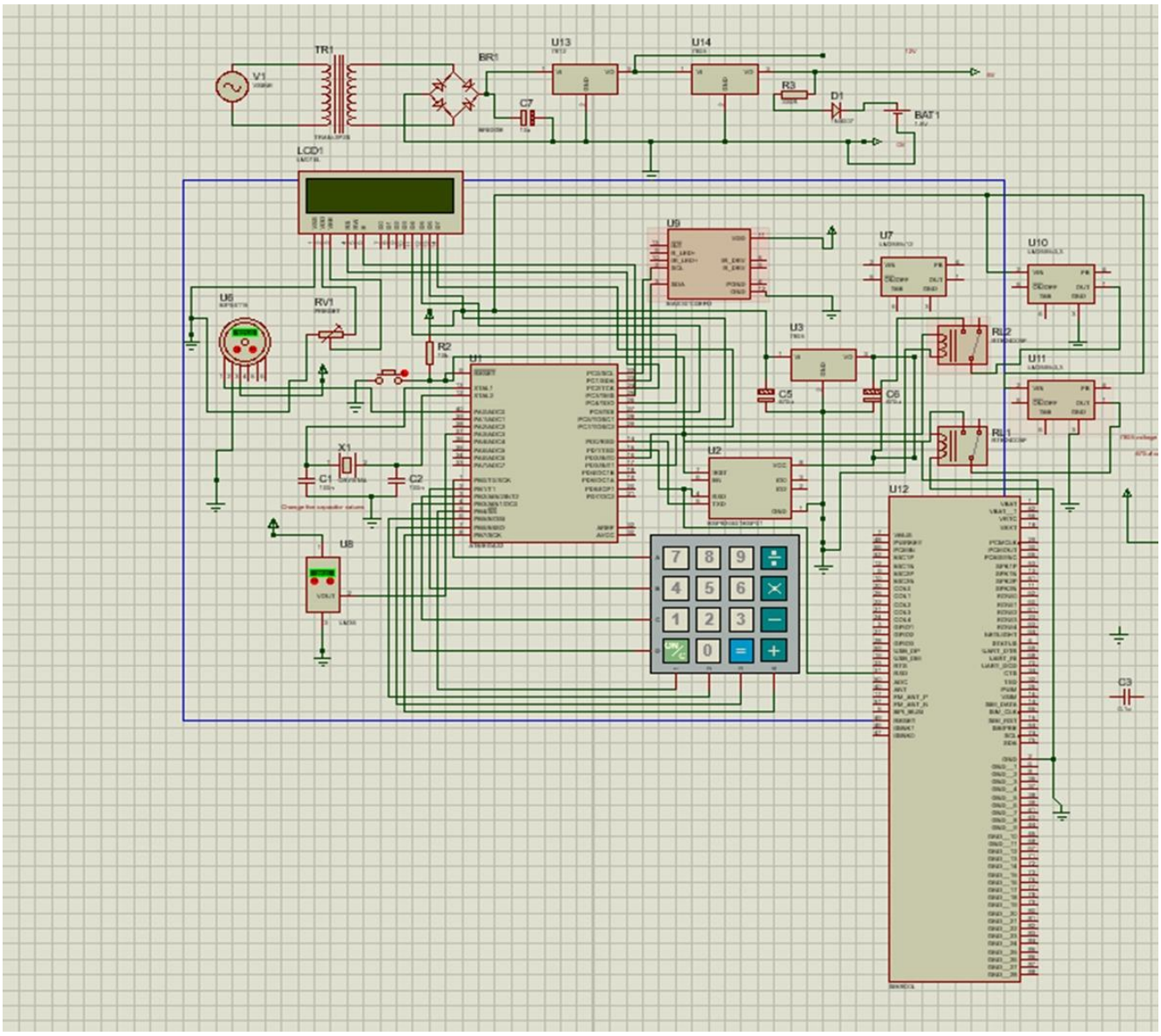



Figure 1. 1

## 3D Diagram

## Testing and Implementation


TR1
BR1
U13
U14
R3
D1
BAT1
C7
LCD1
U9
U7
U10
U6
RV1
R2
U1
U3
RL2
C5
C6
U11
RL1
X1
C1
C2
U2
U12
U8
C3
7
8
9
4
5
6
1
2
3
0
Figure 6. 1

# Action Plan for Remaining Work

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | ACTION PLAN | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | **group member** | **task** | **duration** | **start date** | **1st month** | **2nd month** | **3rd month** | **4th month** | | |
| 4 | | | | | | | | | | |
| 5 | **205112M** | Coding | 2 month | 1st month | | | | | | |
| 6 | | pcb desing and schematic diagram | 1 month | 3rd month | | | | | | |
| 7 | | simulation | 1 month | 4 th month | | | | | | |
| 8 | | | | | | | | | | |
| 9 | **205029N** | Coding wifi module | 2 month | 1st month | | | | | | |
| 10 | | pcb desing and schematic diagram | 1 month | 3rd month | | | | | | |
| 11 | | simulation | 1 month | 4th month | | | | | | |
| 12 | | | | | | | | | | |
| 13 | **205118L** | coding presure detector sensor and temparature sensor | 2 month | 1st month | | | | | | |
| 14 | | pcb desing and schematic diagram | 1 month | 3rd month | | | | | | |
| 15 | | simulation | 1 month | 4th month | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | **205075B** | coding Oxygen meter and HB sensor | 2 month | 1st month | | | | | | |
| 19 | | pcb desing and schematic diagram | 1 month | 3rd month | | | | | | |
| 20 | | simulation | 1 month | 4th month | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | **205094G** | coding gsm module | 2 month | 1st month | | | | | | |
| 24 | | pcb desing and schematic diagram | 1 month | 3rd month | | | | | | |
| 25 | | simulation | 1 month | 4th month | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | | | | | | | | | |
| 28 | | | | | | | | | | |

## Estimated Cost & Expenditure

Table 1. 1

| Item no | Item name | Estimated price |
|---|---|---|
| 1 | Atmega32p Microcontroller | Rs. 663 |
| 2 | MLX90614 infrared temperature sensor | Rs. 2,989 |
| 4 | AMS5915 -1000-D | Rs. 3000 |
| 6 | SIM800L GSM Modules | Rs. 1400 |
| 7 | ESP8266 WiFi Module | Rs. 1,350 |
| 8 | Keypad 4x4 | Rs. 550 |
| 9 | Display Screen-LCD | Rs. 700 |
| 10 | Buzzer(For the alarm) | Rs. 700 |
| 11 | 18650 3.7V – 4300mAh Li-ion Battery (x2) | Rs.720 |
| 12 | Power Supply | Rs. 2000 |
| Estimated Total cost | | Rs. 14,552 |

## Appendix A

## Individual Contribution

My contributions for the development of our proposed systems “Portable Health companion” run from working on the Literature Survey with discovering and briefing the model ‘CheckMe’ to the creation of 3D model as well as report editing and proofreading. Moreover, component identification, pin recognition of my respective components, and the overall circuit diagram.

ESP8266 ESP-01 Wifi Module

The Wifi Module is a crucial component in our proposed system. The functionality of the Wifi module is to establish a connection between an online database and the device to communicate patient vitals and personal information.

ESP8266 modules come in a variety of sizes, from ESP8266-01 to ESP8266-12. The ESP8266 ESP-01 will be used in our system as it's the cheapest and most widely accessible.

ESP8266 works according to several WIFI theories. TCP, UDP, API are some of them. These will be adhered to accordingly moving forward.

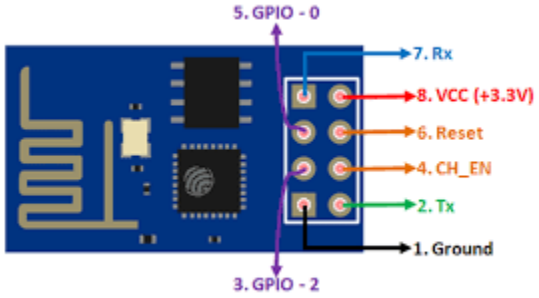



Figure ‘’- ESP8266 Esp-01 model with Pinouts [8]

The specifications of the Wifi module ESP8266 ESP-01 are as follows. [9]

- Voltage - 3.3V
- Current Consumption - 10uA-170mA
- Maximum current consumption - 800mA
- Flash Memory - 16MB
- Processor - Tensilica L106 32 bit
- Processor Speed - 80-160MHz
- RAM - 32K+80K

The RXD and the TXD pins are the backbones of the ESP8266 model, and the pin Rx is used to receive data from the Atmega32 Microcontroller and the pin Tx is used to transmit data to the Microcontroller. The Rx pin of one device is linked to the Tx pin of the second device when two devices are connected via a UART.

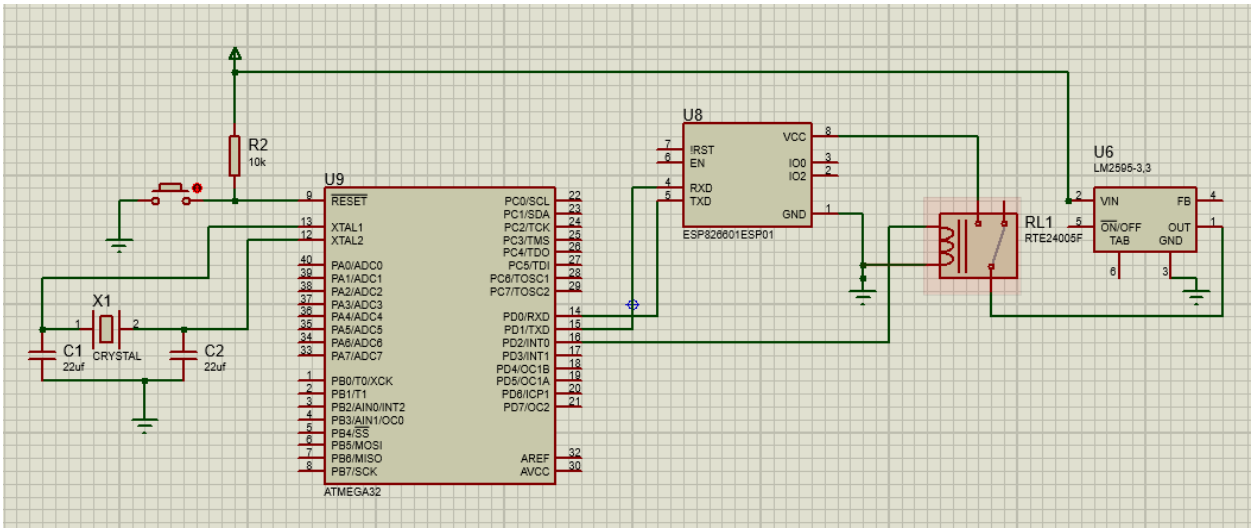



Figure 2. 1 - Circuit diagram for the WIFI module

Unfortunately, both GSM and WIFI modules use the same pins for data transmission. Hence, it was mandatory to look for alternatives to solve the problem. As a replacement, we have used a buck converter to reduce the voltage to a WIFI module-friendly voltage (3.3v) and connect them to a relay to power up the component only when it is required to.

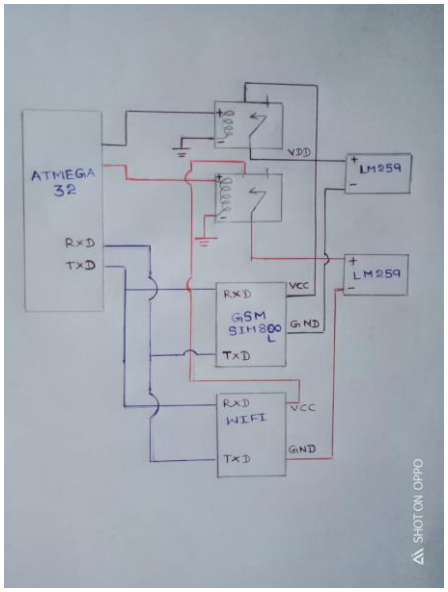



Figure 2. 2 - The use of relays and LM2596 buck converter

In addition, the code for the model will be displayed at the Interim presentation.

Link for the datasheet: [https://www.microchip.ua/wireless/esp01.pdf](https://www.microchip.ua/wireless/esp01.pdf)

## Appendix B

## Individual Contribution

Model Name- SIM800L GSM module

This project requires the use of a GSM module. A GSM module is a hardware device that uses GSM mobile technology to provide a data connection to a remote network. The GSM module used here is SIM800L. Compared to other GSM module types, the use of this module is advantageous for this project.

Special features of this module are : [[10]]

- Connect onto any gloabal GSM network
- Send and receive SMS messages.
- Accepts micro SIM card
- Supply voltage : 3.4V - 4.2V
- UART and AT commands
- Include two antennas.


Figure 3. 1 SIM800L[11]

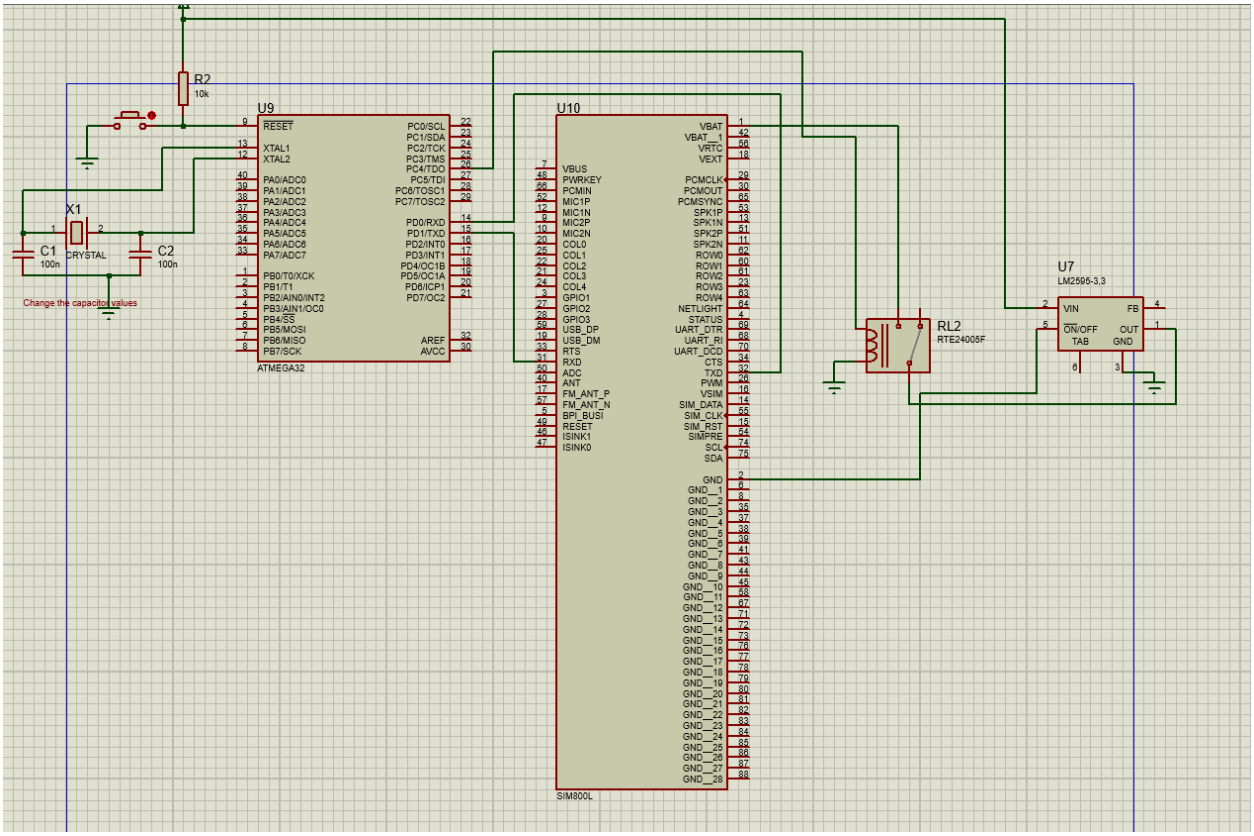



Figure 3. 2 interfacing with Atmega32 in proteus

This software does not have a VCC connect pin for the GSM module so it is connected to the VBAT pin .

The individual circuit diagram is currently drawn.

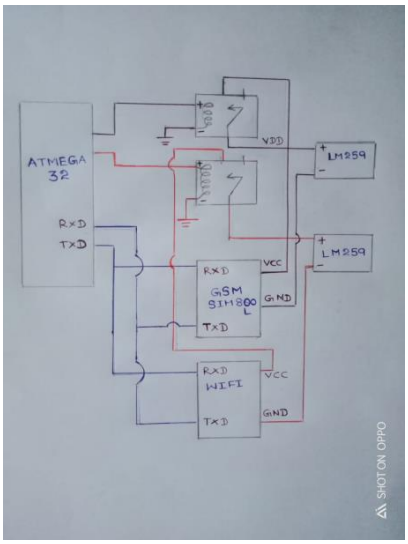



Figure 3. 3-The use of relays and LM2596 buck converter

## Appendix C

## Individual Contribution

Module Name: 4x4 Keypad

The Alphanumeric 4x4 matrix keypad is an input device used for reading the keys pressed by the user and to process it. For the project a 4x4 keypad will be used for gathering patient information such as patient Identification Number, age and contact details.

The keypad will be used to switch on or off the device.

The keypad has 16 characters (keys) but since it could be used in a matrix formation we can connect each row and column separately meaning we would only need 8 pins (4 rows and 4 columns) instead of 16 for the keypad.

The information entered via the Keypad will be displayed on the LCD screen.


Figure 4. 1 A 4x4 Keypad

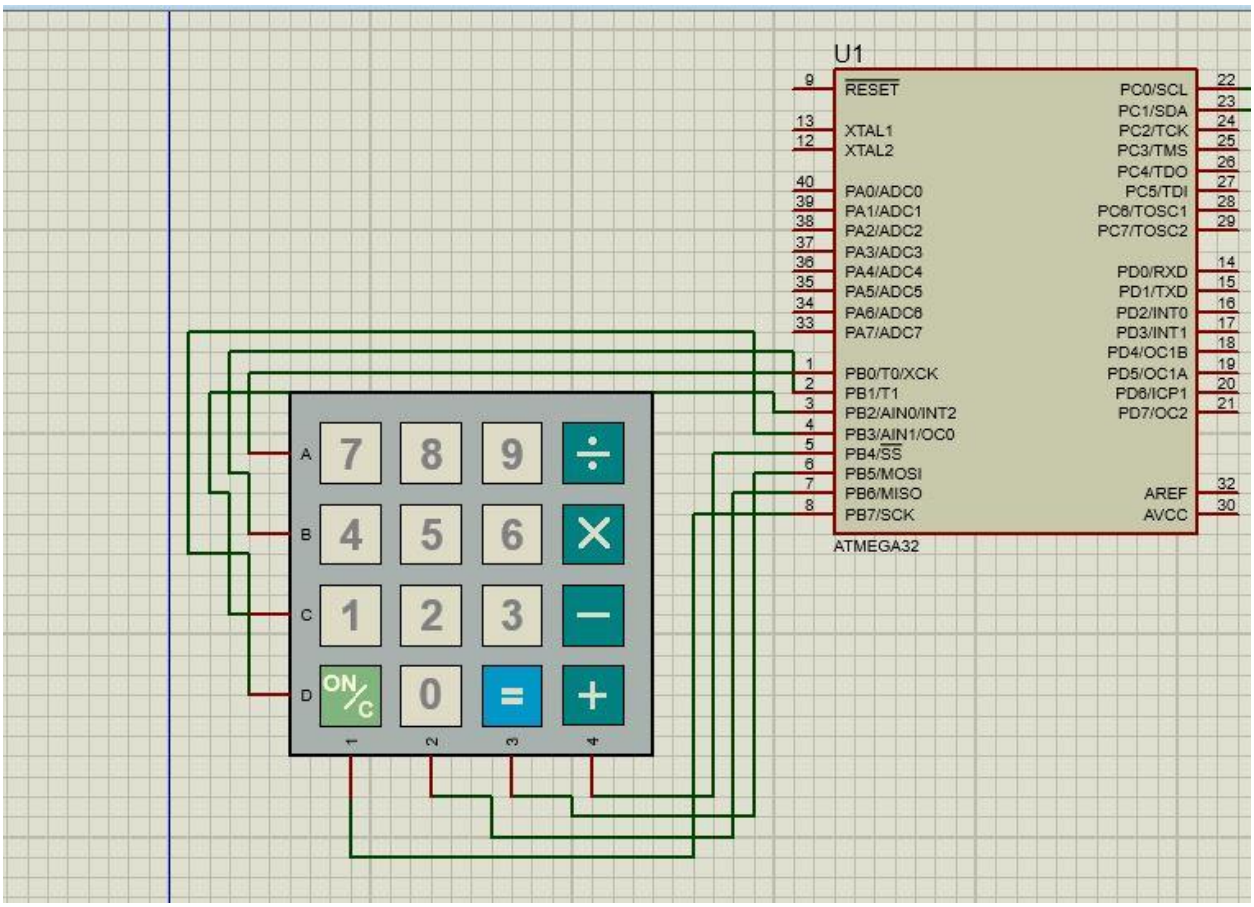



Figure 4. 2-Interfacing a 4x4 keypad  with Atmega 32 in Proteus

Specification link for 4x4 Keypad: https://cdn.sparkfun.com/assets/f/f/a/5/0/DS-16038.pdf

## Appendix D

## Individual Contribution

Power supply [12]

The power supply will power up the microcontroller as well as the sensors . The device will be powered through two Li-ion Batteries ( 18650 3.7V – 4300mAh) and as well as it can be plugged into a domestic power supply which inturn will be converted to direct current when the battery is low. The battery will not be charged.

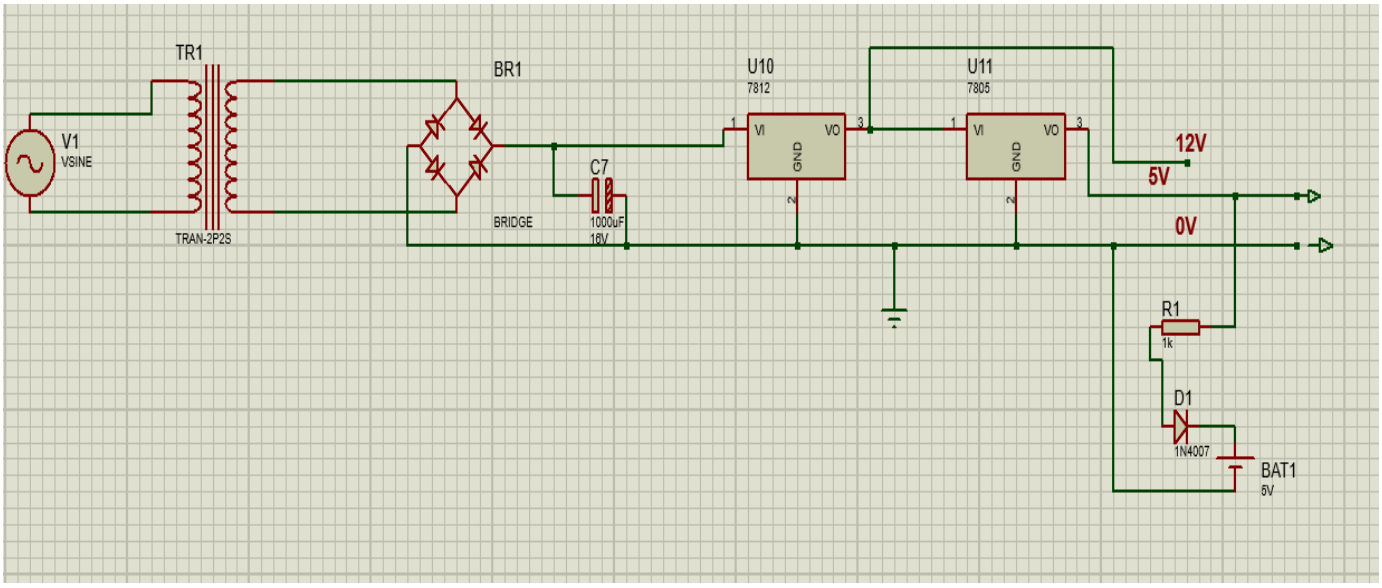



Figure 5. 1- circuit diagram

16x2 LCD display [13]

The LCD display will be used to display patient details and the deatils of the assigned doctor.The information entered via the Keypad will be displayed on the LCD screen.

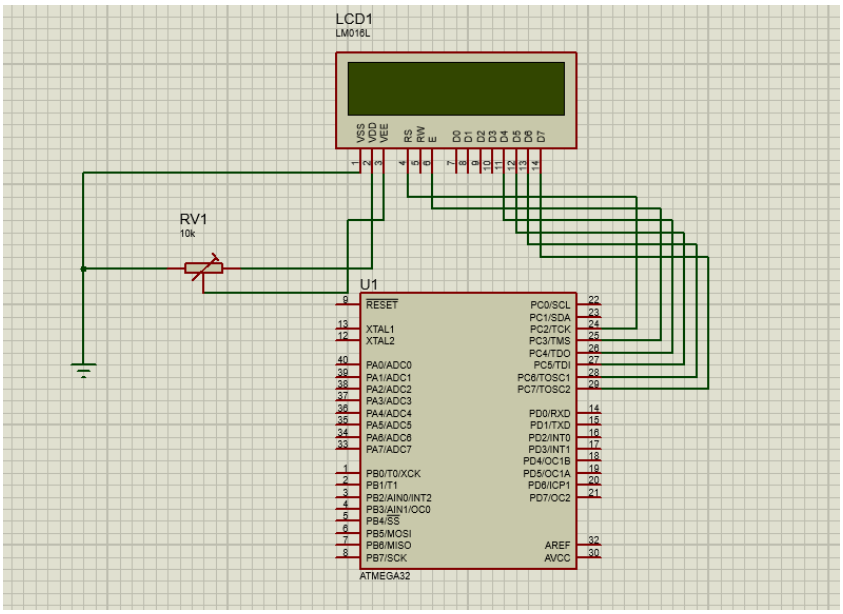



Figure 5. 2 LCD display circuit diagram

Alarm module

For the alarm module a 5V buzzer will be used. The buzzer will be activated when the assigned doctors details are sent to the system. The 5v buzzer is displayed in the figure below.

Figure 5. 3 5V buzzer

## Appendix E

## Individual Contribution

Temperature Sensor [14]

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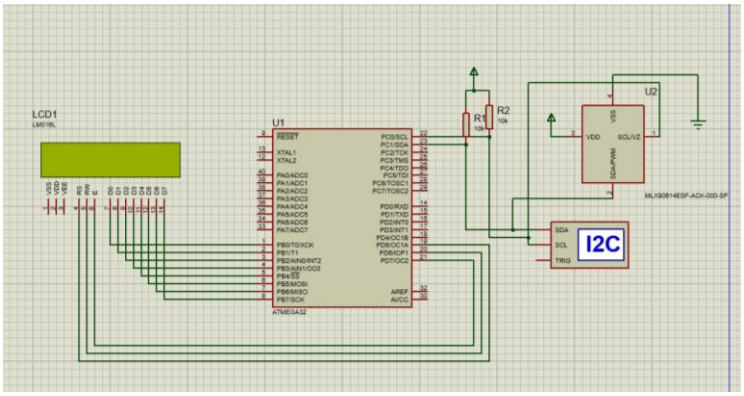


Pressure sensor [15]

Model Name- AMS5915-1000-D

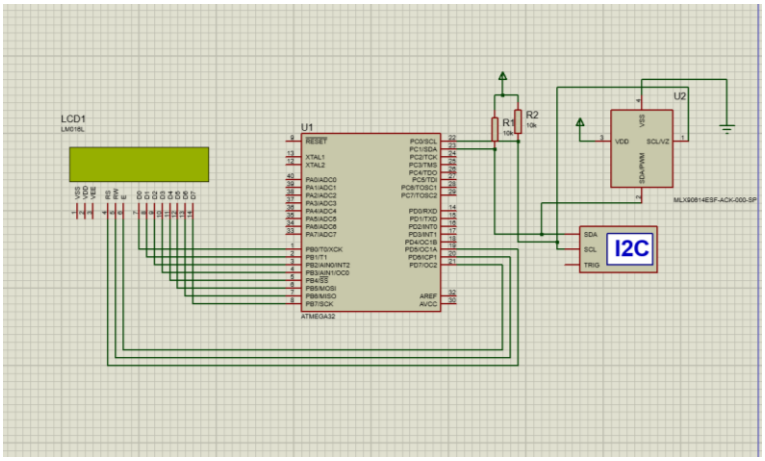


Table 1. 2

| Name | Contribution |
|---|---|

| | |
|---|---|
| 205029N Goonewardena J.S.D.W | Literature Survey,<br>3D model,<br>Component identifiaction<br>Pin recognition,<br>Circuit Diagram<br>Report editing |
| 205118L Wijerathna R C D | Component identify<br>Pin recognition<br>Circuit Diagram |
| 205075B Perera L.S.V. | Report editing, Literature Survey,Introduction,<br>Component identification,<br>(Pulseoximeter and<br>4x4 Keypad)<br>Pin recognition<br>Circuit Diagram |
| 205094G SALGADU W.V.P. | Component identify<br>Pin recognition<br>Circuit Diagram |
| 205112M Van-Hoff S A | 3D model<br>Component identify<br>Pin recognition<br>Circuit Diagram<br>Report editing |

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[15] “ms5536c pressure sensor data sheet - Bing.” https://www.bing.com/search?q=ms5536c+pressure+sensor+data+sheet&cvid=f26250c428e5443494066787a1369037&aqs=edge.0.69i59l3j69i57j69i59j69i60l3.6247j0j1&pglt=43&FORM=ANSAB1&PC=HCTS (accessed Nov. 30, 2021).