PROJECT-II

Report on

# Smart Medicine Dispenser and Health Monitoring

Submitted in partial fulfilment of the requirements
of the degree of

**Bachelor of Engineering**
**(Electronics and Telecommunication Engineering)**

by


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Ramrao Adik Education Society's

**Ramrao Adik Institute of Technology**

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# Certificate of Approval

This is to certify that, the Project - II report entitled

**"Smart Medicine Dispenser and Health Monitoring "**

is a bonafide work done by

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# Declaration

We wish to state that the work embodied in this dissertation entitled "**Smart Medicine Dispenser and Health Monitoring**" has been carried out under the guidance of "Dr Ashwini Naik" at the Department of Electronics and Telecommunication Engineering, Ramrao Adik Institute of Technology during 2020-2021.

We declare that the work being presented forms our contribution and has not been submitted for any other Degree or Diploma of any University/Institute. Wherever references have been made to previous works of others, it has been indicated. We 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.

Saurav Ghag

Madhura Chhatre

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Hrithik Vishe

# Acknowledgements

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We take this privilege to express our sincere thanks to Dr Mukesh D. Patil, Principal, RAIT for providing the much necessary facilities. We are also thankful to Dr Chandrakant Gaikwad, Head of Department of Electronics and Telecommunication Engineering, Project Co-ordinator Dr Ashwini Naik and Project Co-coordinator Mrs Poonam Gadge, Department of Electronics & Telecommunication Engineering, RAIT, Nerul, Navi Mumbai for their generous support. Last but not least we would also like to thank all those who have directly or indirectly helped us in the completion of this project.

# Abstract

Doctors are crucial elements of society. Doctors are responsible for increased life expectancy and improved well-being in society. People who survive diseases such as cancer usually owe their survival to doctors, whose skills and dedication are vital for their cure. In times of pandemic their necessity increases than regular time. At times like today when the Covid-19 pandemic has risen and is spreading worldwide, the doctors and nurses are needed in every nook of the world. The pandemic has raised the need for healthcare workers 24/7 at hospitals which have increased their workload. At such times there is lots of pressure on them to check every patient's needs and to take care of them. To reduce the stress of healthcare workers and let them take a rest for a moment from their busy schedule, our team presents a model that can dispense the medicines to the patients and check their body parameters of the patients. The medicine dispenser will dispense the medicines for the patients which are prescribed by the doctors and at a scheduled time. The health monitor will check the body parameters like SpO2 and BPM. The doctors can check the health of the patients by their sitting in their comfort and only have to run during emergencies. The model can act as an assistant to the doctors.

***"Medicines cure diseases, but only doctors can cure patients."***

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# Chapter 1

## 1 Introduction

Healthcare workers are needed in every nook of the world now. Pandemic has raised the requirements of doctors and nurses almost in every hospital in the world. The doctors and nurses are under tremendous pressure to treat the patients and take intense care of them. The doctor has to prescribe the medicines according to the health of the patient and nurses must give those medicines to the patients and check the body parameters like blood pressure, oxygen level.

Today there is a growing need to assist senior citizens too. Due to their old age, they tend to forget things. If they forget to take medications there might be severe health issues happening to them. Sometimes if there happens an overdose of medication, then it can sometimes lead be fatal. In addition, seniors can face difficulty in handling the medicine as some pills are small in size.

Also, the doctors and nurses have to check the body parameters of the patients in person regularly. For this, health monitoring has been made within the model. The doctors can check the condition of the patient and medicine intake remotely.

### 1.1 Overview

Medication non-adherence is a serious public health issue with the increase in chronic diseases. To improve patient adherence, medication dispensers are often proposed. A medication dispenser is a device that delivers medication to the patient according to predetermined schedules; it is considered a very efficient device for improving medication adherence. Considering that users of medication dispensers are typically in the older age group or are mostly patients with chronic diseases, important investigations should be carried out for achieving the improvements mentioned above. We strive to make the work of doctors easy by creating a model that will dispense medications in the amount prescribed by the doctors themselves and at a scheduled time.

Also, doctors can keep a check on the health of patients from the information uploaded on the server by sitting in their cabins.

Figure 1: Medication Non Adherence

## 1.2 Objective

A smart medication dispenser with a high degree of scalability and remote manageability is proposed and constructed. The proposed smart medication dispenser allows multiple users to use a single medication dispenser, thus providing scalability to the device. It also allows medical staff and system administrators, instead of end-users, to manage medication dispensers, thus leading to cost efficiency and safe operation of the device. Medications for each patient are stored in a slide shaped structure and a slide slides the medicine into a Medication dispenser tray (MDT). One smart medication dispenser has one MDT, but it can be extended depending on the number of patients (we have built one MDT model). The medication schedule configured in the dispenser is updated remotely by medical staff workers. Also, the system settings, embedded programs, and operational errors are managed remotely by system administrators.

## 1.3 Motivation

Today in society there is a growing need to assist seniors. One very important task is taking prescription medication. There are issues concerning seniors' ability to remember to take and handle their medicine on their own. Many seniors who suffer from dementia or Alzheimer's may not remember when to take their medication or what medication to take. In addition, seniors often have difficulty handling their medication, as pills can be small and their containers difficult to open. To provide a solution to these problems, our group decided to design an automated pill dispenser. This would remind the client when to take their medication and the dispenser will dispense the necessary medication at specific times during the day. This would prevent the client from forgetting to take their medication, or accidentally taking the wrong medication while giving seniors increased independence and a better quality of life.

Our motivation to design this model was for the healthcare workers too. This model will help the doctors to have a regular check on their patients remotely and the nurses are not regularly required to give the medicines to patients. This allows the healthcare workers to take a rest for a while from their schedule.

## 1.4 Organization of Report

The rest of the report is organised as follows:

1. Chapter 2 summarizes some of the previous approaches related to medicine dispensing and health monitoring.
2. Chapter 3 discusses strategies and design related to the Medicine Dispenser and Health Monitor.
3. Chapter 4 gives the results of the model.
4. Chapter 5 concludes the present work and puts forward some future direction.

# Chapter 2

## 2 Literature Survey

Automated pill dispensers manufactured by top companies are predicated on transforming drug distribution. These devices are useful in taking proper medications at ease. According to a survey by the patient's authority of India, 74% of death count in hospitals occurs due to overdosage or under dosage of medicines. Figure below shows proof of the above statistics.

**Table 1. Top Five Medication Error Event Types Associated with Wrong Weights (n = 448)**

| EVENT TYPE | TOTAL | % OF TOTAL REPORTS (N=479) |
|---|---|---|
| Wrong dose/ overdosage | 208 | 43.4% |
| Wrong dose/ underdosage | 102 | 21.3% |
| Wrong rate (intravenous) | 47 | 9.8% |
| Extra dose | 12 | 2.5% |
| Other | 79 | 16.5% |

Figure 2: Report of different medication errors

The principal idea that needs to be attended to solve the above-mentioned problem is to design an automated pill dispenser which needs no human intervention. There is a provision of an alarm system built into the device which consists of an LED to indicate that medicine is dispensed.

The aim of this project is also to supervise the heart rate, blood pressure, and oxygen level through respective sensors. The recorded data is available for doctors to view on their servers. Doctors can check the data remotely.

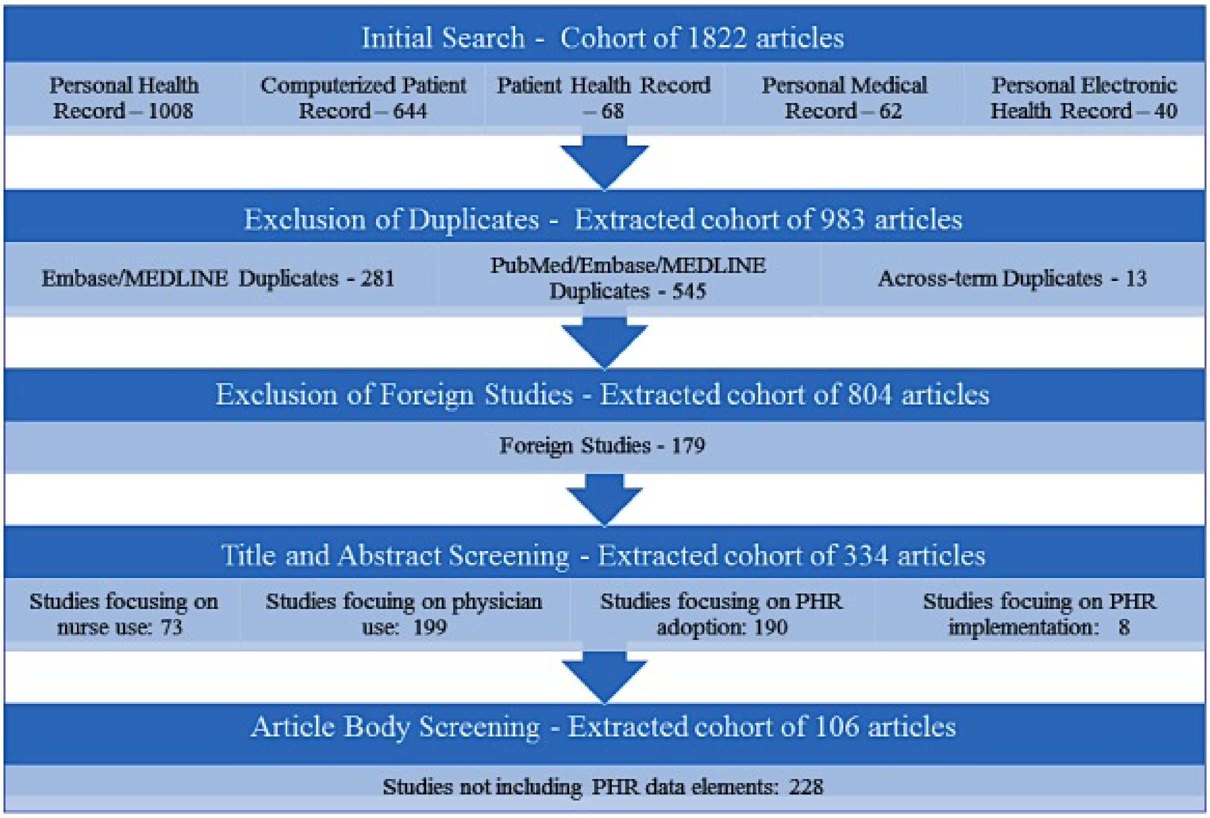


Figure 3: Patient health record monitors

## 2.1 Survey of existing system

Medication management is a complex task and older adults have different usability concerns than younger counterparts regarding vision, cognitive ability and physical function. The medication dispensing device was designed to simplify the complex task of medication management to reduce medication errors and improve communication with providers.

Medication error reduction and better communication are important to reach the larger goals of improved outcomes in older adult health status, rates of hospitalization, rates of nursing home admission, total costs of care and costs per quality-adjusted life-year. Older adults in this study accepted the medication dispensing device as reliable, easy to use and useful in coordinating

Figure 4: Variety of automated pill dispensers

personal medication management. These results indicate that technology-enhanced medication dispensers can be acceptable tools for older adults to help manage their care.

Health monitoring systems in smart environments have evolved rapidly to become a viable alternative to traditional healthcare solutions. Health monitoring systems aim to not only reduce costs but to also provide timely e-health services to individuals wishing to maintain their independence. In this way, elderly people can avoid, for as long as possible, any interaction with healthcare institutions (e.g. nursing homes and hospitals), which in turn reduces pressure on the health system.

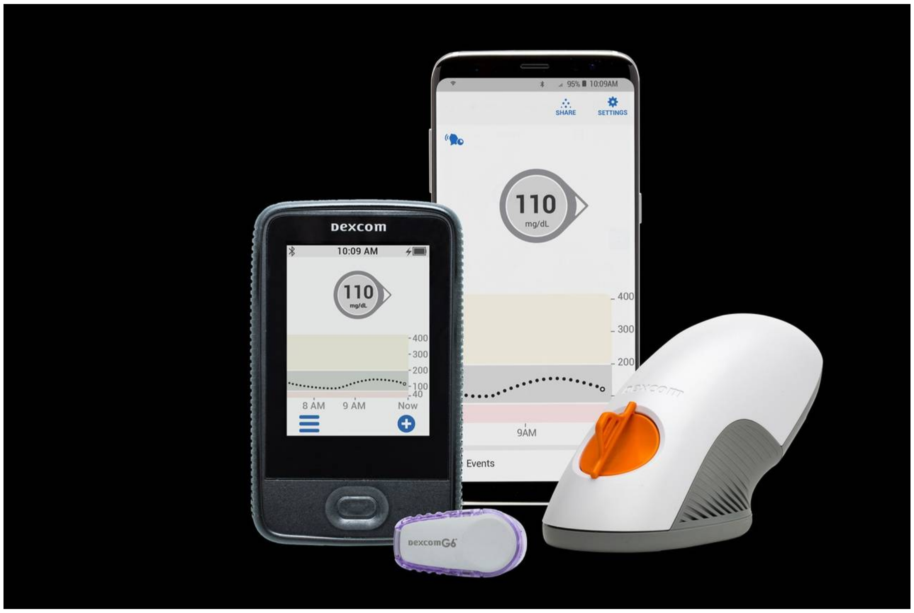


Figure 5: Wearable Health Monitors

## 2.2 Limitation of existing system

- **Staff may lack training on computerized programs:**

Some staff members might not be computer literate and may need extensive training to know how to program automated dispensing machines correctly. When hospital staff members aren't properly trained on the use of technology as it relates to infusion devices, a patient may receive the wrong medicine or wrong dose at the wrong time—all key elements to a patient's safety.

- **The dispensing machines may be programmed incorrectly:**

Many patients in hospitals are receiving morphine drips, heparin drips, and other medicine drips through computerized IVs. While these automated systems have helped decrease the high volume of medication errors in hospitals, they are not foolproof. This is because intelligent pumps and IVs are programmed by humans. So if a nurse is in a hurry to give a patient a drug and programs the wrong dose into the computerized system, the medication error will occur due to the programming error. Also, if a nurse doesn't set up the technology correctly, patients won't get the drugs they are supposed to be receiving. This is a huge concern for diabetics and other patients who need their medications and doses. As a result, critical mistakes made by hospital workers can seriously impact patients' overall health.

- **Administration of drugs through machines may lead to death:**

After surgery, many patients are given morphine drips intravenously to help reduce pain. Unfortunately, if a hospital staff member programs the wrong dose of the drug and an overdose is given, a patient can have difficulty breathing. A patient may stop breathing and die. Sadly, critical mistakes made by hospital workers have resulted in unnecessary fatalities.

- **System Failure may lead to dispensing of the wrong instrument or wrong amount of doses:**

There might sometimes in rare cases occur sudden errors in the programming of the code of the dispensers or any technical errors in the system. This might lead to wrong pill dispensing. All these factors can have a severe effect on the health of the patient.

## 2.3 Problem Statement

There is a need for medical practitioners in the country which is difficult for healthcare workers to handle completely on their own. We provide an assistant which will be along every time. As the Covid outbreak reached India, the need for medical practitioners increased rapidly. Through our project, we present a model who will act as an assistant for the doctor who will monitor the patient 24x7 and keep a check on the patient's body parameters.

## 2.4 Scope

The primary purpose of the shelling out system is to offer the drugs to the customers 24/7 so it is able to assist the village individuals who are a long way far from the clinic or the hospital to shop for the drugs additionally it is able to be mounted like an ATM so it is simple to apply via way of means of the human beings despite the fact that in the event that they can't study and write. The remedy may be changed via way of means of the administrator of the system sometimes primarily based totally at the expiration date or if it's miles empty the system will alarm the administrator to top off the system via SMS or telecom messenger. A new technology of user-centric facts structures is rising in fitness care as affected person fitness tracking structures. These structures create a platform assisting the brand new imaginative and prescient of fitness offerings that empower sufferers and permit affected person-company communication, to enhance fitness effects and decrease costs.

# Chapter 3

## 3 Hardware and Software

### 3.1 Hardware components

The hardware components are implanted in the medicine dispenser and health monitor to make the model work efficiently. The model works as:

1. When the real-time clock reaches the predetermined medication time,
2. The predetermined pharmaceuticals are dispensed from the medication dispensing tray (MDT).

The hardware components used in the project are:

1. **CONNECTING WIRES:**
   Interfacing wires permit an electrical current to travel from one purpose on a circuit to a different one since power wants a medium through that to manoeuvre. Most wires in computers and electronic elements square measure manufactured from copper or Al. Copper is reasonable and electrically conductive. Silver has higher conduction, however, is way costlier.

Figure 6: Connecting wires

2. **BREAD BOARD:**
As the title suggests, the term breadboard can be inferred from two terms, specifically bread and board. A breadboard definition is a plastic board in a rectangular shape that incorporates a number of little gaps in it to allow you to put distinctive components together to construct an electronic circuit. The association on the breadboard isn't changeless, but it can be associated without patching the components. The fabric utilised to create the breadboard is white plastic. At the show, most of the breadboards are solderless sorts, so they are ready to simply plug in the components and associate them through the outside control supply. The various types of breadboards are available based on the specific point gaps. For instance, a 400 point sort, an 830 point sort, etc.

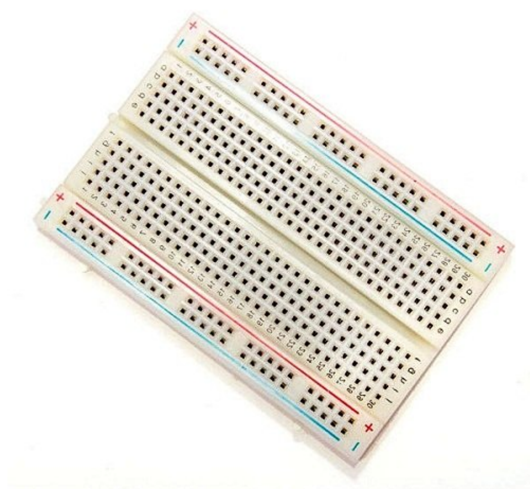

Figure 7: Breadboard

3. **LED:**
An LED is a full light-emitting diode, and in gadgets, a semiconductor gadget that radiates infrared or overt light when charged with an electric current. LEDs work by electroluminescence, a marvel in which the emanation of photons is caused by the electronic excitation of a fabric. The fabric utilised most regularly in LEDs is gallium arsenide, in spite of the fact that there are numerous varieties of this essential com-

pound, such as aluminium gallium arsenide or aluminium gallium indium phosphide.

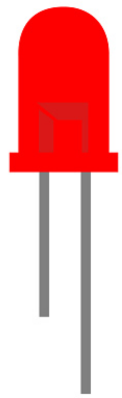

Figure 8: LED

4. **SERVO 9G:**
Small scale Servo Engine SG90 may be a minor and lightweight server engine with tall yield control. The servo can turn around 180 degrees (90 in each course) and works a bit like the standard sorts but little. You'll be able to utilize any servo code, equipment or library to control these servos. Great for beginners who need to create stuff to move without building an engine controller with criticism equipment box, particularly since it'll fit in little places. It comes with 3 horns (arms) and hardware.

   Features:

   - Weight: 9 g


Figure 9: Servo Motor

5. **PCA9685:**
The PCA9685 is a 16-channel I2C-bus controlled LED controller optimised for Red/Green/Blue/Amber (RGBA) colour backlighting applications. Each led yield has a 12-bit determination (4096 steps) PWM controller with a settled recurrence. The controller works at a programmable recurrence from an ordinary 24 Hz to a 1526 Hz with an obligation cycle that's flexible from 0% to 100%, so the LED can be set to yield a particular brightness. All yields are set to the same PWM frequency. With the PCA9685 as the ace chip, the 16-channel 12-bit PWM Servo Driver needs 2 pins to control 16 servos, incredibly diminishing the tenant I/Os. Besides, it can be associated with 62 driver boards at most in a cascading way, which implies it'll be able to control 992 servos in total.

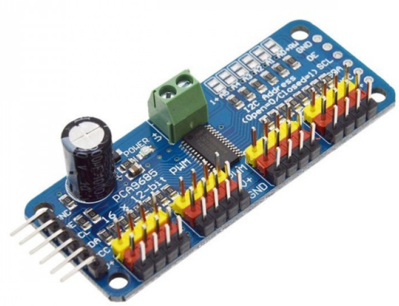

Figure 10: PCA9685

6. **NODE MCU:**
   The NodeMCU ESP8266 advancement board comes with the ESP-12E module containing the ESP8266 chip and a Tensilica Xtensa 32-bit LX106 RISC chip. This chip bolsters RTOS and works at 80 MHz to 160 MHz movable clock recurrence. NodeMCU has 128 KB of Slam memory and 4MB of Streak memory for storing data and programs. Its tall handling control with in-built Wi-Fi, Bluetooth.

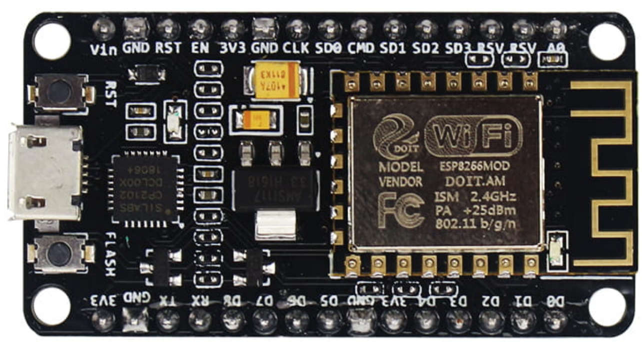


Figure 11: NODE MCU

7. **PCB:**
   A printed circuit board (PCB) is an electronic circuit utilised in gadgets to supply mechanical bolster and a pathway to their electronic components. It is made by combining diverse sheets of non-conductive fabric, such as fibreglass or plastic, that easily hold copper circuitry. A PCB is additionally known as a printed wiring board (PWB) or carved wiring

board (EWB). A PCB works on the copper films/assembly/circuit that are set up on the interior of it to supply a pathway for the stream of current. A PCB can hold different electronic components that will be fastened without utilising unmistakable wires, which encourages its use. PCBs can be found in nearly every electronic and computing device, from motherboards, organise cards, and illustration cards to the inner circuitry of hard/CD-ROM drives. PCBs play a crucial part in the regions of control, execution, unwavering quality, and security of a computing framework.

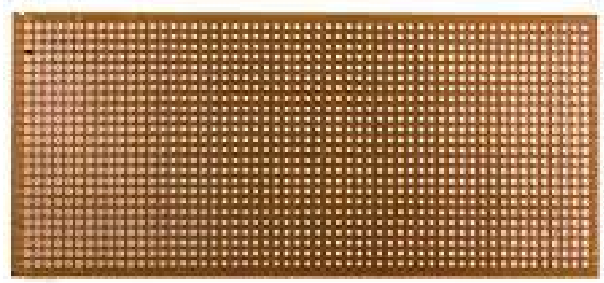

Figure 12: PCB

8. **MAX30100**
The MAX30100 may be a total beat oximetry and heartrate sensor framework arrangement outlined for the requesting requirements of wearable gadgets. The MAX30100 gives a very little add up to arrangement estimate without relinquishing optical or electrical execution. Negligible outside equipment components are required for integration into a wearable device. The MAX30100 is completely configurable through computer program registers, and the advanced yield information is put away in a 16-deep FIFO inside the gadget. The

FIFO permits the MAX30100 to be associated to a microcontroller or microprocessor on a shared transport, where the information isn't being read continuously from the device's registers.

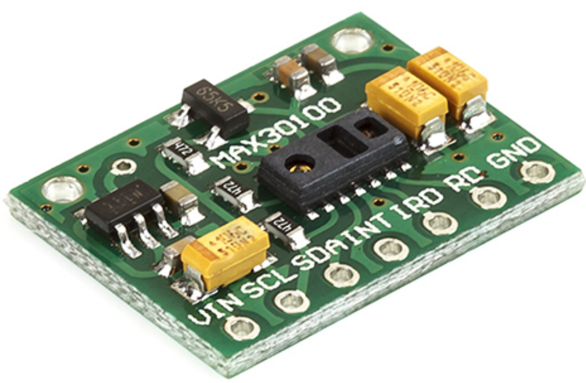


Figure 13: MAX30100

## 3.2 Software implementation

1. **ARDUINO IDE:**
   The Arduino Software (IDE)[Figure1] is an open-source programme that makes it simple to create code and upload it to the board. Any Arduino board can be used with this software. The Arduino Integrated Development Environment (IDE) includes a text editor for writing code, a message area, a text console, a toolbar with buttons for basic functions, and a menu system. It connects to the Arduino hardware and communicates with it to upload and communicate with programmes.

Figure 14: Arduino IDE

2. **VS CODE:**
   Visual Studio Code could be a lightweight code editor options features for debugging, task execution, and version management. It seeks to offer developers solely the tools they have for a speedy code-build-debug cycle, and exploit a lot of subtle workflows to full-featured days like Visual Studio IDE. VS Code is out there for mackintosh OS X, Linux, and Windows. The supported versions are listed within the needs documentation. a lot of platform-specific info will be found within the Setup summary.

Figure 15: VS Code

3. **TINKERCAD:**
   Tinkercad is a free and simple 3D design, electronics, and coding programme. Teachers, students, hobbyists, and designers use it to imagine, design, and create anything! Users may rapidly learn how to use Tin-

kercad by following simple tutorial sessions that focus on the tool's fundamentals.

Figure 16: Tinkercad

4. **PROTEUS:**
   Proteus is a program that allows you to simulate, design, and draw electronic circuits. The Labcenter electronic was the one who came up with the idea. Proteus may also be used to create two-dimensional circuit designs. Proteus is a full-featured development platform that takes you from concept to finish. Intelligent principle layout, hybrid circuit simulation and precise analysis, single-chip software debugging, single-chip and peripheral circuit co-simulation, and PCB automatic layout and wiring are just a few of the benefits.

Figure 17: Proteus

### 3.3 Design Strategies

Our project consists of two parts namely, Medicine Dispenser and Health Monitor. The idea is to make the patients not reliable on nurses and doctors all the time for medicine intake or to check the body health parameters. In this way, patients can become independent for taking medicines and the healthcare workers can also take time out from their busy schedule and know about the patient's health from sitting at their own comfort.

The barriers for loading and dispensing the pills are created on a "Y" shaped beam made of steel. The servo motors are inserted in this barrier and open when the servo motors move. When the barrier opens, the medicine gets dispensed in metal tray which is used as medicine dispenser tray. There is a square opening on the box allowing a person to collect the medicine. The small circular opening at one side of the box is for sensor from where the patient will place his finger to check SPO2 and BPM levels.

Figure 18: Medicine Dispenser actual Circuit

## 3.4 Medicine Dispenser Designing

Medicine dispenser is an instrument that dispenses medicine time to time in prescribed quantity. The medicine, time of medicine intake and quantity of medicine are all under the
doctors' prescription. The patient only needs to take the medicine from the dispenser box when the LED light glows at the set time.

The required components for Medicine Dispenser are servo motors, a wifi module, a resistor and a LED. The servo motors are used to lift the barrier created for medicine pills to slide down before the set alarm time. The wifi module (Node MCU) is used to establish internet connection to send the messages or information on the webapp created. The webapp has all the informatioon about the patient. When the medicine will be dispensed in the Medicine Tray and the LED will glow indicating the patient to collect the medicine. The patient can then pick the medicine from the tray and the information regarding the amount of pills dispensed will be then updated in the webapp.

### 3.4.1 Medicine Dispenser Circuit

The circuit of medicine dispenser contains wifi module(Node MCU), PCA9685, a resistor and LED connected on breadboard. The wifi module is connected for internet purpose. The connections of the circuit are as:

1. **Servo:**
   - GND to ESP32 GND pin;
   - Power to ESP32 VIN pin;
   - Signal to D1, D2, D3, D4 or (GPIO5, GPIO4, GPIO0, GPIO2)
2. **LED:**
   - GND to Cathode
   - D5 to Anode
3. **RESISTOR:**
   - GND to LED

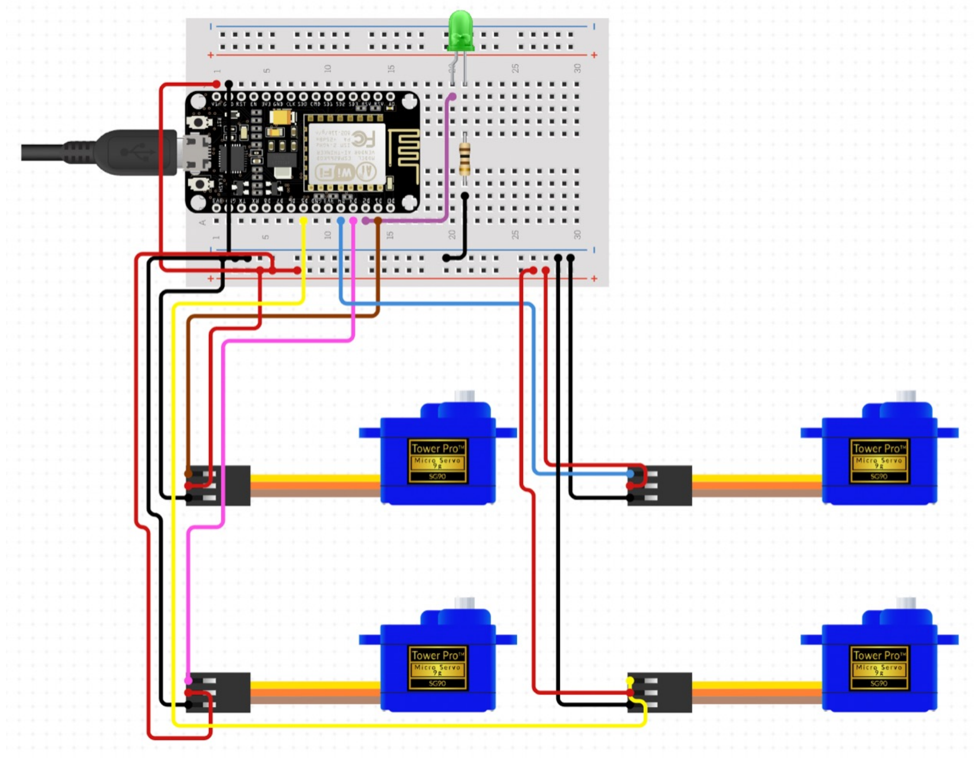

Figure 19: Medicine Dispenser Circuit

### 3.4.2 Working of Medicine Dispenser Circuit

The wifi module has connections to the webapp where updates are displayed. In this prototype state project when one opens the web app, they can see set alarm time option and dispense options for two different pills at a time. When alarm is set and it is time to dispense the medicine, the pill will be dispensed by the barrier being lifted by the servo and the medicine will be dispensed in the medicine tray. If two pills are to be dispensed at the same time then both the pills from each hand of the dispenser slider of the designed model will dispense the medicine when the servo lifts the barrier. Four servos are used wherein two servos are attached to each side of the two dispenser slider hand. First servo of the dispenser slider hand will load the pill in the dispenser slider. The second servo will dispense the medicine in the medicine medicine dispense tray kept at the bottom from where the patient can collect the medicine. The LED will glow when the medicine is dispensed in the medicine dispense tray indicating the patient to collect the medicine.

## 3.5 Health Monitor Designing

A Health Monitoring System technology, an alternative to the traditional management of patients and their health. Health services have become more important with the advent of the need to collect health data remotely from a patient automatically. The wireless body area network (WBAN) is a biomedical sensor network node connected wirelessly to the communication devices to be worn on the body and near the area of the body. The WBAN is composed of small devices and low power biomedical nodes to prolong the lifespan of sensor nodes.

The required components for Health Monitoring System are MAX30100 and Arduino. Arduino boards are able to read input such as light on a sensor or finger on a button and turn it into an output as activating a motor or turning on a LED. The input of placing finger on the sensor is taken here by the arduino and output is given in the health parameter numbers.The MAX30100 is an integrated pulse oximetry and heart- rate monitor sensor solution. MAX30100 in this project senses values and prints the BPM and SPO2 values on serial monitor.

### 3.5.1 Health Monitoring Circuit

In this circuit we interfaced MAX30100 Pulse Oximeter Sensor with Arduino. he MAX30100 Sensor is capable of measuring Blood Oxygen  Heart Rate. The blood Oxygen Concentration termed SpO2 is measured in Percentage and Heart Beat/Pulse Rate is measured in BPM.

**CONNECTIONS:**

1. Vin to MAX30100 Vin
2. GND to MAX30100 GND
3. SDA pin to MAX30100 SDA pin
4. SCL pin to MAX30100 SCL pin
5. Digital pin no 5 to MAX30100 int pin

The arduino which is interfaced wih MAX30100 pulse oximeter sensor takes input from this sensor and gives output in the from of BPM and SPO2 measurements. The LED will glow when finger is placed on the sensor as it will sense the input.

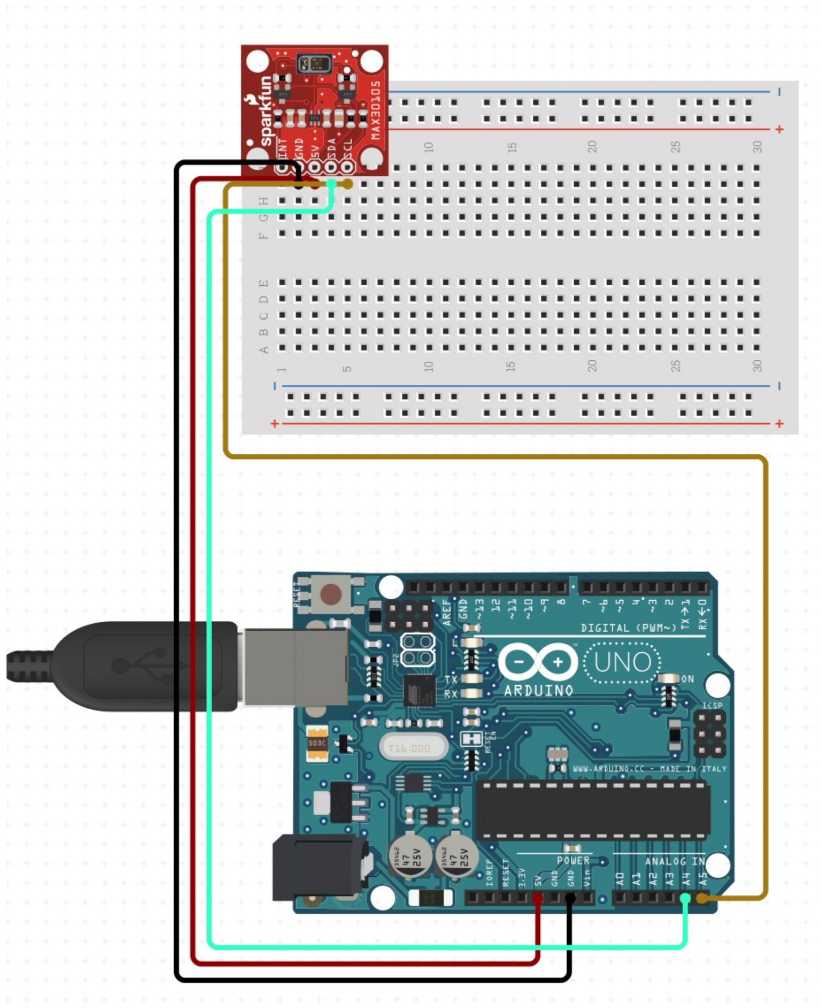


Figure 20: Health Monitor Circuit

### 3.5.2 Working of Health Monitor Circuit

The device has two LEDs, one emitting red light, and another emitting infrared light. For pulse rate, only infrared light is needed. Both red light and infrared light are used to measure oxygen levels in the blood. When the heart pumps blood, there is an increase in oxygenated blood as a result of having more blood. As the heart relaxes, the volume of oxygenated blood also decreases. By knowing the time between the increase and decrease of oxygenated blood, the pulse rate is determined. It turns out, oxygenated blood absorbs more infrared light and passes more red light while deoxygenated blood absorbs red light and passes more infrared light. This is the main function of the MAX30100: it reads the absorption levels for both light sources and stores them in a buffer that can be read via I2C communication protocol.

## 3.6 Combining Medicine Dispenser and Health Monitor

We designed the circuit of medicine dispenser and health monitor seperately and later combined both the circuits. Later we replaced arduino of health monitor to interface with Node MCU as Node MCU has inbuilt ESP32. ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The PCA9685 is a 16-channel 12-bit driver motor. To use multiple servos and make connections and programming easier and efficient we used PCA9685.So, the servos that will be helping in dispensing the medicine will be interfaced with PCA9685. When both the circuit are combined in one, the model will act both as medicine dispenser and health monitor. This will be beneficial as one gets the benefit of two instruments in one instrument.

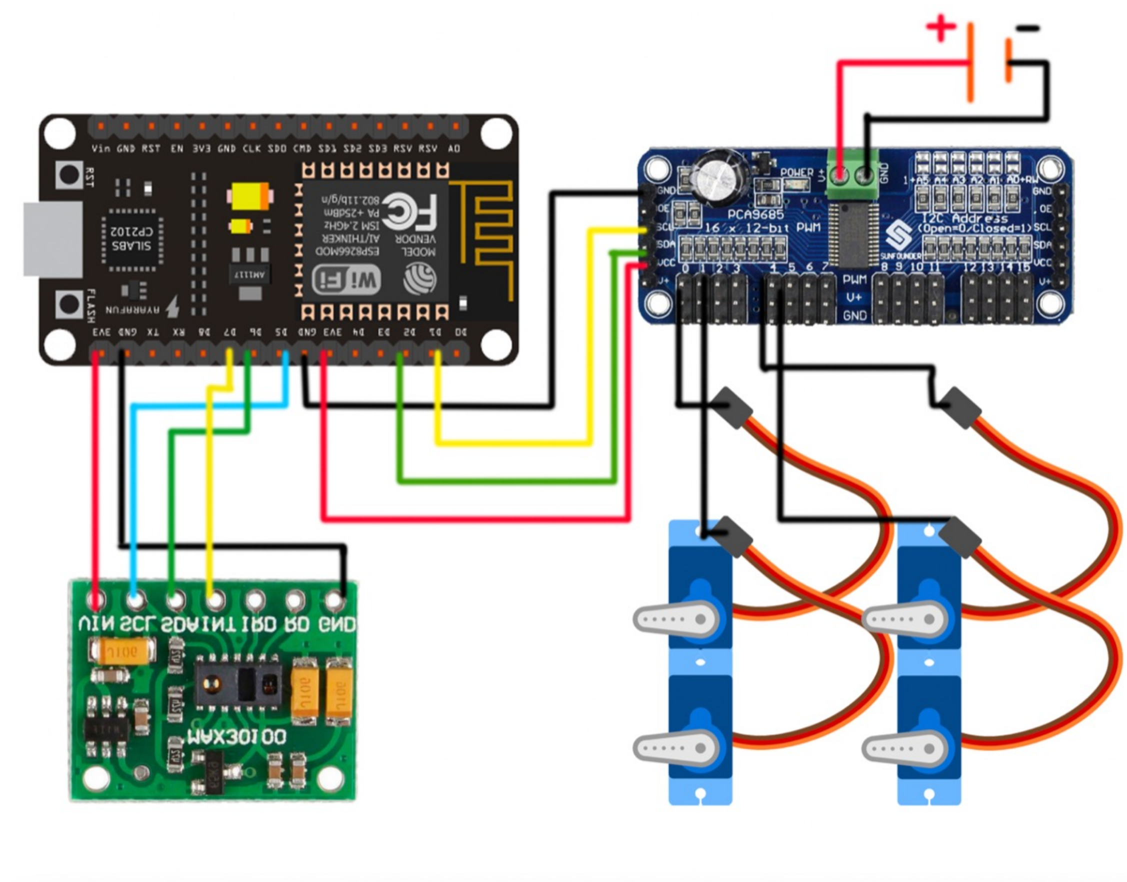


Figure 21: Combined Circuit

## 3.7 Algorithms/Flowcharts

The data obtained from the health monitor and medicine dispenser is communicated serially to Node MCU. The information is given to the web server via the internet and is stored over there. The web server has patients' information and displays the medication prescription, medication timings and body parameters on it. Max30100 records BPM and SPO2 parameter which are uploaded on the web server where doctor has access to the parameters, doc studies and prescribe medicine through the server, where they schedule and set which medicine to take at what time. This is reflected on the client side or patient side so that patient is monitored remotely and prescribed medications accordingly. ESP32 on Node MCU helps in communication between web server and components through internet. nternet acts as an medium of communication between them. The block diagram of the model is shown below:

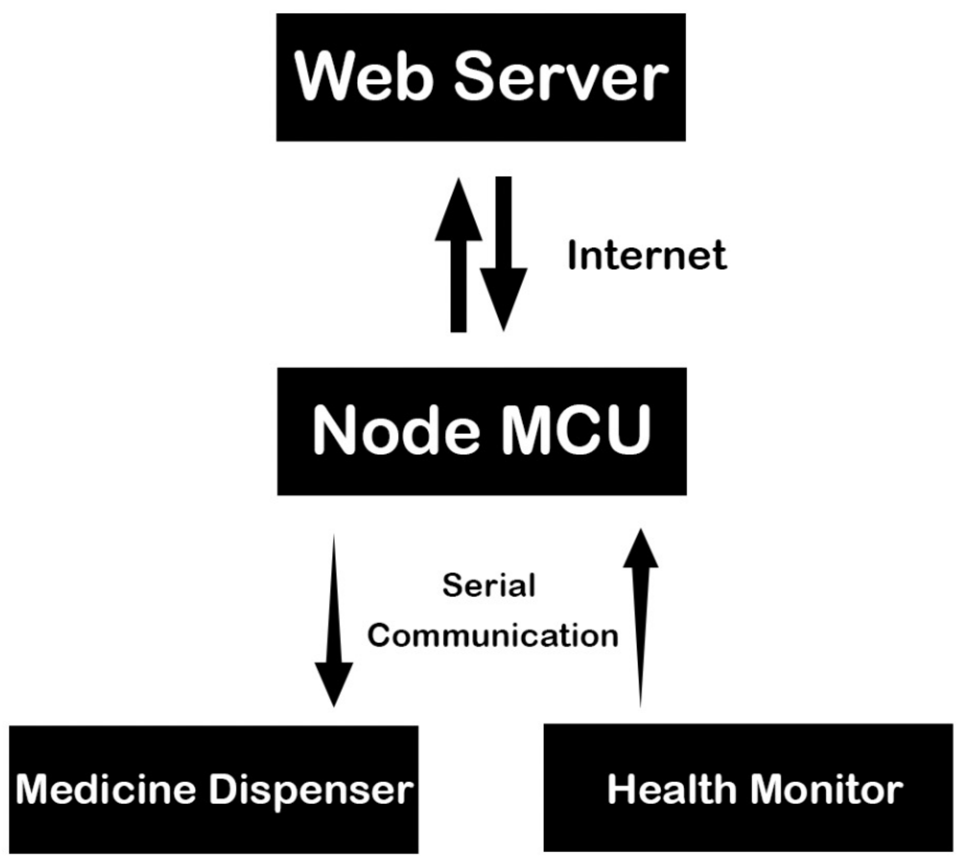


Figure 22: Block diagram of the project

# Chapter 4

## 4 Results

The project consists of a dispenser and a patient monitor. The model consists medicine dispenser which will dispense medicine from time to time as per scheduled by the doctor in a prescribed quantity. A doctor can schedule this dispenser remotely. The patient monitor will monitor the health parameters of the patient such as ECG, SPO2, BPM and Body Temperature from time to time and record the results for the doctor. The end result of the model is shown below:

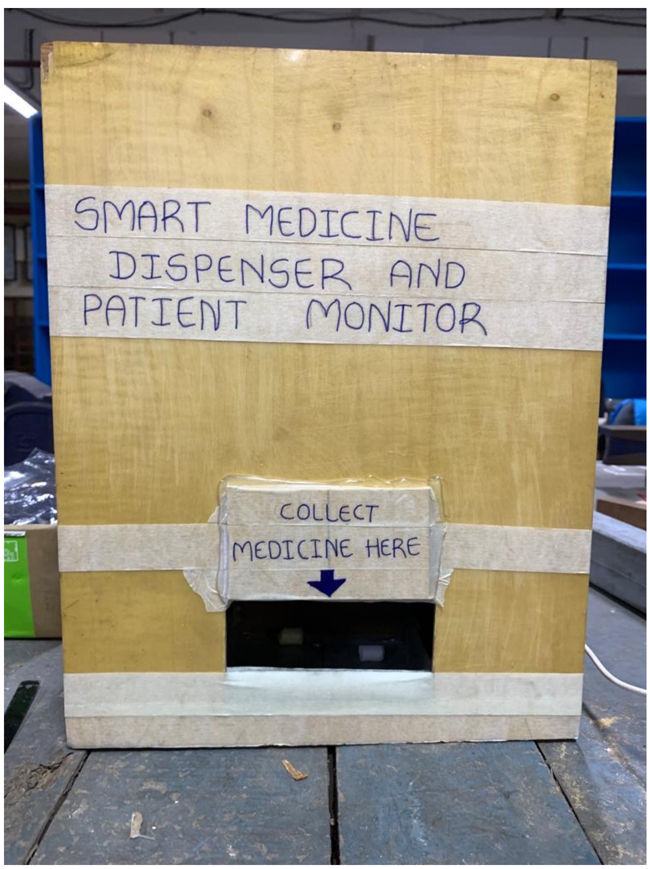


Figure 23: Actual Model

We designed a web app for the patients, where the patients can login in to their information. The SPO2, BPM measurements and the medication requirements are all shown on the server. Figure below shows a screenshot of the web app for the patients.

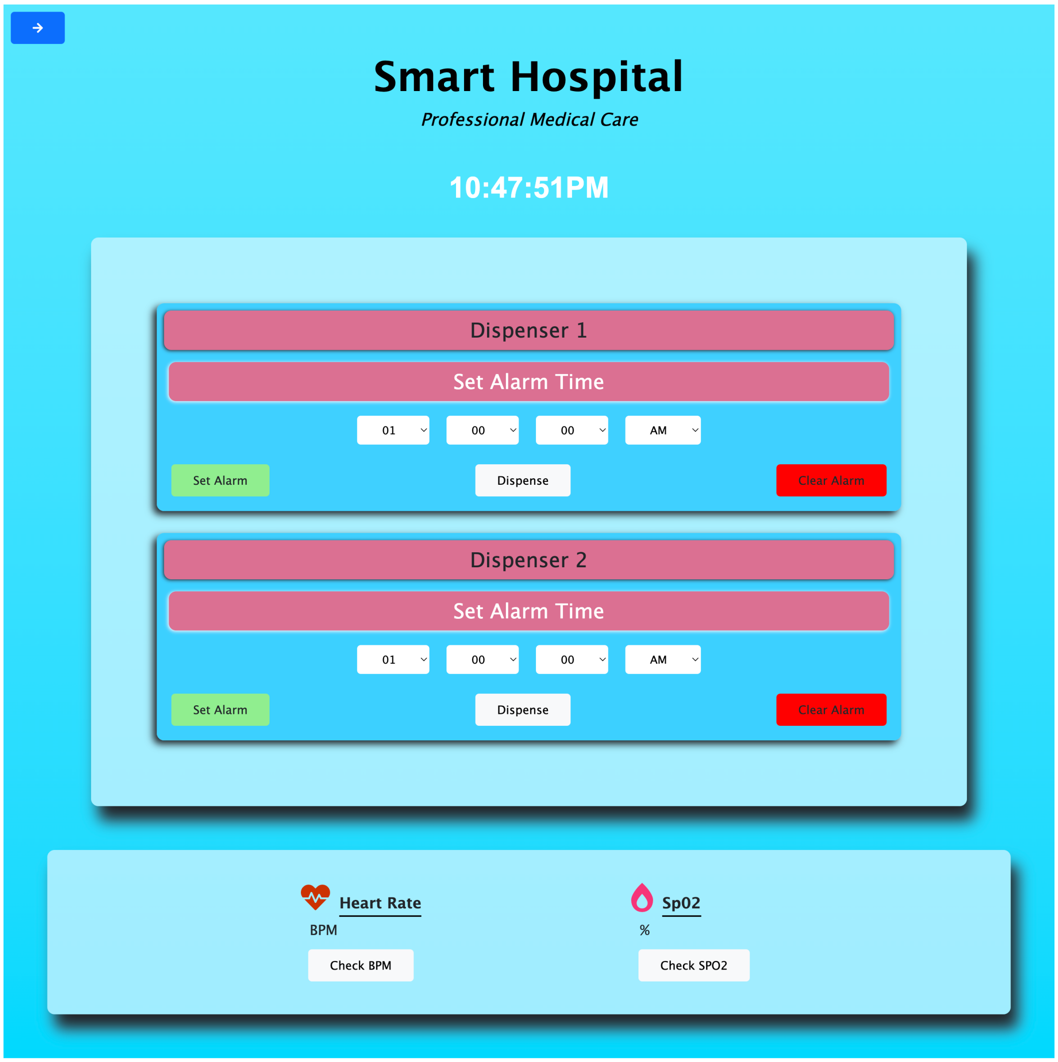


Figure 24: Web-app for patients

The image above gives information about the patient's heart rate and oxygen level. The timer displays the time set for medicines to dispense. At the max, at prototype level of project only two medicines can be dispensed. Hence, there are two dispenser information displayed. Here is the user interface (UI) of the webapp of the dispensing time setting.

Several major discoveries about the scope and functionalities of the Health monitoring system are presented. To promote understanding and provide insights for future directions, we also present a functional taxonomy and temporal analysis of Health monitoring system data kinds and functionality. The availability of novel Health monitoring system data sources, such as tracking devices, and data categories, such as time-series data, was discovered using a functional taxonomy analysis of the extracted data. Health monitoring system features evolved throughout time, from simple data access to data change and, more recently, automated assessment, prediction, and suggestion, according to chronological data analysis.

# Chapter 5

## 5 Conclusion and Future work

The proposed dispenser has three advantages over being drug dispensers.

1. To achieve a high degree of scalability, the drug-allocating servers can be attached in the race, and therefore, a single dispenser can support multiple druggies.

2. To achieve a high degree of remote manageability.

3. To reduce operation costs and sweats, remotely management main styles are designed and enforced.

### 5.1 Conclusion

In this semester we have successfully completed the project with a higly effcient working model involving precise hardware and software. We have made a medicine dispenser and patient monitor which effectivelty monitors patient SpO2 levels,BPM and dispenses medicine prescribed by the doctor at scheduled time.

### 5.2 Future Work

We will be updating the web app made for the doctor by adding more elements such as ECG graph, patients body temperature and also an involving Machine Learning in order to predict the precise prescriptions for realtively minor problems so that the doctor doesn't have to waste time on minor health realted issues. We will be adding a couple of extra components such as MLX90614 for body temperature, ECG probes and a LCD screen in order to display the ECG graph of the patient and lastly we will be making two more dispensers, a syringe dispenser which will refill the syringes as well and an medical instruments dispenser.With the help of this hardware/software project we are making a project that will help to perpetuate the functions involved in the monitoring of patients in order to help the doctors in doing theirs examinations effectivelty, effortlessly and remotely.

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