DAYANANDA SAGAR UNIVERSITY

KUDLU GATE, BENGALURU – 560068

Bachelor of Technology
in
COMPUTER SCIENCE AND ENGINEERING

Major Project Phase-II Report

PATIENT IMAGE RECOGNITION AND MEDICINE DISPENSING SYSTEM USING MACHINE LEARNING AND INTERNET OF THINGS (IoT)

By

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(2021-2022)

DAYANANDA SAGAR UNIVERSITY

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CERTIFICATE

This is to certify that the Phase-II project work titled **“PATIENT IMAGE RECOGNITION AND MEDICINE DISPENSING SYSTEM USING MACHINE LEARNING AND INTERNET OF THINGS (IOT)”** is carried out by **Nobin Johnson (ENG18CS0197), Polaki Monika (ENG18CS0199), Prajwal S (ENG18CS0211), Thimmareddygari Jagadeeswar Reddy (ENG18CS0300),** bonafide students of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bengaluru in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering, during the year **2021-2022**.

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1.

2.

DECLARATION

We, **Nobin Johnson (ENG18CS0197), Polaki Monika (ENG18CS0199), Prajwal S (ENG18CS0211), and Thimmareddygari Jagadeeswar Reddy (ENG18CS0300),** are students of eighth-semester B.Tech in **Computer Science and Engineering**, at School of Engineering, **Dayananda Sagar University**, hereby declare that the phase-II project titled **“Patient Image Recognition and Medicine Dispensing System Using Machine Learning and Internet of Things (IoT)”** has been carried out by us and submitted in partial fulfillment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2021-2022**.

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NOMENCLATURE USED

ML	Machine Learning
HTML	Hyper Text Markup Language
CSS	Cascading Style Sheets
JS	JavaScript
IoT	Internet Of Things
JSON	JavaScript Object Notation
UI	User Interface
GPIO	General Purpose Input Output
IR	InfraRed
KNN	K Nearest Neighbors
BGR	Blue, Green, Red
RGB	Red, Green, Blue

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ABSTRACT

This project attempts to develop an Automated Medicine Dispensing System. Some of the modules involved are face recognition, the use of motors and detectors with IoT (Internet of Things), Database Management, and Web development.

An automated Medication Dispensing System detects the patient using unique features such as face identification. The system then fetches the medication prescribed to the identified patient from the database. The system then uses servo motors to dispense the tablet from a tube containing the tablets. When the patient reaches out their hand, the IR sensor detects the presence of an object, and the medication is dispensed. The quantity of the medication is updated in the database and displayed on a webpage in real-time. The system is user-friendly and efficient.

CHAPTER 1

INTRODUCTION

CHAPTER 1: INTRODUCTION

Due to the current state of the world, the medical industry has been burdened with the growth in the number of patients. This has led to excessive demand for faculties such as doctors and patients, which cannot perform the basic activities done before such as checkups and medication supply. The proposed system aims to automate these once performed routines such as medication dispensing using machine learning and Internet of Things (IoT) aspects.

1.1 SCOPE

In late 2019 a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), caused an acute respiratory disease, coronavirus disease 2019 (covid-19), spread from its origins in China to become a pandemic. As of 26 March 2020, 455 770 cases had been identified worldwide, causing 20 740 deaths. No successful therapeutic intervention for covid-19 has yet been established, so supportive care is the most important aspect of clinical management, supporting the patient’s physiology to aid recovery. Optimal provision of supportive care is therefore fundamental both to the wellbeing of individual patients and to securing the confidence of the general population. To enable the provision of the best care, clinicians need evidence-based recommendations developed using accepted methods. Such clinical guidelines must be readily available; hence this project is useful as a supportive care automated method. It's very useful in medical institutions and can be installed as a standard. Since it's scalable, a single unit can be provided for any number of patients. It will have a social impact due to the current state of the world. The contactless machinery in healthcare has grown in demand and this will be used to reduce the spreading of diseases as well as provide a sanitized and hygienic way of medication dispense.

CHAPTER 2

PROBLEM DEFINITION

CHAPTER 2: PROBLEM DEFINITION

To build an automated medication dispensing system that includes the Internet of Things (IoT) for motor and sensor controls which can address the challenge of the need for independence in supporting patients with less ability to identify and prescribe medicine and to maintain/ schedule those in the treatment. Machine Learning models will be implemented for facial recognition and person recognition systems using computer visions. Database and web development aspects will be integrated to build a visual tracker for the stock of medication remaining and a faculty portal for faculty operations through ethernet using database and HTML, CSS, and backend elements.

CHAPTER 3

LITERATURE REVIEW

CHAPTER 3: LITERATURE REVIEW

An elaborate literature survey was done for the relevant research. The following table contains a detailed summary of the papers, we used for our project.

Table 3.1 Literature Review

Si. No.	Title	Author	Description	Year
1	Path follower & obstacle avoidance smart robot vehicle: Applications of arduino programming	K. Ayush and R. Biswas	Working on Arduino and its application and design in the development of a path-following, obstacle avoidance robot.	2021
2	Servo Motor	H. Fattah	Describes the working of servo motor and stepper motor.	2021
3	Infrared sensors and ultrasonic sensors	X. Bi	Gives insights into the concepts of infrared and ultrasonic sensors.	2021
4	NoSQL comparison 2021: Couchbase server, MongoDB, and Cassandra (DataStax)	A. Yudovin and C. Gutierrez	Comparison and analysis between MongoDB and Cassandra.	2021
5	RT-MongoDB: A NoSQL database with differentiated performance	R. Andreoli, T. Cucinotta, and D. Pedreschi	Provides an extension to MongoDB that enables differentiated per-user/request performance.	2021

6	Accuracy enhancement in face recognition using 1D-PCA & 2D-PCA based on multilevel reverse-biorthogonal wavelet transform with KNN classifier	I. Dinariyah and Alamsyah	Implementation of decomposition and improving the accuracy of facial recognition in the AT&T and YALE dataset.	2021
7	An ingenious face recognition system based on HRPSM_CNN under unrestrained environmental condition	M. Tamilselvi and S. Karthikeyan	Implementation of HRPSM-CNN algorithm in the visually impaired assistive device, providing an accuracy rate of 97% & 96% for ORL, AR and LFW face database respectively.	2021
8	Machine Learning based Patient Face Recognition and Medicine Dispensing System using Raspberry Pi	Azher, Mohammed & Jyothi, K	Gives the basic architecture and flow chart of the system.	2020
9	Raspberry Pi	J. F. Nusairat	Revolves around coding to the Raspberry Pi device. Gives insight into how a connected environment can be built between cloud, device, and user.	2020

10	Performance analysis of NoSQL and relational databases with CouchDB and MySQL for application’s data storage	C. A. Győrödi, D. V. Dumşe-Burescu, D. R. Zmaranda, R. Ş. Győrödi, G. A. Gabor, and G. D. Pecherle	Gives the advantages and disadvantages of each DBMS and is outlined in form of a performance comparison.	2020
11	An improved face recognition algorithm and its application in attendance management system	S. M. Bah and F. Ming	Presents a method known as the LBP algorithm combined with image processing techniques to address issues hampering face recognition.	2020
12	Face recognition systems: A survey	Y. Kortli, M. Jridi, A. A. Falou, and M. Atri	Reviews well-known techniques for facial recognition and analyses them.	2020
13	A Comparison of Arduino, Raspberry Pi and ESP8266 Boards	Ooko, Samson	Gives a detailed description between Arduino, Raspberry Pi, and ESP8266 boards.	2019
14	A review of comparison between NoSQL	Kaur, R. & Sahiwal, J.K.	Describes the comparison between MongoDB and CouchDB.	2019

	databases: MongoDB and couchDB			
15	A Review on Various Aspects of MongoDb Databases	A. Chauhan	Detailed analysis of MongoDB; giving insights into its advantages, uses issues, etc.	2019
16	Using modern web frameworks when developing an education application: a practical approach	S. Ivanova and G. Georgiev	Gives an overview and comparison of existing web technologies and frameworks.	2019
17	Implementation of database using python flask framework: College database management system	N. Chauhan, M. Singh, A. Verma, A. Parasher, and G. Budhiraja	Describes usage of python flask framework.	2019

CHAPTER 4

PROJECT DESCRIPTION

CHAPTER 4: PROJECT DESCRIPTION

An automated Medication Dispensing System detects the patient using unique features such as face identification. The system then fetches the medication prescribed to the identified patient from the database. The system then uses servo motors to dispense the tablet from a tube containing the tablets. When the patient reaches out their hand, the IR sensor detects the presence of an object, and the medication is dispensed. The quantity of the medication is updated in the database and displayed on a webpage in real-time. The system is user-friendly and efficient.

4.1 PROPOSED DESIGN

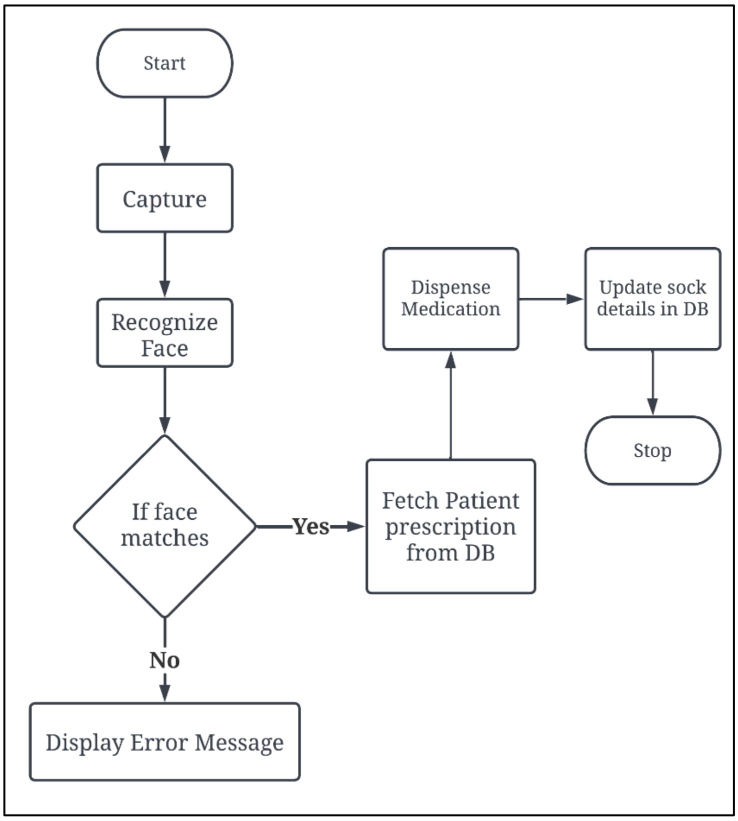


Figure 4.1.1 Flowchart of the dispensing system

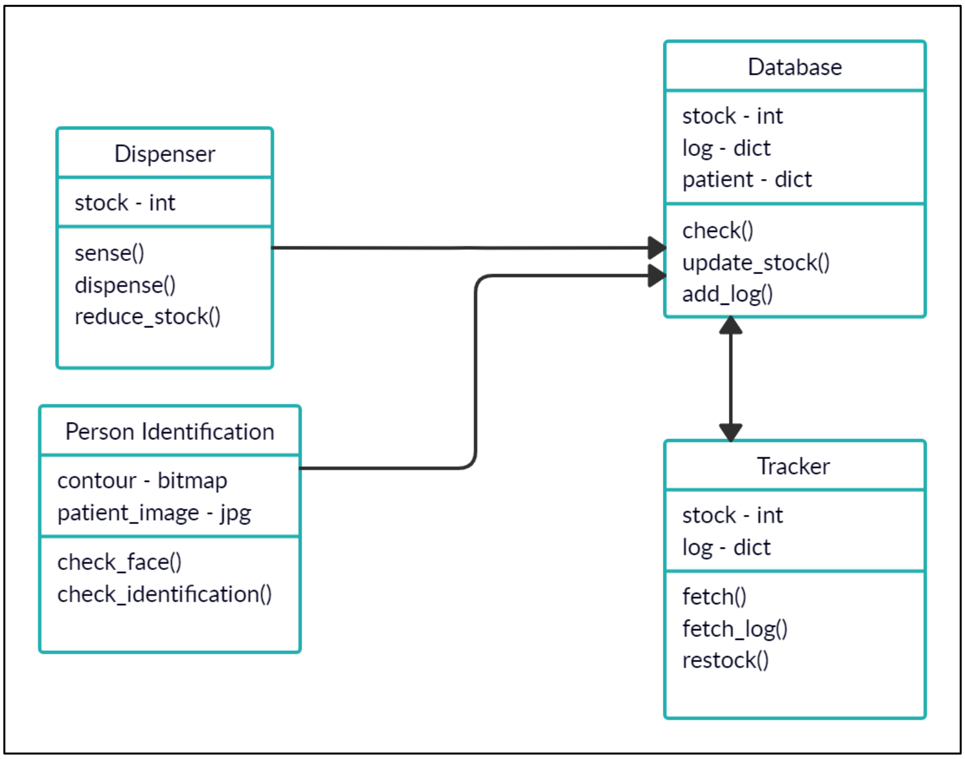


Figure 4.1.2 UML-Class diagram

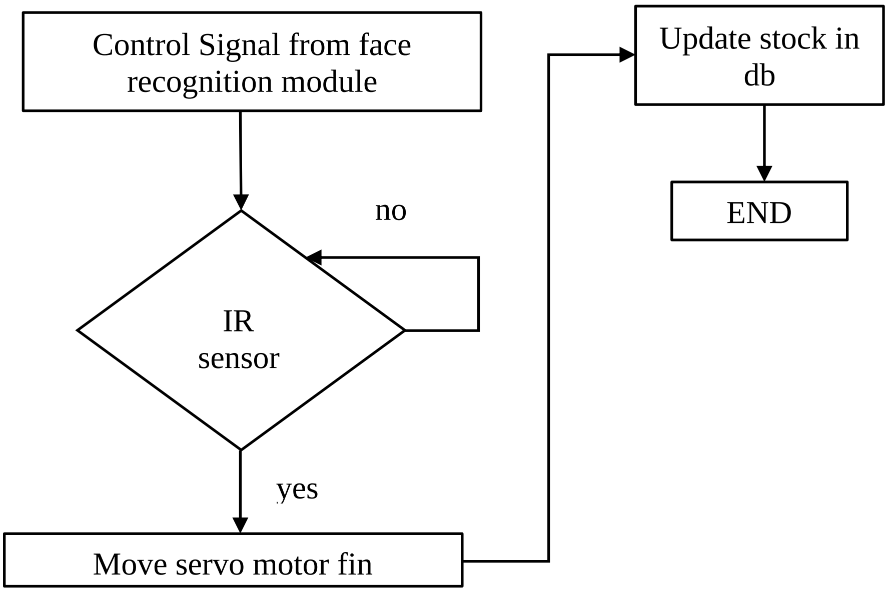


Figure 4.1.3 Dispensing module data flow diagram

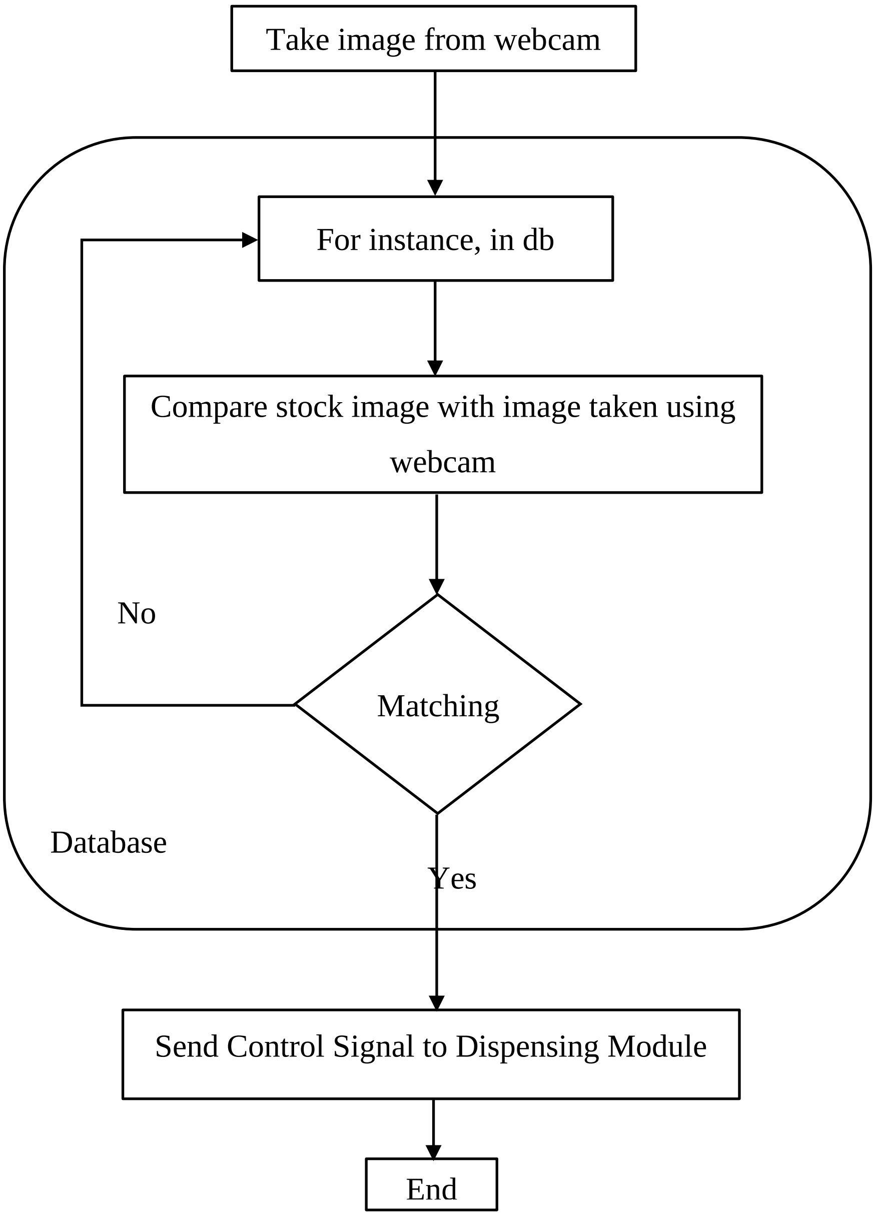

Take image from webcam
For instance, in db
Compare stock image with image taken using webcam
No
Matching
Database
Yes
Send Control Signal to Dispensing Module
End

Figure 4.1.4 Face recognition module data flow diagram

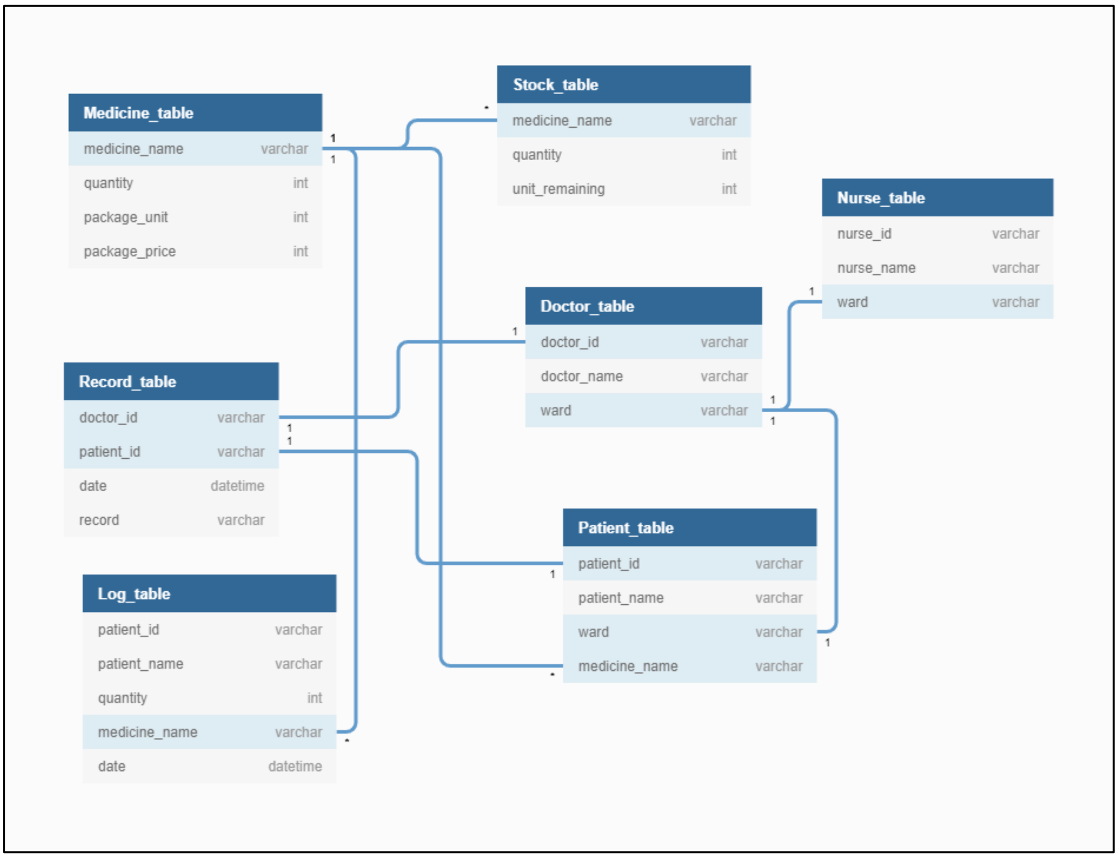


Figure 4.1.5- Database schema design

4.2 ASSUMPTIONS AND DEPENDENCIES

4.2.1. Assumptions

- Properly maintained database
- Proper lighting conditions

4.2.2. Dependencies of the project

- MongoDB
- Pymongo MongoDB python driver
- OpenCV python computer vision driver

- Flask python micro web framework
- RPi python raspberry Pi GPIO interface
- Nodejs
- Reactjs

CHAPTER 5
REQUIREMENTS

CHAPTER 5: REQUIREMENTS

5.1 FUNCTIONAL REQUIREMENTS

- Image Recognition – The system must be able to recognize the live video stream of the camera module using machine learning. Failure may result in wrong or non-dispensing.
- Image Processing – The system must be able to process images using computer vision and image processing embedded modules as well as dynamically process live streams.
- Real-Time system – The system must be able to work with real-time objects and supply the required output with minimal delay.

5.2 NON-FUNCTIONAL REQUIREMENTS

- Performance- The machine learning model used for image classification needs to have high accuracy.
- Availability – The system must be highly available as patients might need to use it multiple times throughout the day.
- Reliability – The system must be highly reliable.
- Portability – The system must be able to be ported to other systems containing a python environment.
- Scalability – The system must be highly scalable.

5.3 SOFTWARE REQUIREMENTS

Name	Version	Description
Python Ide Such as Visual Studio Code/Spyder/Google Collab JavaScript IDE such as Visual Studio Code or Atom	NA	Environment for writing and executing python and JavaScript programs
Computer vision(cv2)	4.5.3.56	Allows python programs to use cameras and image/video feeds
pymongo	3.12.0	Driver for MongoDB python3 interface
Hypertext Markup Language (HTML)	5	Used for creating the front-end structure of output webpage
Cascading Style Sheets (CSS)	3	Used to style the front end of the output webpage
JavaScript	ES2015	Used to script the front-end webpage
MongoDB	4.4	Used as the database to hold patient credentials
RPi.GPIO	0.7.0	Used to interface the gpio pins present in the Raspberry Pi using python
flask	2.0.x	Used as server program for output webpage

python	3.9.x	Used as the language to build machine learning models
Debian OS	11	Used as the primary operating system for Raspberry Pi
Virtual Network Computing(vnc) server	6.7.4	Used to access the Raspberry Pi UI
PuTTY	0.74	Used to access the Raspberry PI using ssh
IDE which contains JavaScript Runtime Environment such as Visual Studio Code or Code Sandbox	NA	JavaScript run time environment
NodeJS	17.3.0	Used for server-side programming and it is built on chrome v8 JavaScript engine
ReactJS	17.0.1	Used to build user interfaces for web application

5.4 HARDWARE REQUIREMENTS

- Raspberry Pi 2/3/4
- Ethernet Cable
- Micro SD Card
- Router with port forwarding option
- 2-ampere power supply

- Micro USB cable
- USB web camera (Logitech c270 HD camera)
- Servo motors
- Connecting Wires

CHAPTER 6
METHODOLOGY

CHAPTER 6: METHODOLOGY

The Raspberry pi will be used as the microcontroller due to its portable, volatile, and user-friendly nature. The IR sensor and servo motors will be used in conjunction due to their specific features which serve as requirements in this system. The best database for our particular system will be MongoDB as the webpage is a simplistic structure and MongoDB offers fast connection and operations with a NoSQL and documented oriented data structure. The CNN pre-trained model and the SVM is the best-suited algorithm for facial recognition systems and it is much more efficient and sophisticated. The Backend for the tracker webpage will be created using Nodejs and express, due to its robust, minimal, and flexible set of features which is required for our single route webpage.

6.1 METHODS

- Face-Recognition - The patient’s image is captured using an external webcam. It is then processed through a facial recognition system that detects and recognizes the face of the patient. Once the patient’s face is recognized, a signal/call is sent to the medicine dispensing module.
- Medicine Dispensing - Medicine dispensing is an essential part of our project. The doctor includes the type of medicine that has to be given to the patient. Once the type of medicine is decided, the respective medicine is dispensed through the cylindrical container. IR sensor is used to monitor the dispensing of the medicine. The quantity of medicine dispensed is updated in real-time on the website as well as the database.
- Database – The database plays a crucial role in the development of this project. The details related to the doctor, nurse, ward, and patient are maintained.

Information about the medicine and also the stack images of faces are stored in the database. MongoDB is chosen as a database because of its robust nature, powerful querying, and analysis, etc.

- Website – The front end of the project, which houses the details related to medication dispensed, the quantity of medication left, etc. are built using HTML, CSS, JavaScript, and ReactJS. The doctor and nurse portal are present which helps the doctors and nurses to log in using their unique credentials and check the details about the patient, time of medication dispensed, etc.

6.2 DATA COLLECTION

- The primary data that is required is the images of the patient. Also, we require the basic details of the patient such as patient name, age, gender, dependent, address, etc. These details will be stored in our database.
- For facial recognition, an external webcam - a Logitech c270 HD camera is used.
- We are taking 1000 images of each team member to train the model.
- Sample prescription with medicine and quantity.

CHAPTER 7
EXPERIMENTATION

CHAPTER 7: EXPERIMENTATION

Problems or setbacks arise in almost every project/real-world problem. Adequate steps have to be taken to correct these problems and move ahead to find the solution. Even in our project, we faced a few setbacks.

The major problem that we faced while implementing the project is integrating the various modules. Communication between the modules was difficult to handle.

We solved this communication problem by making use of REST services. RESTful web services are REST architecture-based web services. In this architecture, everything is a resource. They are lightweight, highly scalable, and maintainable; and are very commonly used to create APIs for web-based applications.

The below lines of codes are the most prominent part of our project. They form the core of the project and will give us insights into the various modules and functions of the project.

7.1 DISPENSER FUNCTION

The dispenser function contains the lines of code required for dispensing the medication to the patient. A 5-second time frame is given between dispensing 2 or more medications so that it is easy for the patient to collect the medication from the medicine dispensing tube.

```
class Dispenser():
    def __init__(self,ir,servo,name):
        self.name=name
        self.ir=ir
        self.servo=servo
    def dispense(self):
        global duty
```

```
servo_output=GPIO.PWM(self.servo,50)
while True:
    ir_sensor=GPIO.input(self.ir)
    if ir_sensor==0:
        servo_output.start(5)
        while duty<8:
            servo_output.ChangeDutyCycle(duty)
            time.sleep(0.1)
            print(duty)
            duty=duty+1
        while duty>5:
            servo_output.ChangeDutyCycle(duty)
            time.sleep(0.1)
            duty=duty-1
            print(duty)
        number=Quantity.find_one({'name':self.name})['quantity']
        Quantity.delete_one({'name':self.name})
        Quantity.insert_one({'name':self.name,'quantity':number-1})
        Log.insert_one({'medicine':self.name,'time':str(datetime.datetime.now())})
        break;
```

7.2 SERVER CODE (BACKEND)

There are 6 tables in our database – stock table, record table, log table, doctor table, nurse table, and patient table. They store relevant information about the characteristic of each table.

```
Doctor=client.Doctor_Database
Nurse=client.Nurse_Database
Patient=client.Patient_Database
```

```
  Log=client.Log_Database
  Record=client.Record_Database
  Stock=client.Stock_Database
  Stock_table=Stock.Table
  Record_table=Record.Table
  Log_table=Log.Table
  Doctor_table=Doctor.Table
  Nurse_table=Nurse.Table
  Patient_table=Patient.Table
```

The below lines of code explain the functions related to the fetching of the medicines A, B, C and D.

```
  def fetchA():
 if Log_table.count_documents({'Medication':'Medicine 1'})==0:
     return jsonify({})
 else:
     d=[]
     for documents in Log_table.find({'Medication':'Medicine 1'}):

d.append({'Medication':documents['Medication'],'Patient':documents['Patient'],'Time':
documents['Time']})
     return jsonify(d)
@page.route('/fetchB',methods=['GET'])
def fetchB():
 if Log_table.count_documents({'Medication':'Medicine 2'})==0:
     return jsonify({})
 else:
     d=[]
     for documents in Log_table.find({'Medication':'Medicine 2'}):

d.append({'Medication':documents['Medication'],'Patient':documents['Patient'],'Time':
documents['Time']})
     return jsonify(d)
@page.route('/fetchC',methods=['GET'])
def fetchC():
  if Log_table.count_documents({'Medication':'Medicine 3'})==0:
     return jsonify({})
  else:
     d=[]
     for documents in Log_table.find({'Medication':'Medicine 3'}):

d.append({'Medication':documents['Medication'],'Patient':documents['Patient'],'Time':
documents['Time']})
     return jsonify(d)
@page.route('/fetchD',methods=['GET'])
def fetchD():
  if Log_table.count_documents({'Medication':'Medicine 4'})==0:
     return jsonify({})
  else:
     d=[]
     for documents in Log_table.find({'Medication':'Medicine 4'}):

d.append({'Medication':documents['Medication'],'Patient':documents['Patient'],'Time':
documents['Time']})
     return jsonify(d)
@page.route('/checkStock',methods=['GET'])
```

7.3 FRONT END CODE

The front end of the website is designed using HTML, CSS and ReactJS.

```
import './App.css';
import Navbars from './Screens/navbar';
import Home from './Screens/Home'
import {BrowserRouter as Router,Switch,Route} from "react-router-dom"
import 'bootstrap/dist/css/bootstrap.min.css';
import Doctor from './Screens/doctor-portal.js'
import Nurse from './Screens/Nurse.js'
import Footer from './Screens/Footer';
import LOGA from './Screens/logA'
import LOGB from './Screens/logb'
import LOGC from './Screens/logC'
import LOGD from './Screens/logD'
```

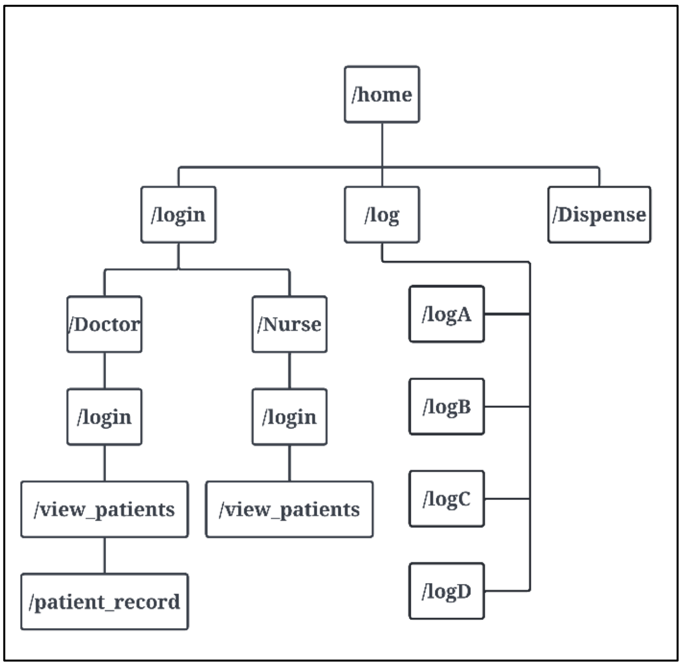


Figure 7.3.1: Directory and sub-directories of the front end.

7.4 FACE RECOGNITION

The face recognition module in our project plays an important role. It detects and recognizes the face. A deep learning pre-trained model, the Caffe Model, is used to detect faces. The bounding boxes are drawn and a blob is created from the image i.e., the image is ready in the input format for the neural network and performs the pre-processing on the image. The image is re-sized using mean subtraction and the image is converted from BGR to RGB format.

The below code extracts the features from the face using OpenCV.

```
for (i, imagePath) in enumerate(imagePaths):
# extract the person name from the image path
if (i%50 == 0):
    print("Processing image {}/{}".format(i, len(imagePaths)))
    # print(imagePaths)
name = imagePath.split(os.path.sep)[-2]

# load the image, resize it to have a width of 600 pixels (while maintaining the aspect ratio), and then grab the image dimensions
image = cv2.imread(imagePath)
image = imutils.resize(image, width=600)
(h, w) = image.shape[:2]

# construct a blob from the image
imageBlob = cv2.dnn.blobFromImage(
    cv2.resize(image, (300, 300)), 1.0, (300, 300),
    (104.0, 177.0, 123.0), swapRB=False, crop=False)

# apply OpenCV's deep learning-based face detector to localize faces in the input image
```

```
detector.setInput(imageBlob)
detections = detector.forward()
```

The below set of code detects and recognizes the face in the live video stream via the webcam.

```
for i in range(0, detections.shape[2]):
        # extract the confidence (i.e., probability) associated with the prediction
        confidence = detections[0, 0, i, 2]

        # filter out weak detections
        if confidence > 0.5:
            # compute the (x, y)-coordinates of the bounding box for the face
            box = detections[0, 0, i, 3:7] * np.array([w, h, w, h])
            (startX, startY, endX, endY) = box.astype("int")

            # extract the face ROI
            face = frame[startY:endY, startX:endX]
            (fH, fW) = face.shape[:2]

            # ensure the face width and height are sufficiently large
            if fW < 20 or fH < 20:
                continue

            # construct a blob for the face ROI, then pass the blob through our face
embedding model to obtain the 128-d quantification of the face
            faceBlob = cv2.dnn.blobFromImage(face, 1.0 / 255,
                (96, 96), (0, 0, 0), swapRB=True, crop=False)
            embedder.setInput(faceBlob)
```

```
vec = embedder.forward()

# perform classification to recognize the face
preds = recognizer.predict_proba(vec)[0]
j = np.argmax(preds)
proba = preds[j]
name = le.classes_[j]
```

CHAPTER 8
TESTING AND RESULTS

CHAPTER 8: TESTING AND RESULTS

The below table gives us insights into the test cases and the results of the testing that has been performed in this project.

Table 8.1 Analysis of test cases

TEST CASE	EXPECTED OUTPUT	RECORDED OUTPUT
FACE RECOGNITION		
No face in the camera	Stream continues till face is detected.	Stream continues till face is detected.
Patient Face	Dispense prescribed medicine.	Dispense prescribed medicine.
Unknown Face	Error message saying “Unknown”.	Error message saying “Unknown”.
DISPENSING UNIT		
Normal Case	Medication is dispensed.	Medication is dispensed.
One tablet remaining	Medication is dispensed and the stock light is turned on.	Medication is dispensed and the stock light is turned on.
Zero tablets remaining	Error message saying “Please restock medication”.	Error message saying “Please restock medication”.

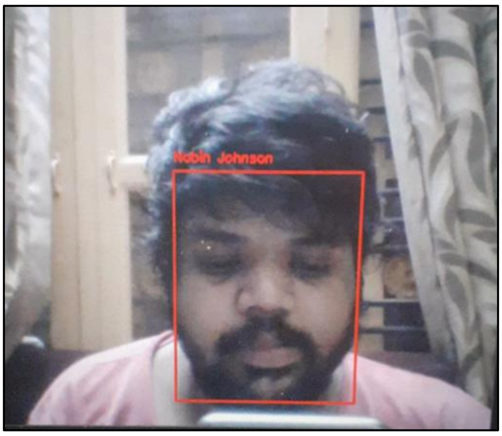


Figure 8.1: Test Case 1 - Expected and Predicted outputs are the same.

Expected Output: Nobin Johnson, Id - 1000

Predicted Output: Nobin Johnson, Id - 1000

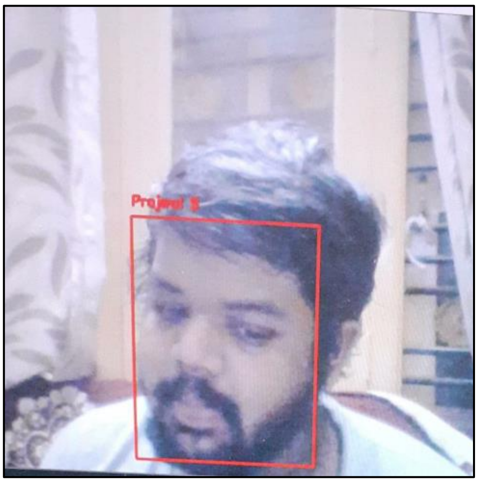


Figure 8.2: Test Case 2 - Expected output is different from the predicted output.

Expected Output: Nobin Johnson, Id -1000

Predicted Output: Prajwal S, Id -1002

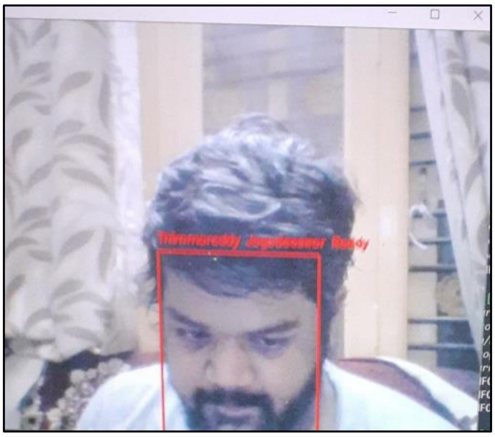


Figure 8.3: Test Case 3 - Expected output is different from the predicted output.

Expected Output: Nobin Johnson, Id -1000

Predicted Output: Thimmareddygari Jagadeeswar Reddy, Id -1003

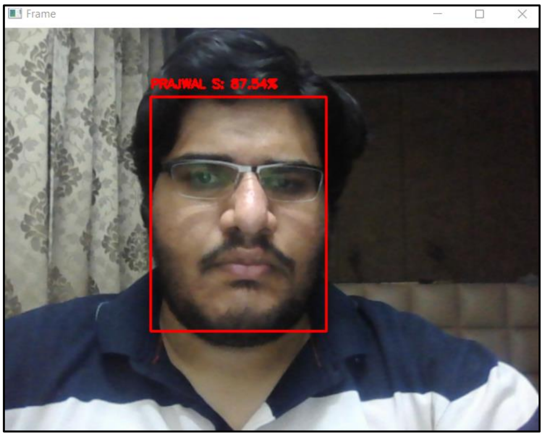


Figure 8.4: Test Case 4 - Expected and Predicted outputs are the same.

Expected Output: Prajwal S, Id -1002

Predicted Output: Prajwal S, Id -1002

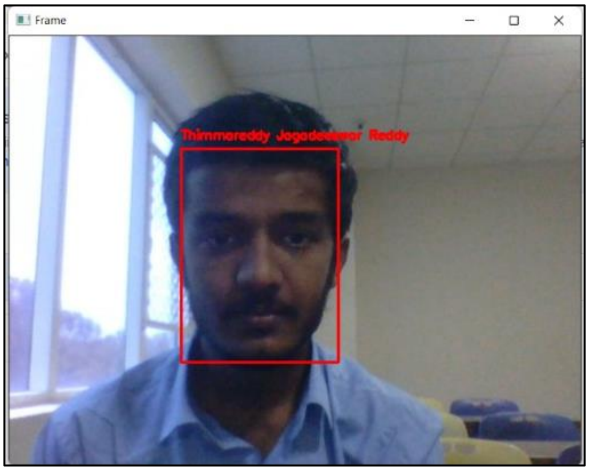


Figure 8.5: Test Case 5 - Expected and Predicted outputs are the same.

Expected Output: Thimmareddygari Jagadeeswar Reddy, Id -1003

Predicted Output: Thimmareddygari Jagadeeswar Reddy, Id -1003

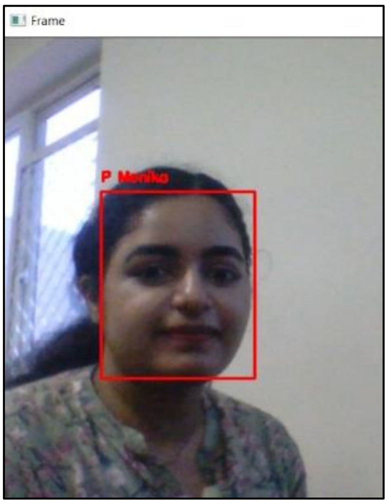


Figure 8.6: Test Case 6 - Expected and Predicted outputs are the same.

Expected Output: P Monika, Id -1001

Predicted Output: P Monika, Id - 1001

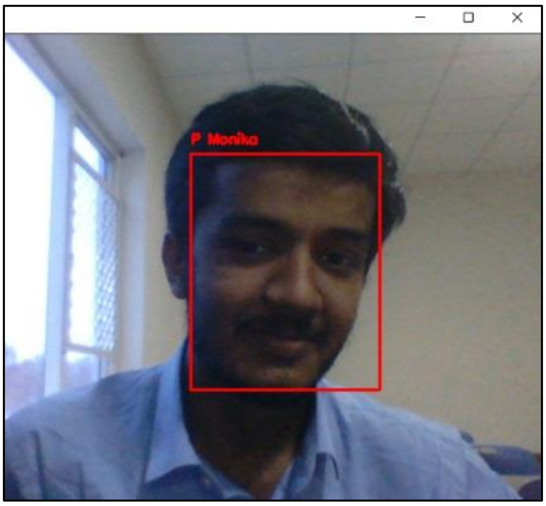
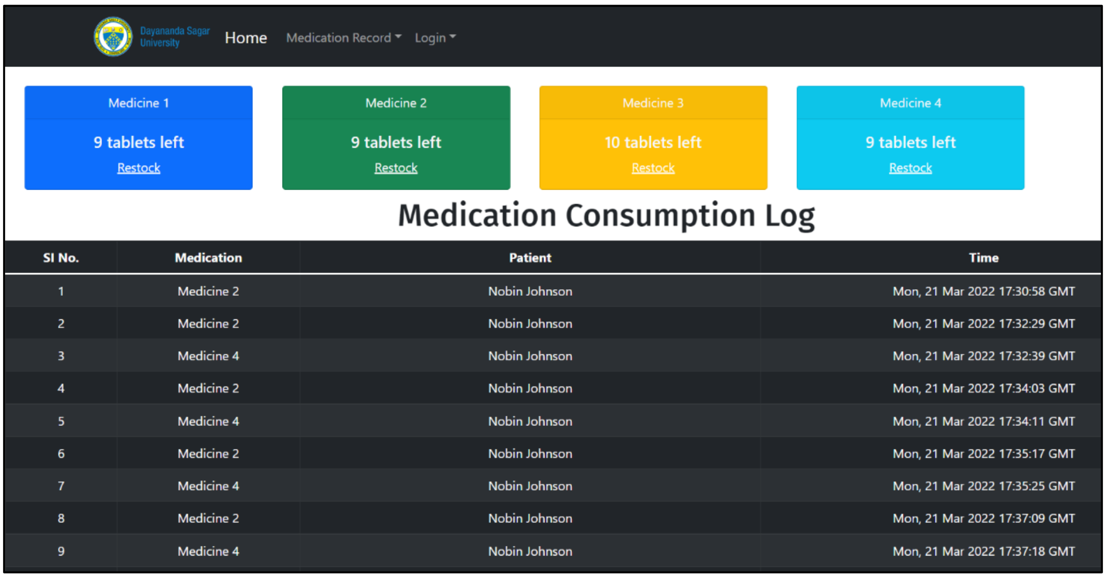


Figure 8.7: Test Case 7 - Expected and Predicted outputs are different.

Expected Output: Thimmareddygari Jagadeeswar Reddy, Id -1003

Predicted Output: P Monika, Id -1001



Medicine 1
9 tablets left
Restock

Medicine 2
9 tablets left
Restock

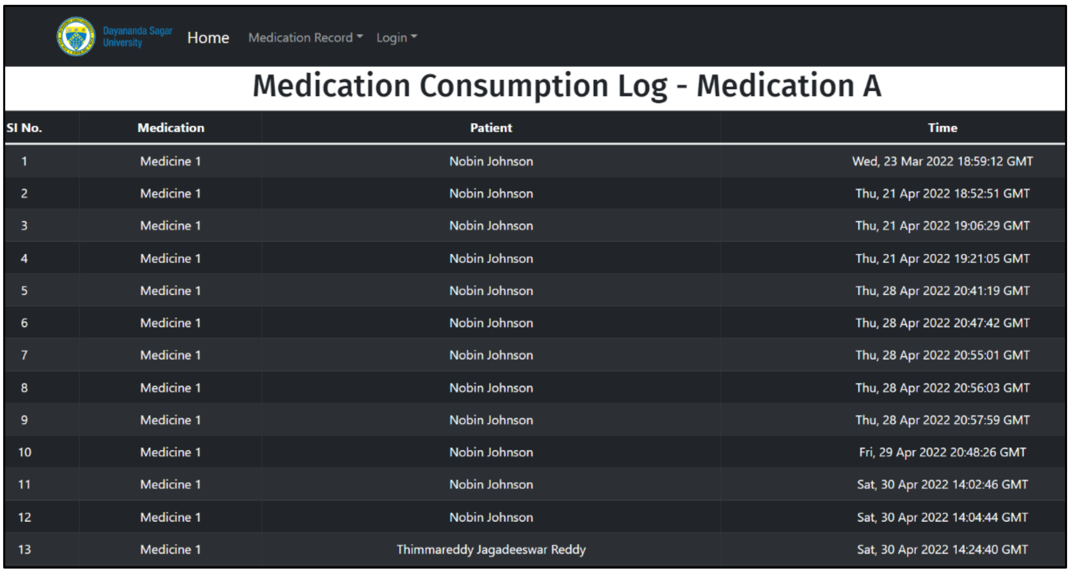
Medicine 3
10 tablets left
Restock

Medicine 4
9 tablets left
Restock

Medication Consumption Log

Sl No.	Medication	Patient	Time
1	Medicine 2	Nobin Johnson	Mon, 21 Mar 2022 17:30:58 GMT
2	Medicine 2	Nobin Johnson	Mon, 21 Mar 2022 17:32:29 GMT
3	Medicine 4	Nobin Johnson	Mon, 21 Mar 2022 17:32:39 GMT
4	Medicine 2	Nobin Johnson	Mon, 21 Mar 2022 17:34:03 GMT
5	Medicine 4	Nobin Johnson	Mon, 21 Mar 2022 17:34:11 GMT
6	Medicine 2	Nobin Johnson	Mon, 21 Mar 2022 17:35:17 GMT
7	Medicine 4	Nobin Johnson	Mon, 21 Mar 2022 17:35:25 GMT
8	Medicine 2	Nobin Johnson	Mon, 21 Mar 2022 17:37:09 GMT
9	Medicine 4	Nobin Johnson	Mon, 21 Mar 2022 17:37:18 GMT

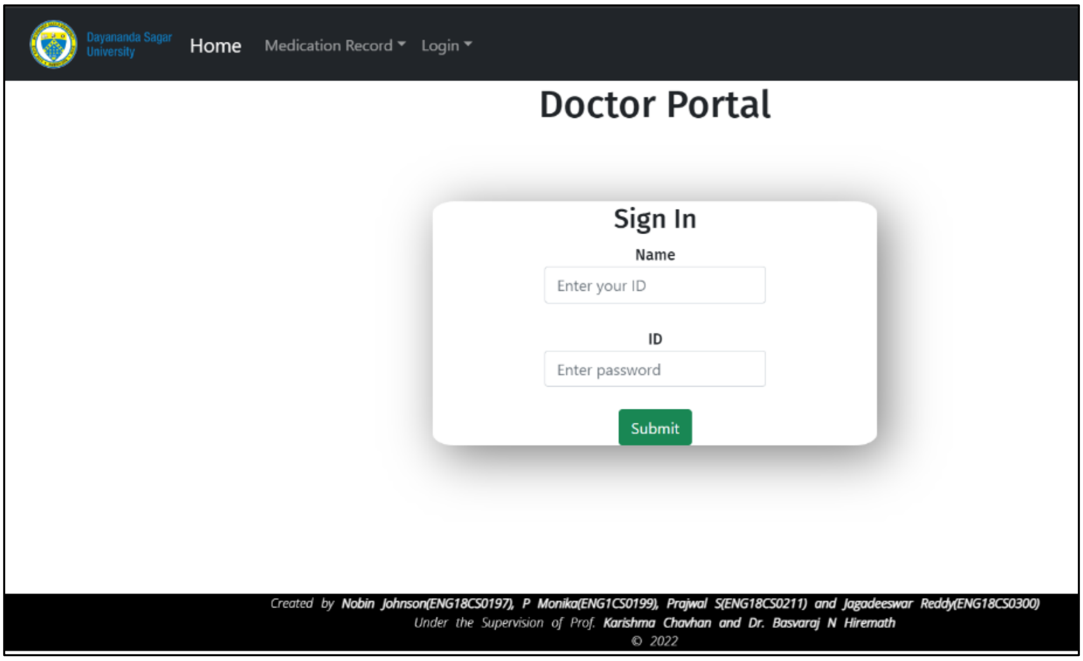
Figure 8.8: Homepage of the website.



Medication Consumption Log - Medication A

Sl No.	Medication	Patient	Time
1	Medicine 1	Nobin Johnson	Wed, 23 Mar 2022 18:59:12 GMT
2	Medicine 1	Nobin Johnson	Thu, 21 Apr 2022 18:52:51 GMT
3	Medicine 1	Nobin Johnson	Thu, 21 Apr 2022 19:06:29 GMT
4	Medicine 1	Nobin Johnson	Thu, 21 Apr 2022 19:21:05 GMT
5	Medicine 1	Nobin Johnson	Thu, 28 Apr 2022 20:41:19 GMT
6	Medicine 1	Nobin Johnson	Thu, 28 Apr 2022 20:47:42 GMT
7	Medicine 1	Nobin Johnson	Thu, 28 Apr 2022 20:55:01 GMT
8	Medicine 1	Nobin Johnson	Thu, 28 Apr 2022 20:56:03 GMT
9	Medicine 1	Nobin Johnson	Thu, 28 Apr 2022 20:57:59 GMT
10	Medicine 1	Nobin Johnson	Fri, 29 Apr 2022 20:48:26 GMT
11	Medicine 1	Nobin Johnson	Sat, 30 Apr 2022 14:02:46 GMT
12	Medicine 1	Nobin Johnson	Sat, 30 Apr 2022 14:04:44 GMT
13	Medicine 1	Thimmareddy Jagadeeswar Reddy	Sat, 30 Apr 2022 14:24:40 GMT

Figure 8.9: Log of the medicine A that has been dispensed to the patient.



Doctor Portal

Sign In

Name

Enter your ID

ID

Enter password

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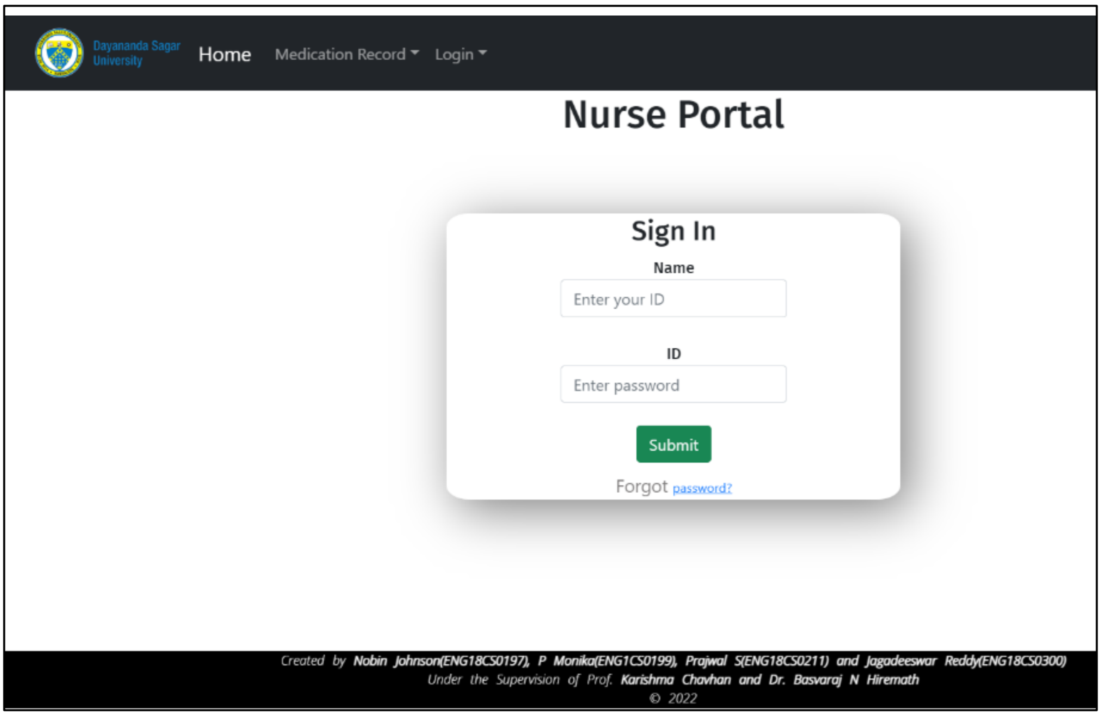
Figure 8.10: Sign in portal for the doctor.



Nurse Portal

Sign In

Name

Enter your ID

ID

Enter password

Submit

Forgot password?

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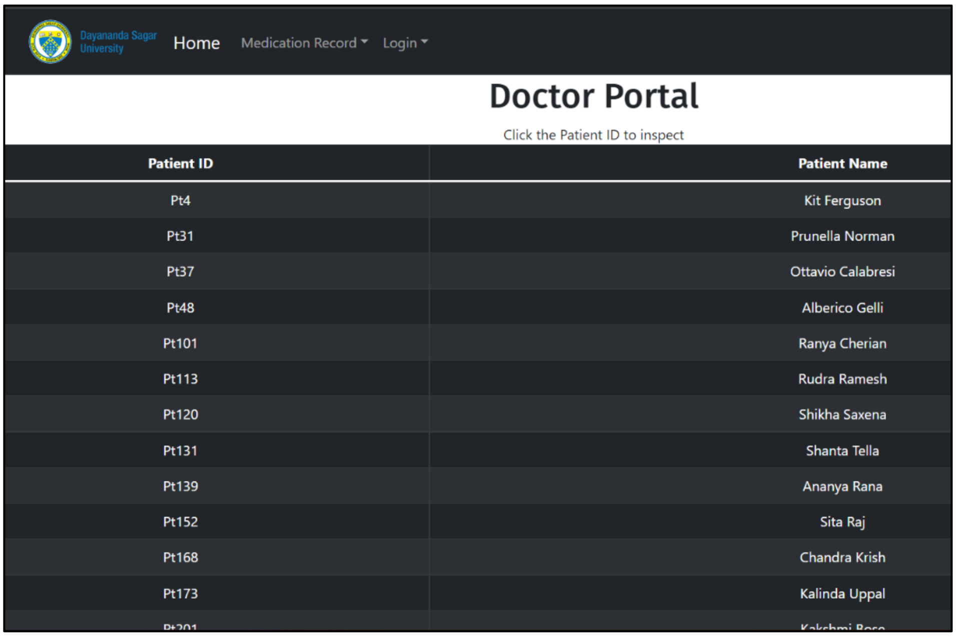
Figure 8.11: Sign in portal for the nurse.

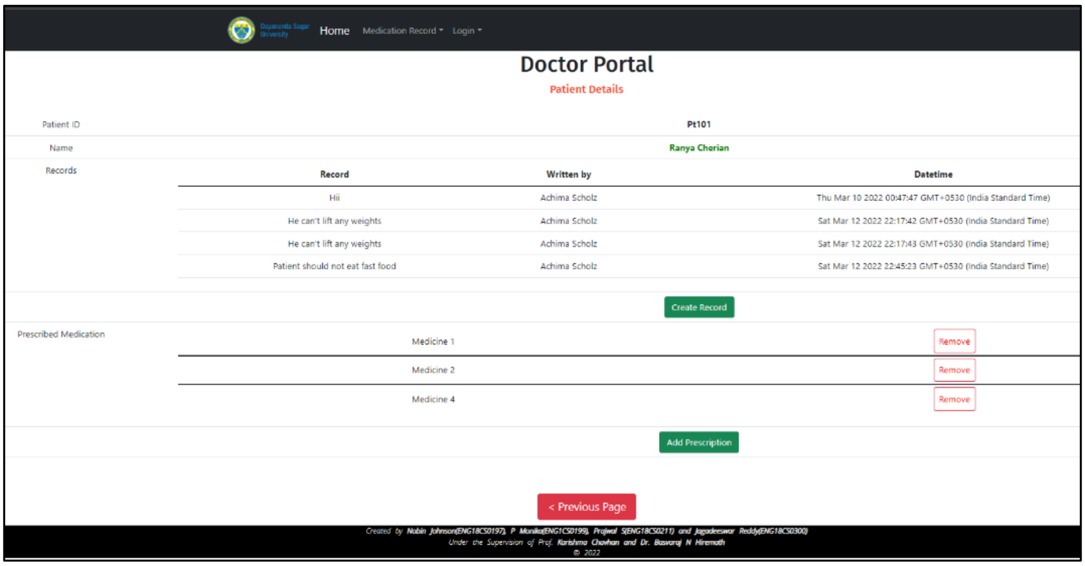


Doctor Portal

Click the Patient ID to inspect

Patient ID	Patient Name
Pt4	Kit Ferguson
Pt31	Prunella Norman
Pt37	Ottavio Calabresi
Pt48	Alberico Gelli
Pt101	Ranya Cherian
Pt113	Rudra Ramesh
Pt120	Shikha Saxena
Pt131	Shanta Tella
Pt139	Ananya Rana
Pt152	Sita Raj
Pt168	Chandra Krish
Pt173	Kalinda Uppal
Pt201	Kakshmi Bose

Figure 8.12: Details regarding the patient i.e., patient ID and patient name that is visible to the doctor, once the doctor has logged in.



Doctor Portal

Patient Details

Patient ID	Pt101
Name	Ranya Cherian
Records	

Record	Written by	Datetime
Hii	Achima Scholz	Thu Mar 10 2022 00:47:47 GMT+0530 (India Standard Time)
He can't lift any weights	Achima Scholz	Sat Mar 12 2022 22:17:42 GMT+0530 (India Standard Time)
He can't lift any weights	Achima Scholz	Sat Mar 12 2022 22:17:43 GMT+0530 (India Standard Time)
Patient should not eat fast food	Achima Scholz	Sat Mar 12 2022 22:45:23 GMT+0530 (India Standard Time)

Prescribed Medication

Medicine 1

Medicine 2

Medicine 4

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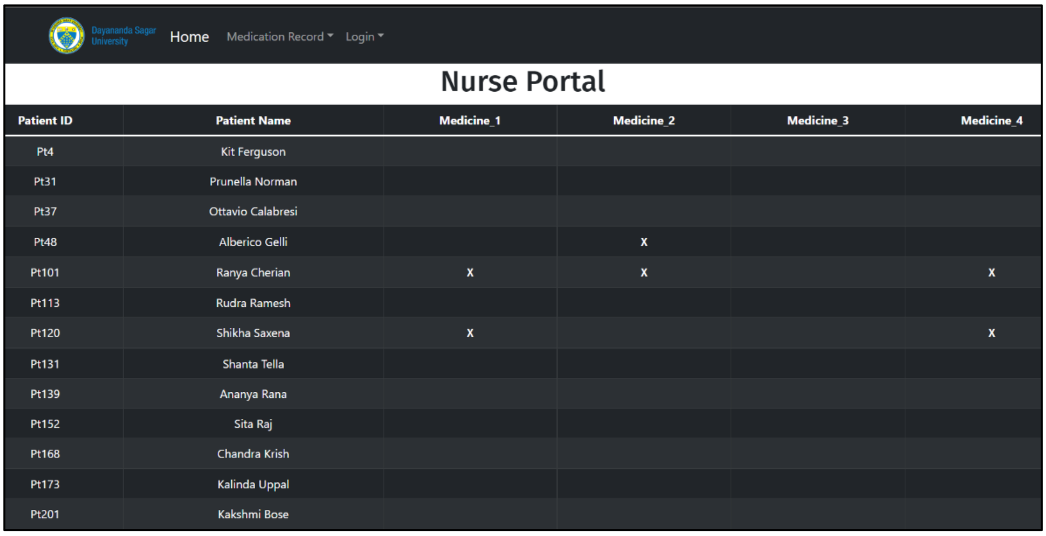
Figure 8.13: Details pertaining to the particular patient once the doctor has logged in and clicked on a particular patient ID.



Nurse Portal

Patient ID	Patient Name	Medicine_1	Medicine_2	Medicine_3	Medicine_4
Pt4	Kit Ferguson				
Pt31	Prunella Norman				
Pt37	Ottavio Calabresi				
Pt48	Alberico Gelli		x		
Pt101	Ranya Cherian	x	x		x
Pt113	Rudra Ramesh				
Pt120	Shikha Saxena	x			x
Pt131	Shanta Tella				
Pt139	Ananya Rana				
Pt152	Sita Raj				
Pt168	Chandra Krish				
Pt173	Kalinda Uppal				
Pt201	Kakshmi Bose				

Figure 8.14: Medications that are prescribed to a patient is visible once the nurse has logged in.

CHAPTER 9

CONCLUSION AND FUTURE WORK

CHAPTER 9: CONCLUSION AND FUTURE WORK

The Automatic Medicine dispensing system makes use of the latest technologies and is ergonomic in design. This system can be incorporated into clinics, pharmacies, and laboratories. The system is scalable, portable, reliable, and provides high availability. The web page provides a UI that is user-friendly and easy to use. There is a lot of scope wherein, the system can be optimized further and more technical aspects can be added.

In future iterations, different aspects of the system may be improved. A different web development stack may be used for the webpage as well as the mobile application. Fetch API provides basic features and may be replaced with a more robust API. A different database that is small may be used instead of MongoDB such as Firebase or SQLite. The webpage may be hosted using on-premise servers instead of using cloud services.

The system can be updated where in the following scenarios can be considered: patient taking medicine at the wrong time instead of the prescribed time; different sized capsules have to be dispensed; integrating the system with a mobile app so that notifications are sent periodically to the patient to consume the medication and so on.

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APPENDIX A

APPENDIX A

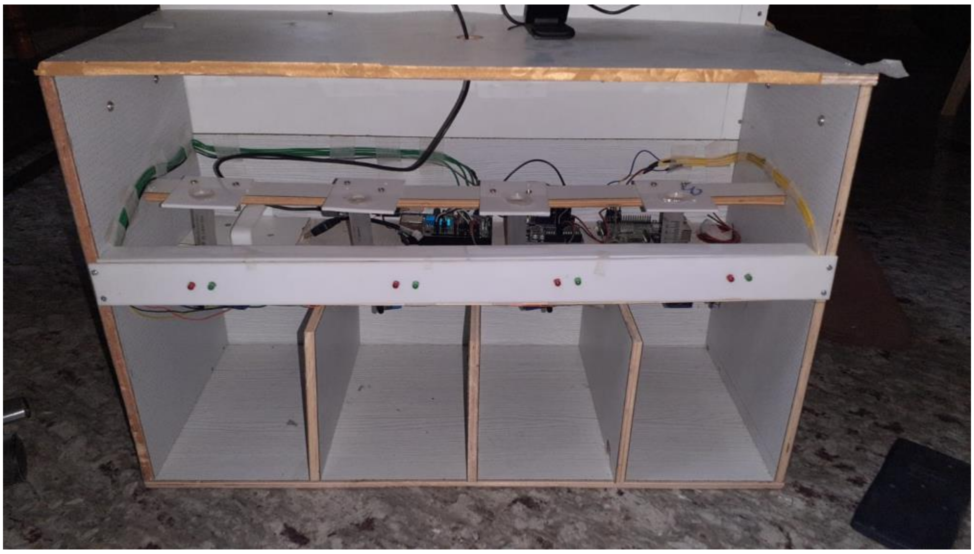


Figure A.1: Front view of the Medicine Dispensing System.

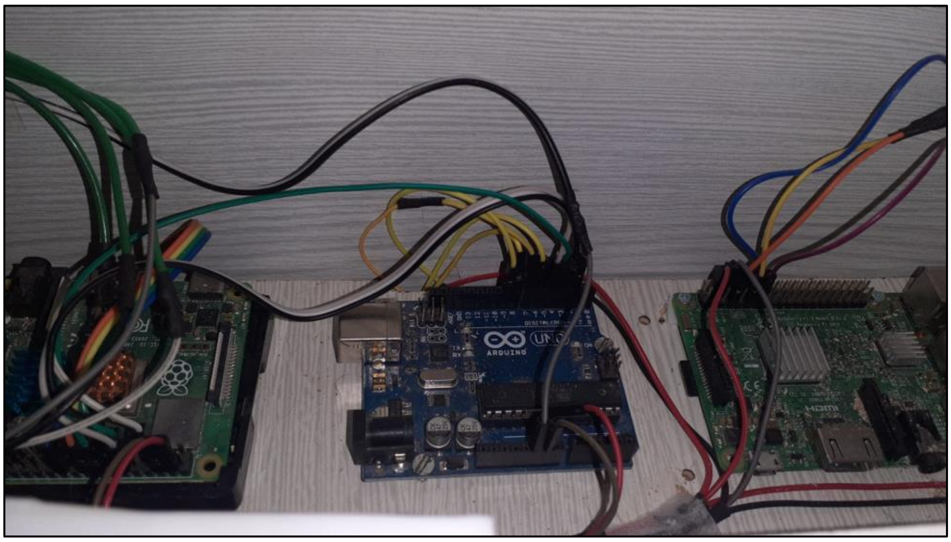
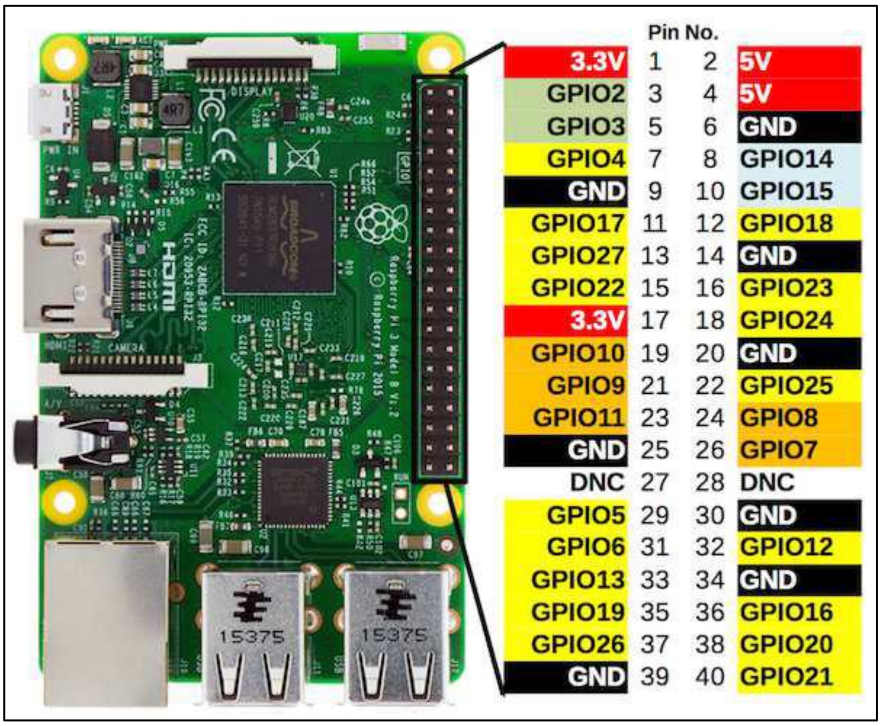


Figure A.2: Raspberry Pi Setup



	Pin No.		
3.3V	1	2	5V
GPIO2	3	4	5V
GPIO3	5	6	GND
GPIO4	7	8	GPIO14
GND	9	10	GPIO15
GPIO17	11	12	GPIO18
GPIO27	13	14	GND
GPIO22	15	16	GPIO23
3.3V	17	18	GPIO24
GPIO10	19	20	GND
GPIO9	21	22	GPIO25
GPIO11	23	24	GPIO8
GND	25	26	GPIO7
DNC	27	28	DNC
GPIO5	29	30	GND
GPIO6	31	32	GPIO12
GPIO13	33	34	GND
GPIO19	35	36	GPIO16
GPIO26	37	38	GPIO20
GND	39	40	GPIO21

Figure A.3: Raspberry Pi 4B Architecture

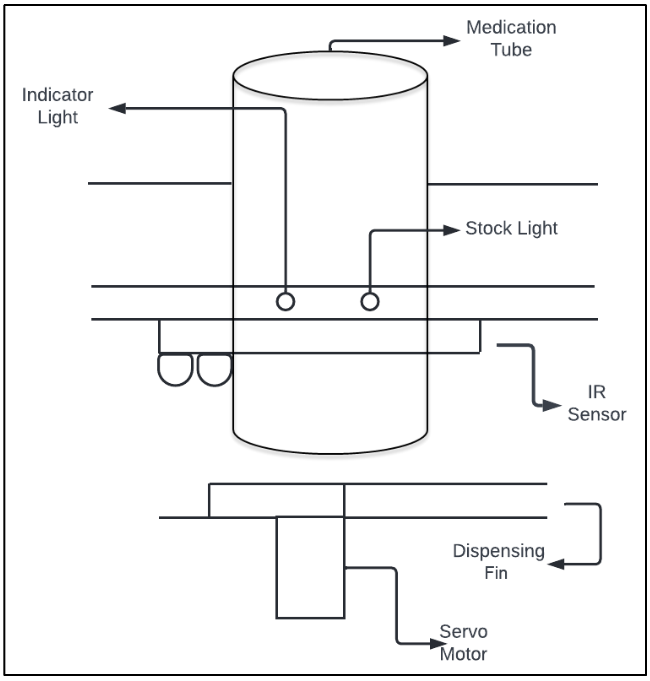


Figure A.4: Front View of the medicine dispensing system.

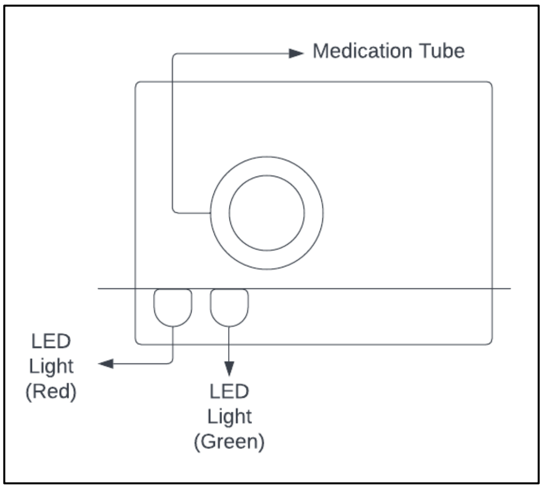


Figure A.5: Top view of the medicine dispensing system.

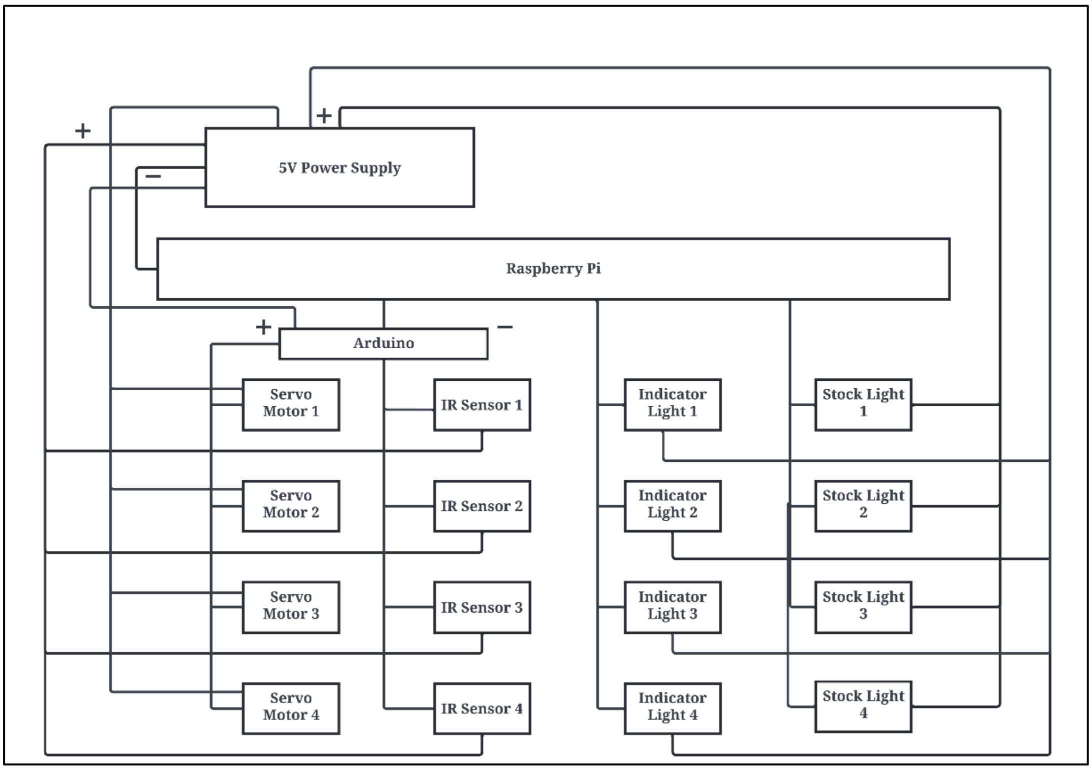


Figure A.6: Connection between the Power Supply, Raspberry Pi, Arduino, Servo Motors, IR Sensors and LED lights.

GITHUB LINK

GITHUB LINK

The below GitHub link contains the code of our project and report in a PDF format.

Link: https://github.com/Major-Project-22

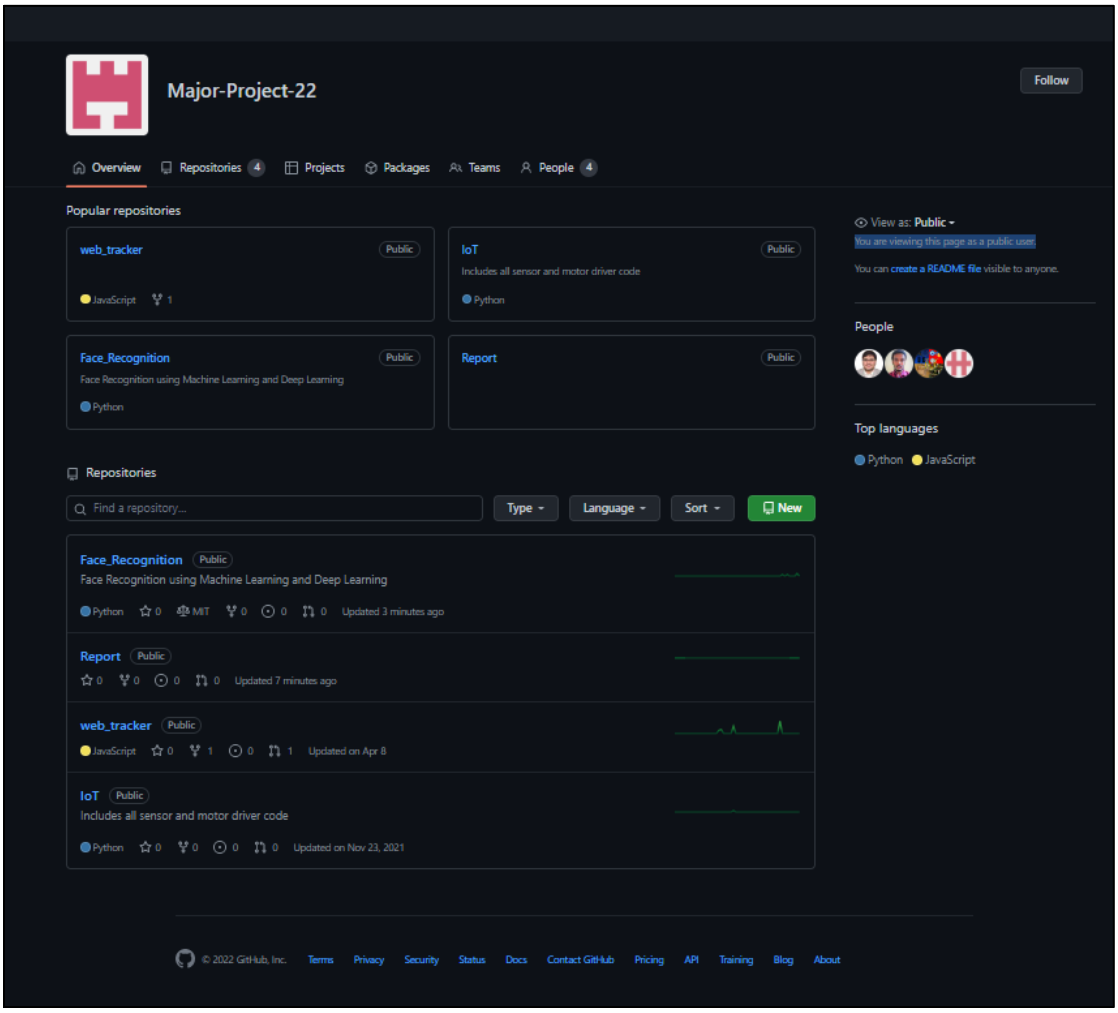


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Figure: GitHub link containing the code and the report of our project.

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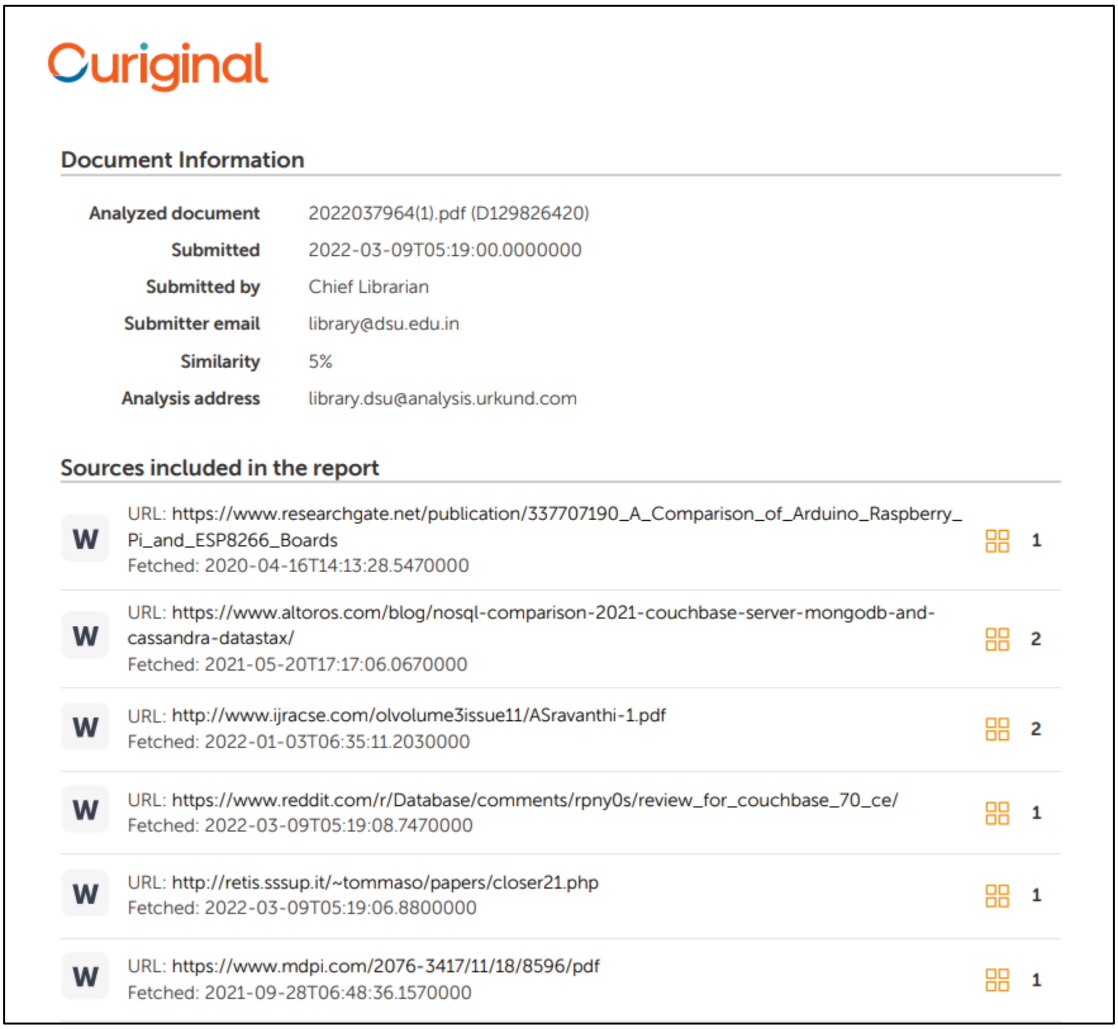
Our paper titled “Analysis of Technologies used in Automatic Medicine Dispensing Systems” has been accepted at the IEEE International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE) 2022 Conference. The paper was presented on the 23rd of April, 2022.



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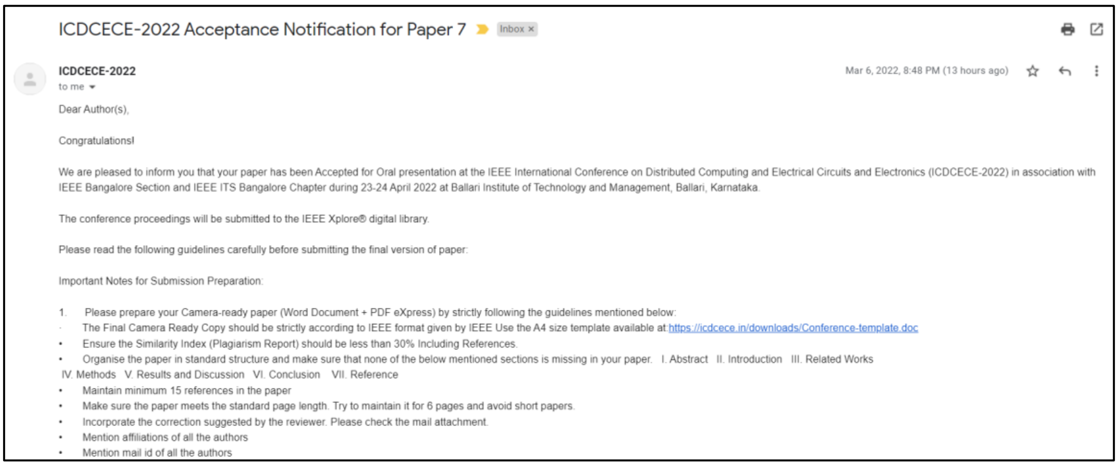

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- Make sure the paper meets the standard page length. Try to maintain it for 6 pages and avoid short papers.
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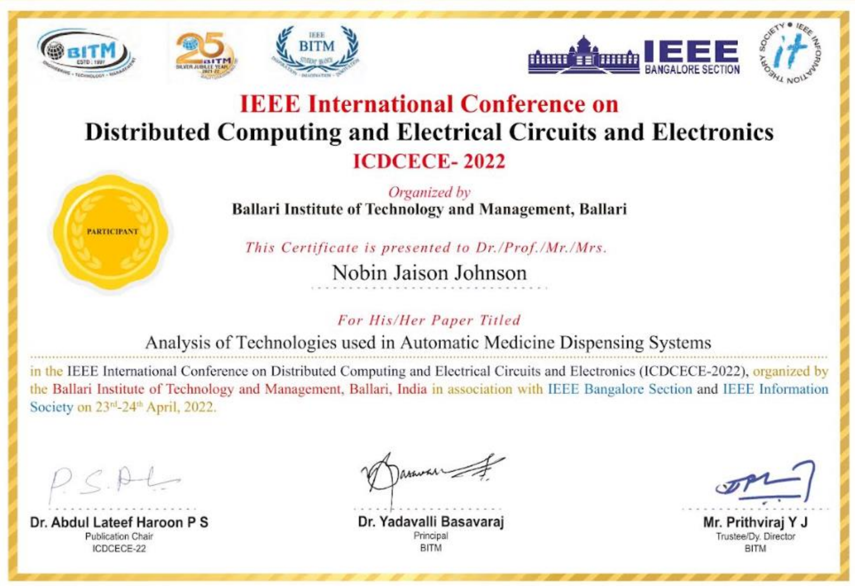

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For His/Her Paper Titled
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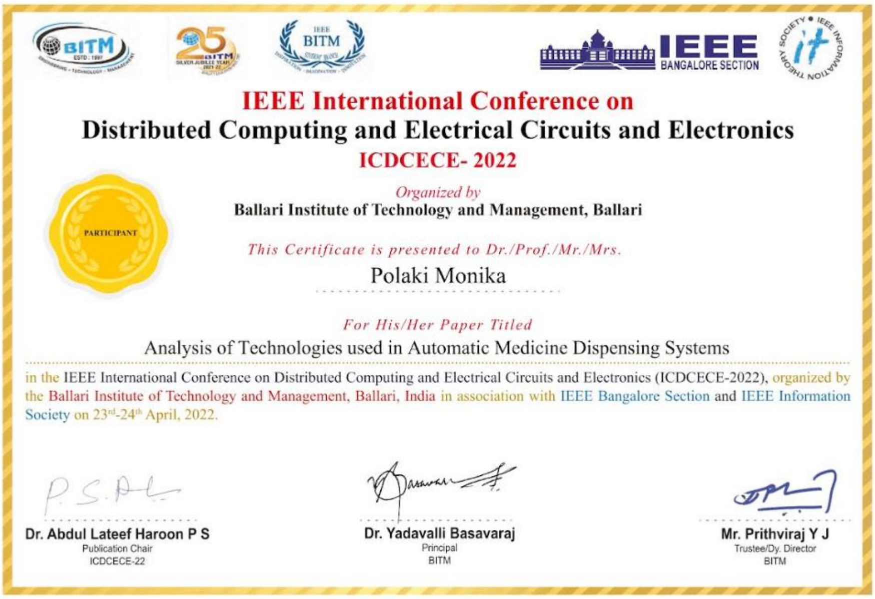

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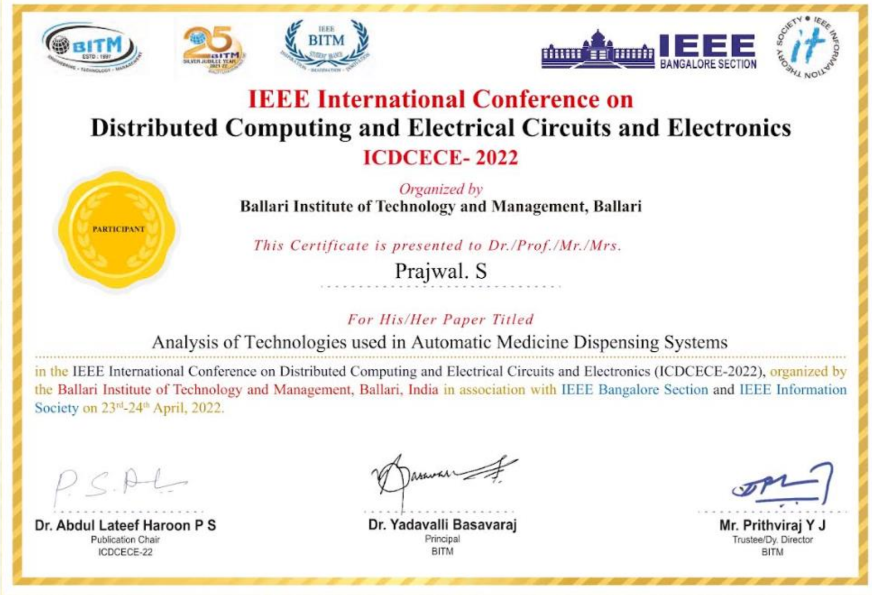

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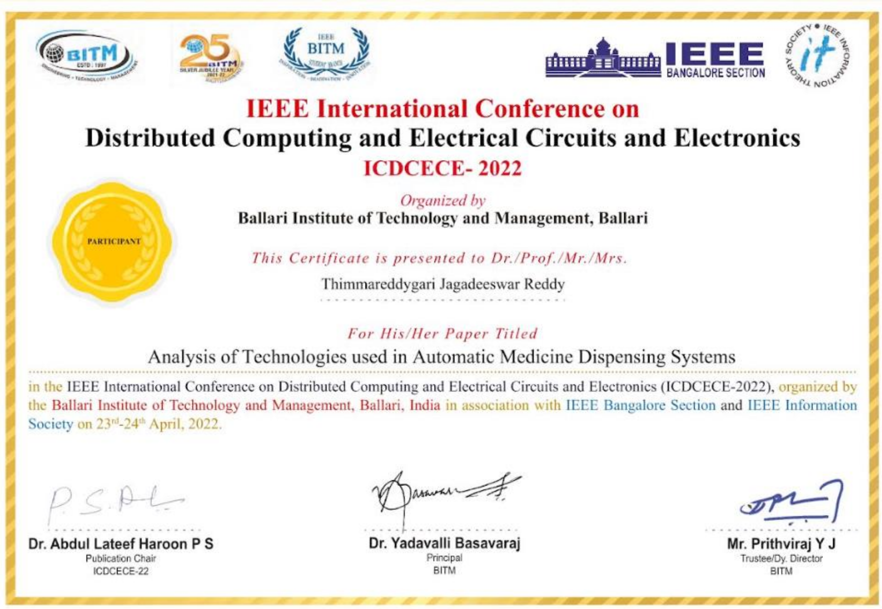

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Distributed Computing and Electrical Circuits and Electronics
ICDCECE- 2022

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Figure: Paper Presentation Certificate – Thimmareddygari Jagadeeswar Reddy