APPENDIX-A: FRONT COVER AND EDGE:

Thesis Book Edge

Automatic Medication System for Patient Care

2022

Front Cover Page

AUTOMATIC MEDICATION SYSTEM FOR PATIENT CARE

Maryam Akhlaque 18ES75

Irfan Ali 18ES50

Zarmeena Nizamani 18ES31

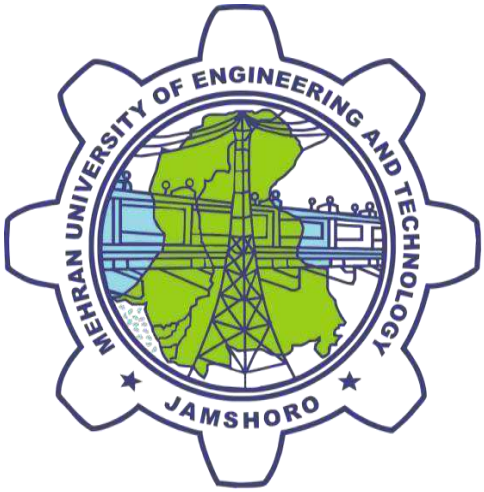
Bachelor of Engineering (BE)

Electronic Engineering

MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO

OCTOBER 2022

AUTOMATIC MEDICATION SYSTEM FOR PATIENT CARE



A thesis submitted by

Maryam Akhlaque 18ES75

Irfan Ali 18ES50

Zarmeena Nizamani 18ES31

Supervisor	**Co-Supervisor**
Engr: Qurban Ali Memon	Engr.Shoaib Hassan Khaskheli

Submitted in the partial fulfillment of the requirements for the degree of Bachelor of Engineering in Electronics

Faculty of Electrical, Electronics & Computer Engineering

MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO

OCTOBER 2022

CERTIFICATE

This is to certify that "**Project/Thesis Report on Automatic Medication System for Patient Care"** is submitted in partial fulfillment of the requirement for the degree of Bachelor of Electronic Engineering by the following students:

Maryam Akhlaque 18ES75

Irfan Ali 18ES50

Zarmeena Nizamani 18ES31

_____	_____
Supervisor	**Co-Supervisor**
Engr.Qurban Ali Memon	Engr. Shoaib Hassan Khaskheli

_____

(Chairman, Department of Electronic Engineering)

Date: _____

ACKNOWLEDGEMENT

It is a huge thank you to Almighty ALLAH who is most merciful and wise, who gave us and allowed us to complete the task.

We are glad to be here in the Electronic Engineering Department of Mehran University of Engineering and Technology, Jamshoro under the consideration of well-educated and experienced faculty.

We are highly grateful to our Supervisor Engr. Qurban Ali Memon for his great support. His advice and knowledge were helpful in this project. We are glad to have supportive CoSupervisor Engr. Shoaib Hassan Khaskheli for our final year project. We are highly grateful to him for his cooperation, support, and motivation. His knowledge and experience made us able to complete the project, in his supervision we completed our project successfully. In authoring this thesis, his advice was helpful for us.

DEDICATION

****

We Dedicate all our strength to our respected "**PARENTS & TEACHERS"** who do we really inspire, your pure love, devotion, natural attitude, and sincerity are of immense importance joy and pride for us.

****

ABSTRACT

Nowadays, one of the most challenges that some people face is to identify their medicine in daily life. It is important to take medicine on time because it may highly affect their health specially if they are suffering from a disease. So, for that, we design a system whose main idea is to provide medication to the people at right time.

We are Interface an RFID (radio frequency identification) to scan the prescription. (The system has also the option for manual entry), design an android app for the record patient's medication and health monitoring. Sometimes patient's temperature gets warm for that fever is detected through the temperature sensor and sends a message about the patient current condition to the doctor through the app. In the last, we Interface some devices for the indications of medicines.

This project is based on ESP microcontroller module for controlling the commands in which we use C language to operate or control the ESP microcontroller for the desired commands. Then First, we described or defined all medicine that which doctor gives the patients, and it describes manually in the system. Example: Take two paracetamol tablets in a day two times. And describe all prescriptions like that. Finally, we use an app that sends the data of patients' medicines consumptions as well as their blood pressure and temperature reading by an app to the doctor.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ESP	Espressif Systems
RFID	Radio Frequency Identification
SOC	System on Chip
IOT	Internet of things
WIFI	Wireless Filtering
MIT	Massachusetts Institute of Technology
PLCs	Programmable Logic Controllers
TCP	Transmission Control Protocol
IP	Internet Protocol

List of Symbols

µ	Micro
Ω	O

Chapter-1

INTRODUCTION

There are millions of visually impaired people worldwide. The medication care process pursuits to ensure that medicinal drug management is accomplish effectively and thoroughly. Many patients in the medical field don't take their medications according to schedule. That may lead to admissions to hospitals and care homes, serious injuries, or even death. Some patients find it challenging to follow a complicated drug regimen because it may be too complicated, or the patient may not be able to recall their prescribed schedule. We are introducing a system named Automatic medication system for patient care. This system encodes the prescription given by the doctor Furthermore, the system will detect the timing and dose of the medicine. After that, the completion of the prescription all the data will automatically send to the doctor through an app that we design for this, and we also include a fever detector. This system proposes a smart prescription medication service with the development of cloud-based database management and control service system to benefit both doctors and patients. The research presented in this thesis attempt to solve this critical issue by developing an intelligent medication schedule with minimal effort. This should enhance the lives of patients and enable independent living. Two widespread issues with the healthcare system are addressed by the research that is being presented. The first is the inability of patients and healthcare professionals to precisely match a patient's need with a medicine's type, dosage, and timing. As a result, many individuals do not take their medications as prescribed, which causes unnecessary illness progression, lower product quality, and fatality. Second, there will soon be a lot of pressure on the healthcare system. This stress is highlighted by stating that the current healthcare system will collapse within the next ten years because to the rising patient to worker ratio brought on by the baby boomer population bulge. Many patients would to live on their own. They would be given greater freedom as a result, which would also lessen the burden on the healthcare system. In this thesis, a software

application that uses a mobile platform to track and monitor a subject's health regimen is implemented. Patients can enter their medical dosages and scan their prescriptions using the proposed prototype application, which activates system alarms for medication ingestion in accordance with the dosage plan. The application also allows patients to order prescription refills from registered pharmacies. The presented infrastructure has the potential to accelerate beneficial changes taking place in the interactions among patients, healthcare professionals, and patient's health practices. With such an infrastructure, individuals can obtain the necessary information to make desirable behavior changes and thereby achieve healthier lifestyle choices. There is a big need for an integrated IT platform where patient health can be tracked and monitored through the mobile world anytime anywhere. Global health and healthcare programmes are about to undergo a revolution thanks to modern health informatics systems. However, it will take a significant amount of work from thousands of designers, analysts, software engineers, and medical specialists to make this vision a reality. The number of patients and their illnesses continue to increase in the contemporary global medical environment as new diseases appear at an accelerated rate. More and more people are juggling various medications that must be taken throughout the day. Patients may find it more challenging to remember the dosage and schedule of their medications when they take more medications. To achieve better results, patients should have access to a convenient location where they can keep track of all of their medications, a schedule of their dosages, and regular refill reminders. There is also much information that is needed by a physician daily to keep track of a patient's health. The physicians can receive up-to-date information about my delays in medicine intake or missed dosages and can send pharmacists orders for refills and prescriptions on the go. This can result in a large shift in the locus of action and control, from the physician's office to the patient's home. This shift will result in more individualized healthcare when medical care is necessary. The patient can contact doctors through the mobile app to take advice about medicines. Medicines can be scanned through a barcode scanner and all details will send to doctors to overcome the platforms of patients easily. The primary goal of today's drug management systems is to provide patients with the best possible treatment while also being as cost-effective

as possible. The delivery of the appropriate medication at the appropriate time and location necessitates a multi-step process in which individuals with varying levels of training and expertise are in charge of the various processes. Persons needing specific assistance to help them overcome their challenges in daily life, as opposed to people who are totally sighted. Personal health monitoring systems and devices have grown in popularity throughout time and are now readily available to customers thanks to technological improvements. Smartphones and other mobile devices are excellent candidates for a solution that might benefit patients and doctors. Mobile health initiatives have proliferated all over the world. With smartphones being widely available, their wireless capabilities, sampling processing power, safe data storage, and real-time monitoring capabilities could be coupled to create a cloud application for the medical sector that will link patients, doctors, and pharmacists. This technology tries to combat this issue by monitoring a patient's dosing schedule, displaying the dosage and timing of the medication via timely alarms and notifications, and securely transmitting the information to a central server in the cloud. The data, once transmitted, will remain secure and accessible to the physician who could conveniently check their patient’s dosage routine and dosage levels and information, and its fusion with secure health monitoring data, there can be significant impact on the prevention steps and individual lifestyle choices that patient’s make.

1.1 MOTIVATION:

Because the use of Android mobile phones is increasing and people have easy access to them, we came up with the idea of developing an application for Android phones that will help individuals focus on their health-related issues and maintain their health on a regular basis using only an Android phone.

1.2 PROBLEM STATEMENT:

Nowadays, one of the most challenges that some people face is to identify their medicine in daily life. It is important to take medicine on time because it may highly

affect their health specially if they are suffering from a disease. So, for that, we design a system whose main idea is to provide medication to the people at right time. One of the key components of a healthy life is receiving good and timely medical care. An android-based health-care application can aid and facilities patients to keep them healthy, and the development of the automatic medication system for patient care helps to patient to take their medicine on time also it saves the time of doctor. There are numerous essential functionalities missing from the current Android applications. In Pakistan this system is not being made. Our motivation behind designing this system is that in Pakistan this type of system is not built yet. This is what we address in this work.

1.3 AIMS AND OBJECTIVES:

This project aims to introduce a medication system to give the prescription in the form of encoded data to make a prototype layout for Visually Impaired People.

Objective 1: Interface RFID is programed with ESP32 to scan the tags applied on each medicine

Objective 2: ESP32 will find data accordingly and send data to ADAFRUIT IO database where doctor and anyone else with ID can read the data and reply to patient.

Objective 3: Data will be displayed on i2c OLED display and buzzer will sound on successful card swap.

Objective 4: An LM35 temperature sensor takes continuous reading of temperature.

Objective 5: Temp readings will be displayed on ADAFRUIT Dashboard and OLED Display.

1.4 MATERIAL:

1. ESP 32 Module
2. RFID (Radio Frequency Identification) module
3. RFID Cards
4. OLED Display with i2c
5. LM35 Temperature Sensor
6. Breadboard
7. Jumper wires
8. SD card Arduino module
9. Circuit Base

1.5 THESIS LAYOUT:

Chapter one is a preface that describes the design what it's and what the reason behind it what we worked on and its aims and objectives. Here we've explained each applicable introductory information that's necessary for a smaller compendium.

Chapter two is a literature review that is grounded on exploration papers. We've studied nearly twenty research papers from which we collected information for our design which

helped us a lot in terms of understanding this design deeply, we've presented 10 research papers review that is more related to our project and its crux too.

Chapter three is the proposed methodology in which we discuss how to be designed and developed our project. It also shows the achievability and algorithm that we designed for our project. We work on both hardware and software. In the hardware design, we first interfaced an ESP module in which RFID scan the medicines and shows the data on an OLED display, and in the software part we designed an application for the record of patients and also when a patient's temperature is high then through a sensor a msg will go to the doctor through this application.

Chapter four is about the result and discussion on what we attained and obtained. Here we verified our result and have displayed some outputs. In our first case, we performed the detection of medicines and then the record will go to the doctor.

Chapter-2

LITERATURE REVIEW

2.1 INTRODUCTION:

The ESP is the main microcontroller of the project which controls the whole operation of detection of medicines that were scanned by RFID. Due to the WI-FI connection, we connected esp32 can module with the signal microcontroller which is also the advantage for us that we didn't have to use two microcontrollers at once. It is a line of inexpensive, low-power microcontrollers on a chip with dual-mode Bluetooth and Wi-Fi built in. It is used in Smart industrial devices, including PLC's, smart medical devices and wearable health monitors.

2.2 LITERATURE SUREVY:

[1] According to Mohammed and Salih (2013, August), forgetfulness is a significant challenge for patients who do not take care of their medications with the exact dosage on time. It has been discovered that this results in malfunctioning and lowers the efficiency of their medication; a well-known practical solution has been researched and provided here. An elderly person can readily use a dose reminder system, which is a straightforward home appliance that can be quickly configured by the caregiver. It was crucial to design a workable solution to this problem, which will boost accuracy and reduce the amount of caregiving time and money needed, as time and dose control have proven to be very beneficial in sickness treatment. The prototype created here was made to be affordable so that it could be used by the majority. All of the features are functional, and the model is transportable, but the size is a little greater than necessary. The plan was tested and put into effect successfully.

Figure 2.1: Prototype front and side view

Figure 2.2: The system internal view

[2] Almuzaini & Abdullah-al-wadud (2018) conducted research on how the technology's quick development has increased our reliance on it for day-to-day tasks. The advantages of the technology may be seen in how it not only meets the expectations of the typical user but also extends a helping hand to those with unique requirements. Even while technology has given persons who are blind or visually impaired a number of talents, they still have considerable challenges completing many of the daily tasks that depend on others. Finding and managing their drugs is one of the most demanding and important daily duties, especially if they have chronic illnesses and must take certain medications on a regular basis. As a result, people frequently develop their own systems using non-visual means like identifying drugs by their smell or encircling bottles of a similar form with an elastic band. These methods are susceptible to errors and occasionally cause people to take the wrong prescriptions. Some patients cannot afford to employ assistive technology, such

as a barcode reader, and it is cumbersome to transport it around. The privacy of users who are blind is compromised by other methods, such as crowdsourcing-based mobile applications. In order to discover a practical and practical solution for the visually impaired patients to identify their drugs, the writers of this study concentrate on researching the literature for the possibilities presented by the computer technology.

Figure 2.3:Low-tech tools for medication identifications

Figure 2.4:Visual tags 1(2D QR code & ID barcode)

Figure 2.5: Medication box detection in different rotation and scale

[3] The primary goal of Kader, Islam, and Anisuzzaman's research paper is to create a smart medicine box to remind elderly patients or hospital patients to take the right dosage of medication at the right time, according to their study from October 2018. To store the medication, the device contains twenty-one airtight chambers. A patient's attendant or

nurse can create a weekly schedule for medication reminders by keeping medication in twenty-one compartments for three doses per day. The attendant can manually adjust the time for taking medications or load a text file containing the times for each compartment's medications onto an SD card. The time can be read from the device's real-time clock. The device plays a sound in the speaker to provide information about the quantity of medicine and blinks the LED of the specific compartment where medicine is kept for that time when the time matches the predetermined time. The device also tells the patient whether to take the medication before or after eating. The tool can guarantee medication safety, proper dosage, and the avoidance of elderly drug amusement.

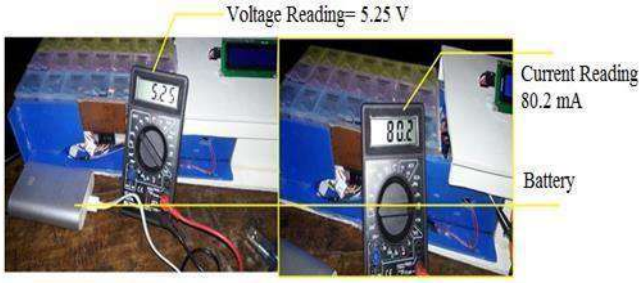


Figure 2.6: Power consumption of the system

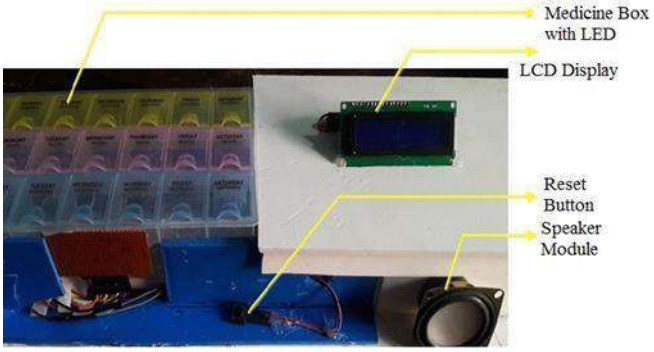


Figure 2.7:1Complete overview of the system

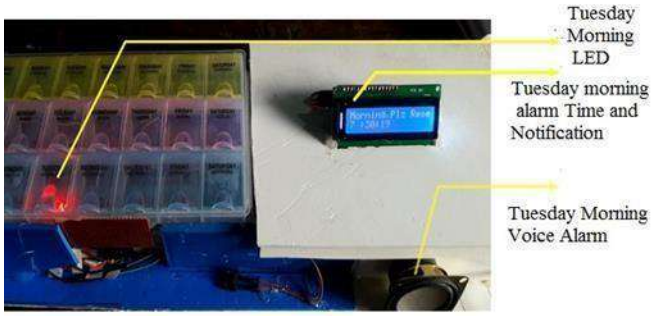


Figure 2.8: Tuesday morning alarm

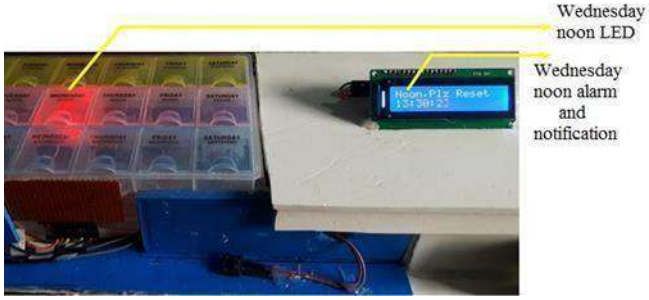


Figure 2.9: Wednesday morning alarm

[4] Mahmud & Khan (2021, May) conducted research that found it challenging to keep track of one's entire medical history. A person might not have his or her medical records on hand when they suddenly get unwell. We made the decision to create a project for an android and iOS medical app that will always allow access to a user's medical history and record. To make it simple for the user to manage and distribute them among facilities. This is especially useful when someone is managing numerous documents while visiting a specialist. The whole medical history required to diagnose a patient can be stored and updated by users, including vital signs, medical reports, and newly prescribed drugs. React-native is used to create the app, while Firebase is utilised as a cloud and Redux is

used to manage the app's store. Health passport is intended to be a global platform for patient involvement that will enhance medical care and motivate users to get more involved in their health by avoiding repeating the same test at several facilities, saving time and money. In general, the app acts as a liaison between patients and medical professionals. In actual emergencies, this can be quite beneficial. It can have a significant impact on a person's medical life when used properly.

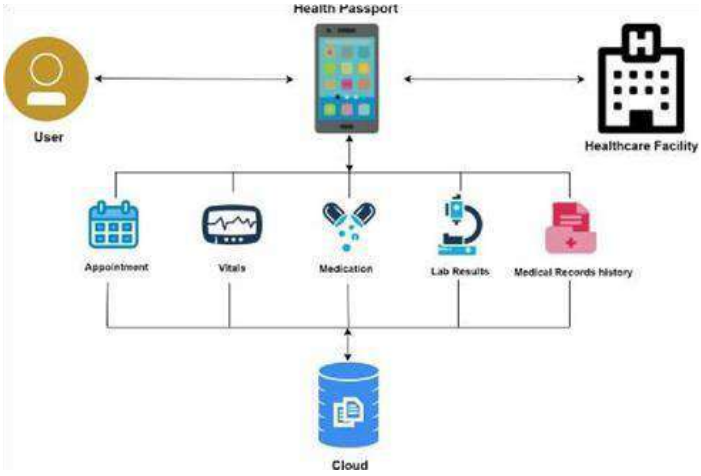


Figure 2.10:2.0 Block diagram structure of Health Passport

Figure 2.11: Feature diagram of Health Passport

Figure 2.12: Some screenshots from different pages of the final prototype of the iOS app

[5] The implementation of an automated medication dispensing system based on a mobile robotic remote sensing unit is discussed in this study by Ayub, Zahid, and Butt (2019, March). Because it has been found that the health sector is not fully prepared to deal with unfavourable events efficiently, such as in providing timely medication administration systems to disaster victims, the goal is to improve nursing synergy for the medication administration process in disastrous events. Therefore, the goal of the project is to assist persons who have been affected by disasters by setting up this novel robotic mobile dispensing system at medical camps to deliver autonomous medicinal services in accordance with a doctor's prescription. By reducing the requirement for medical staff and human error, the proposed approach helps medical administration carry out the medication task effectively. This proposed system has been compared to various pharmaceutical dispensing systems, and the results show that it is effective and superior.

Figure 2.3: Control Station Pictorial View

Figure 2.4: Medicine Dispenser case

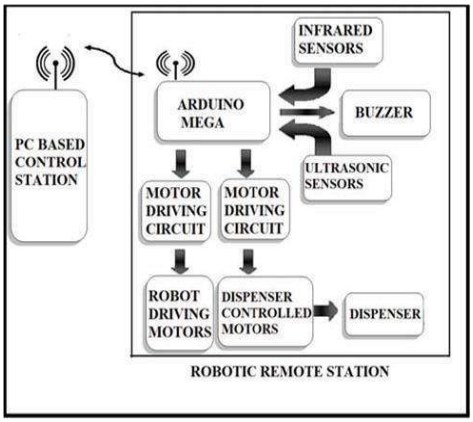


Figure 2.5: Block Diagram of Proposed System

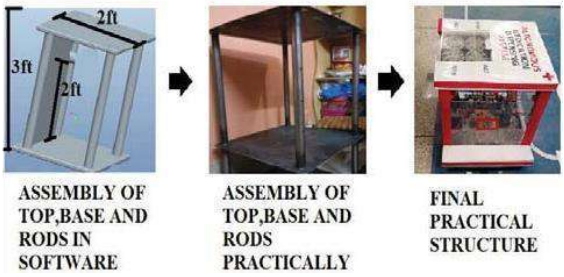


Figure 2.6: Overall Frame of Proposed System

Figure 2.7: Line following test bench

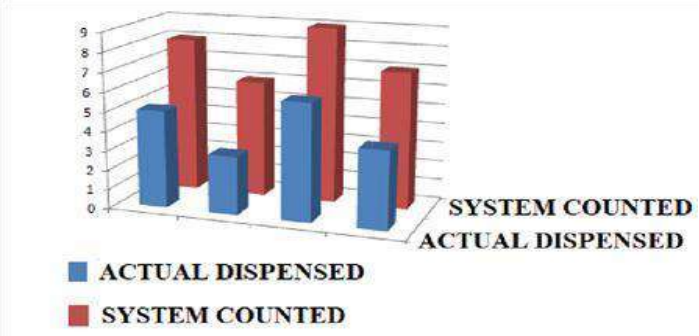


Figure 2.8: Comparison of system counted and actual dispensed {6} Issue of detecting and scanning bar codes in video streams is the subject of a study by Dunets and Klym from May of this year. Using a Raspberry Pi 2 model B, a system for locating bar codes in panoramic photos was developed. The system detection and bar code scanning video stream software algorithm for the Raspberry Pi was proposed. It has been proven that this technique can be used to industry, medicine, and control systems.

Figure 2.9: Results of program's work

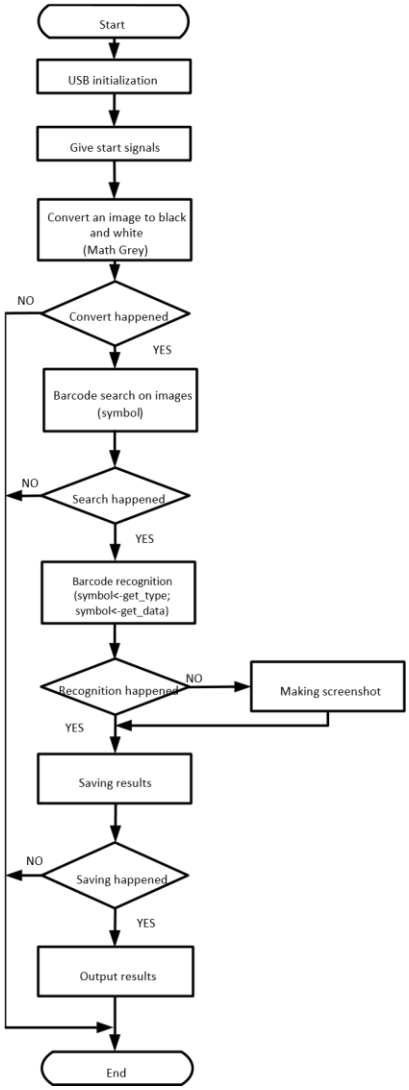
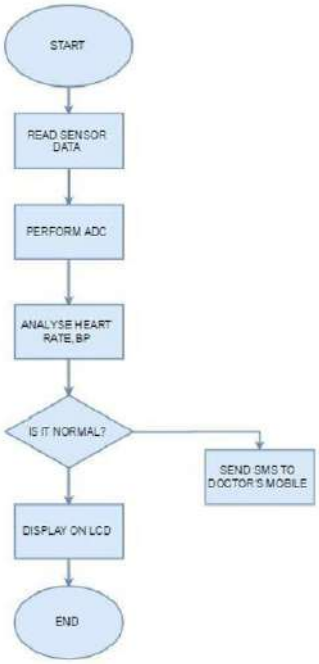


Figure 3.0: Graphical representation of the system's primary algorithm.

{7} This project showcases the most recent advancement in electronics—a telemetric system built on the internet of things (IOT) that may be used to monitor patients who are confined to beds. It offers a tool that may be used to keep tabs on the wellbeing of the patient. Thus, it is feasible to observe the patient continuously. In today's automated environment, interest in biomedical engineering is rapidly growing. Engineering progress has considerably benefited biomedical electronics, which has improved doctors' productivity and sped up service delivery. Family members can also use this system to stay informed on their loved ones' health. It offers details on the heart's beats per minute (BPM). Similar to systems used in hospitals, this one allows users to monitor their vital signs using sensors even when they are not being observed. In this project, an emergency message would be sent to a doctor's or family member's phone if the sensors' output starts varying over the expected pace. Additionally, the same is continuously updated on a cloud platform.



Chapter-3 PROPOSED METHODOLOGY

3.1 INTRODUCTION:

In this chapter, we discuss methodology. Our design consists of two parts first one is the hardware second one is the software part.

In the hardware part, we designed a system in which prescription is scanned in front of RFID sensor and ESP module further tells through programming.

In the software part, we design an android app for the record of a patient that will send to the doctor.

3.2 HARDWARE DESIGN:

First, we described or defined all medicines that which doctor gives the patients, and it describes manually in the system. Example: Take two paracetamol tablets in a day two times. And describe all prescriptions like that. Then RFID scans the medicines and through the ESP microcontroller to process the time and dosage of the medicines. We use Arduino

programming language to operate or control the ESP module for the desired commands. After that system is to remind the patient's medicine's timing and doses through the LCD to take the medicine at the right time. LCD indicate the timing and doses to take medicines if it's time to take them. If the patient is dumb and uneducated, then the medicines time displayed on the LCD to take medicines. if the patient takes already that medicines, then the system also shows that you take already them. Finally, we use an app that sends the data of patients' medicines consumptions as well as their blood pressure and temperature reading by an app to the doctor.

3.3 DESIGN FLOW:

Figure 3.3: Flow Chart of Procedure

3.4 ESP MODULE

It might be a software program with internet access. It enables the creation of an IOT (Internet of Things) system. Any microcontroller can connect to your WiFi network using this self-contained SOC (System on Chip), which coordinates TCP/IP protocol stack. The ESP is capable of offloading all WI-FI networking tasks to another application processor or enabling an application. A 3.3V control supply is necessary. It consumes 100Amps current. It is used in our project for WI-FI network and a website of ada fruit connected to it.

Figure 3.4: ESP Module

3.5 OLED DISPLAY:

It employments to form advanced show in gadget such as tv's screen,computer monitors,and versatile frameworks such as smart phones and hanheld game.It is used here
for displaying the medicines.

Figure 3.5: OLED Display for medicines identification.

3.6 RFID (Radio frequency Identification):

A type of tracking system that uses radio frequency to look for, identify, track, and communicate with objects and people is what RFID labels are. They function essentially as smart labels that can hold a variety of data, including serial numbers, summaries, and even entire pages of information. We use in our project for detecting medicines that which medicine is it.

Figure 3.6: RFID for detecting medicines.

3.7 LM35 Temperature Sensor:

A device that measures temperature may be the LM35, which has an analogue yield voltage matching to the temperature. The yield voltage is given in centigrade (Celsius). No additional calibrating circuitry is needed. The affectability of LM35 is 10mV/degree Celsius. Produce voltage also increases when temperature rises.

Figure 3.7: LM35 sensor for fever

3.8 HARDWARE INTERFACING:

Figure 3.7.1: Hardware design (1)

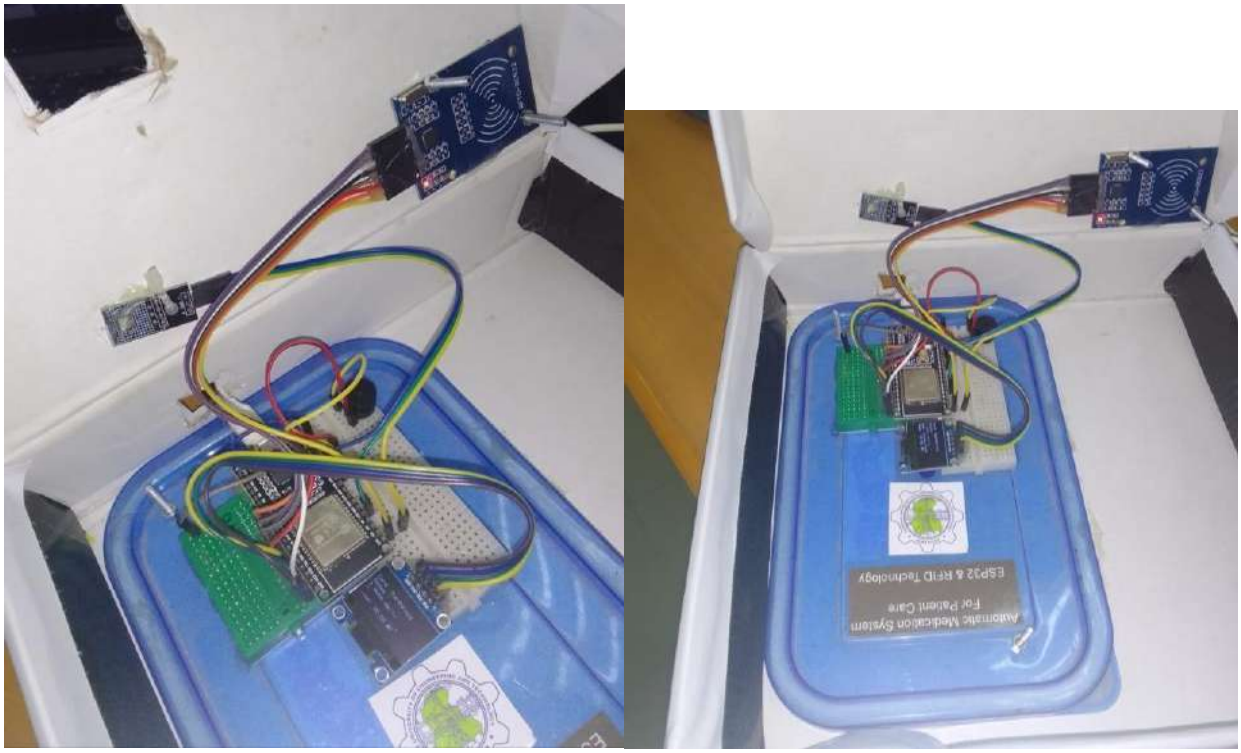


Figure 3.7.2: Hardware Design (Part2)

3.8 SOFTWARE PART:

In this part we basically designed an application for the record of patient that will go to doctor through a website named “Ada Fruit” in which doctor sends a msg to patient that will display on OLED we designed our app for the communication between doctor and

patient.

3.8.1 MIT App Inventor:

A user-friendly, visual programming environment called MIT App Inventor makes it possible for anybody, including kids, to create fully working apps for smartphones and tablets. Those new to MIT App.

In less than 30 minutes, Inventor can have a basic first app up and running. For novices, MIT App Inventor for Android is excellent. They offer thorough, step-by-step tutorials. Users can better comprehend an app's components thanks to the visual layout and dragand-drop functionality of this layout.

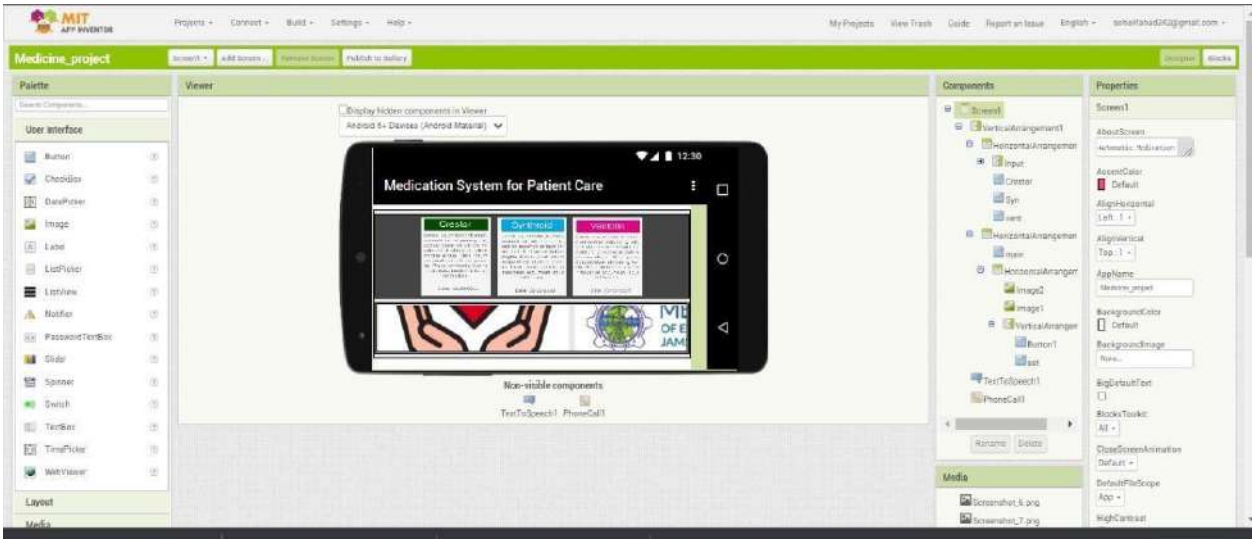


Figure 3.8: MIT App Inventor

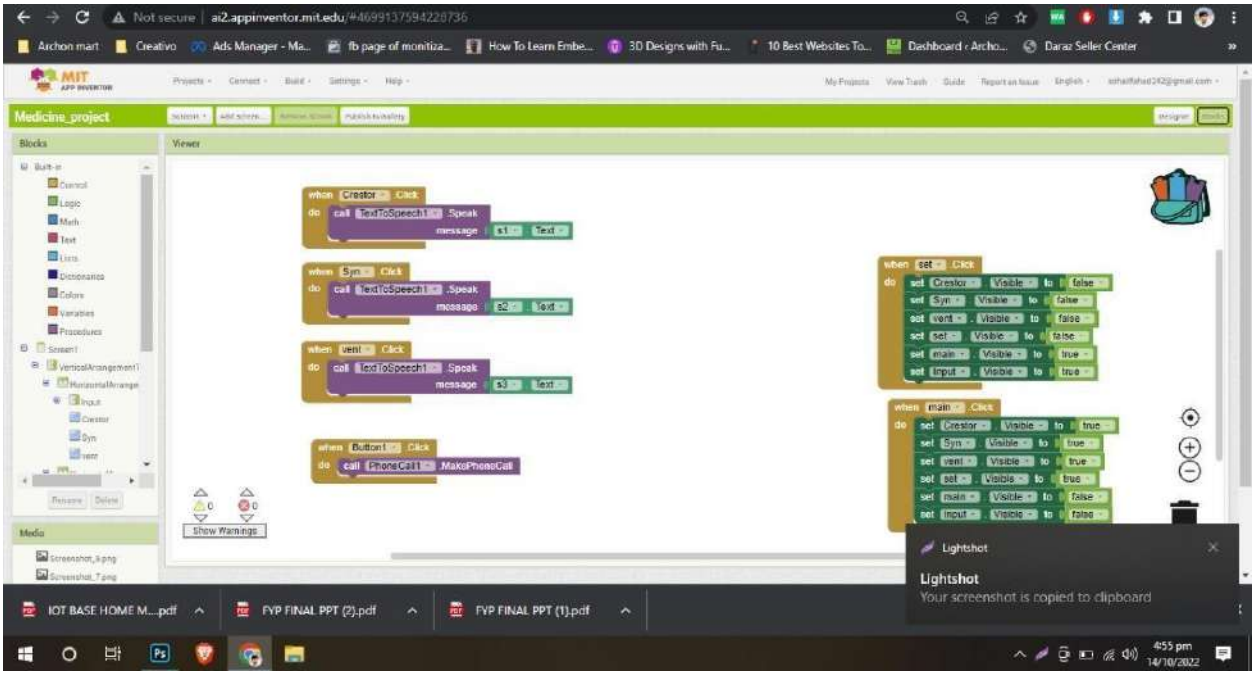


Figure 3.8.1: App description (Part 1)

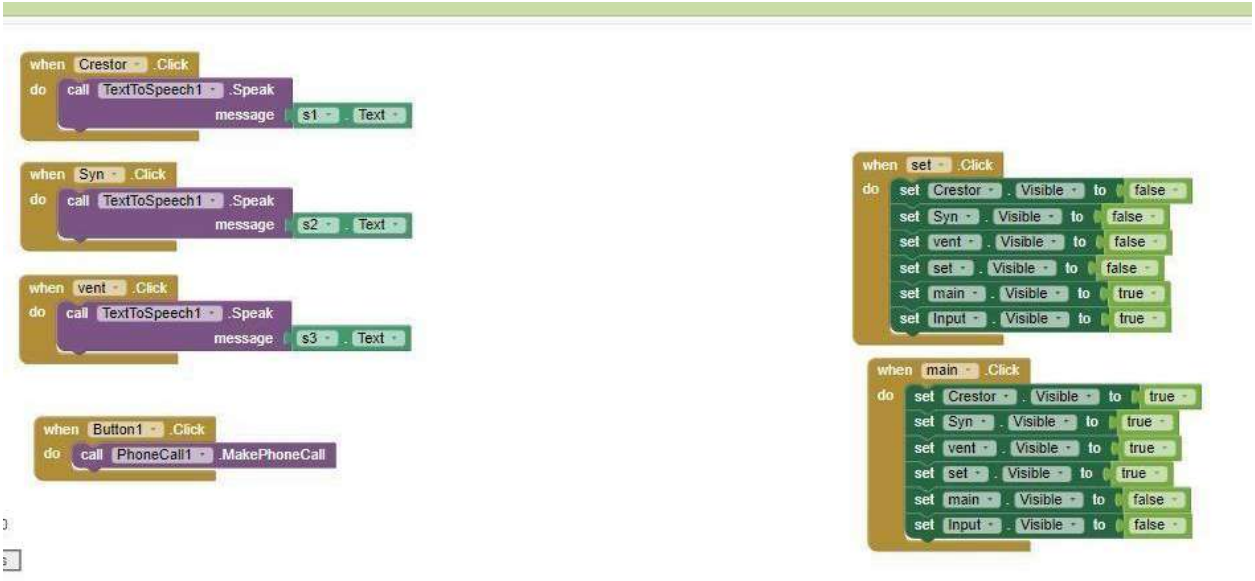


Figure 3.8.2: App description (Part 2)

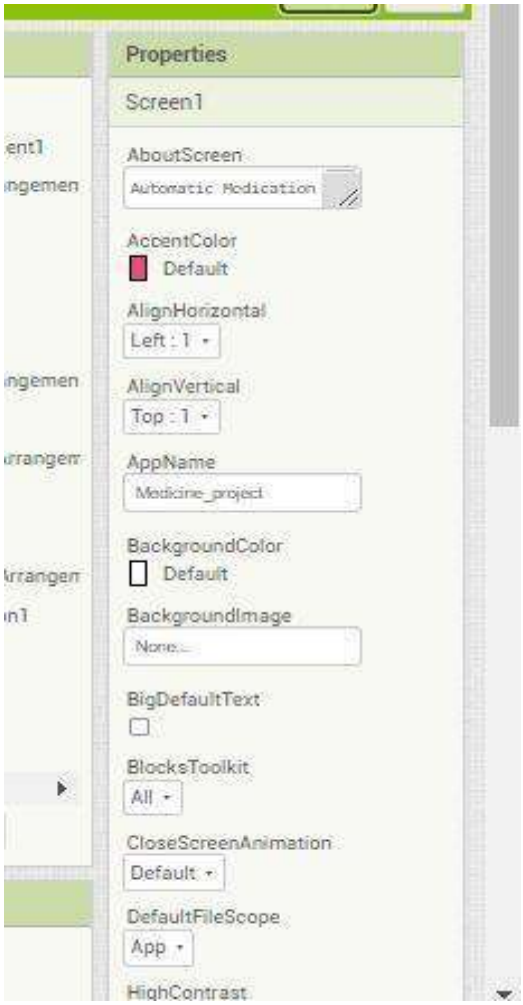


Figure 3.8.3: App description (Part 3)

3.8.2 Ada Fruit Website:

Because it is a cloud service, we manage it for you, and you don't have to. It is accessible over the internet. Although its primary purpose is data storage and retrieval, it is capable of much more. It is a platform created to show, react to, and interact with the data from your project. We also protect your data for you by keeping it secure (we never sell or provide this info to another company) and private (data feeds are private by default). Everyone has access to the internet of things.

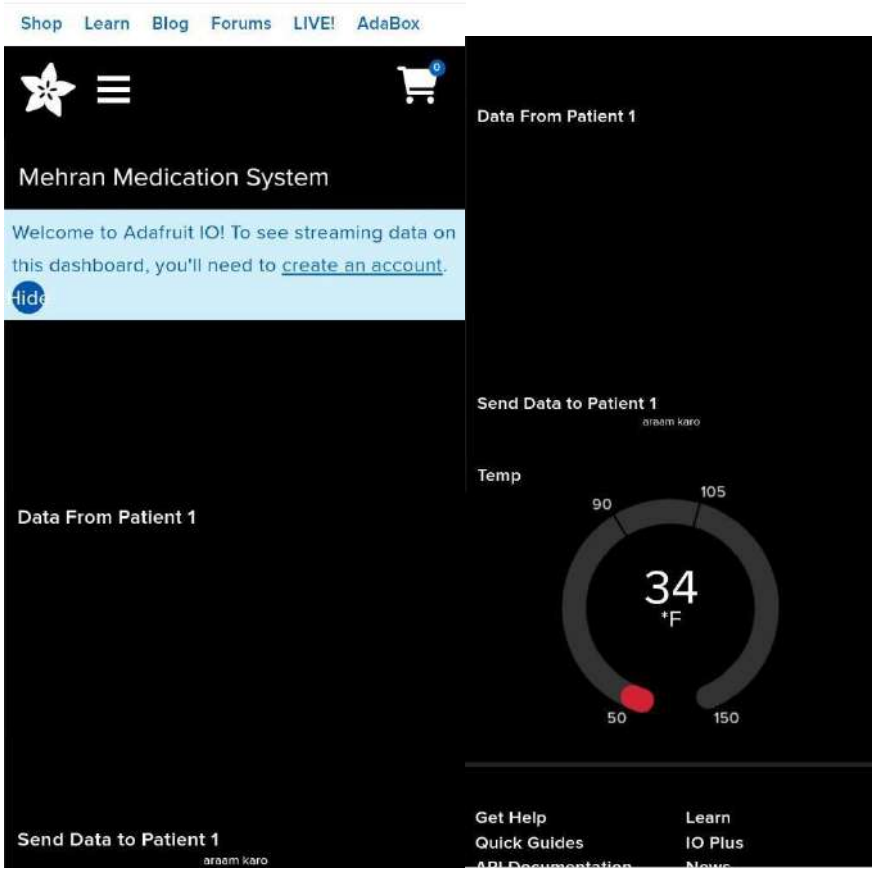


Figure 3.9: Dashboard of Ada Fruit

CHAPTER-4 RESULTS AND DISCUSSION

We have represented results an automatic medication system that helps the people read and to easily connect with the doctor. By the help of this system people either aged or

younger can easily interconnected with the doctor and take each information from the doctor. The purpose of this system is as the current situation of our country people cannot reach on time in hospital either due to traffic or any severe issues that's why it helps to save time. Or as we know the doctor has limited time to check a patient so through this system we can also talk to the doctor in detail.

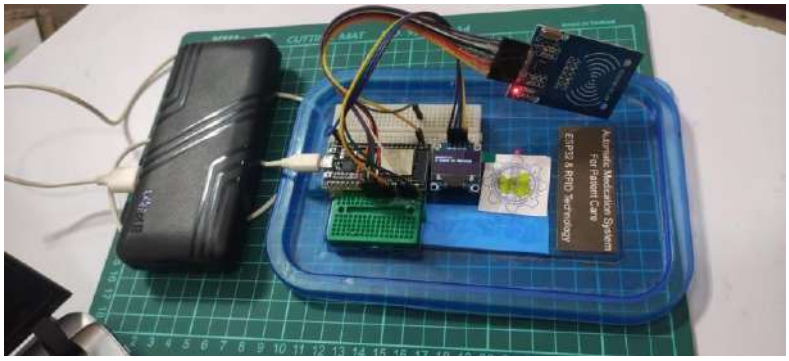


Figure 4.0: Complete Layout of project

Figure 4.1: Medicines timing and dosage indications in OLED

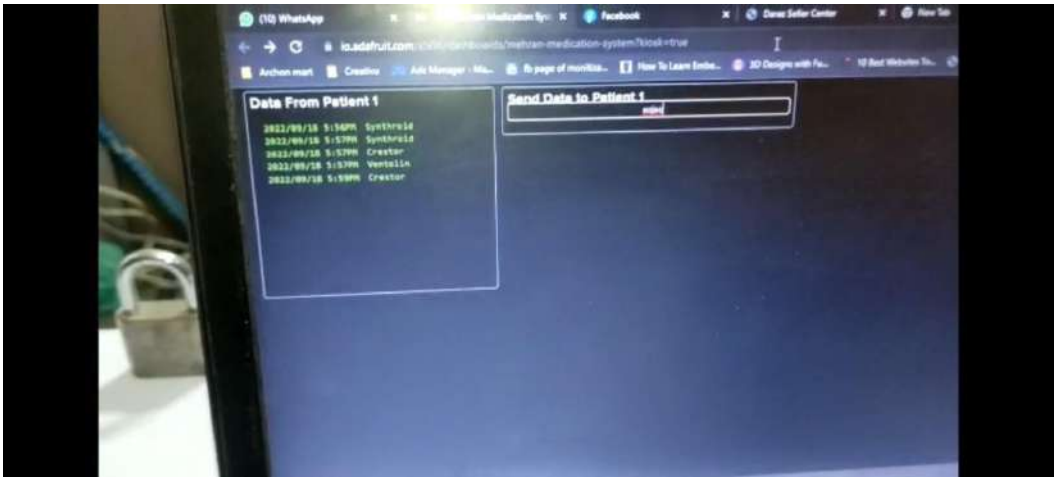


Figure 4.2: Adafruit website for doctor to communicate with patient

Figure 4.3: App for the record of medicines

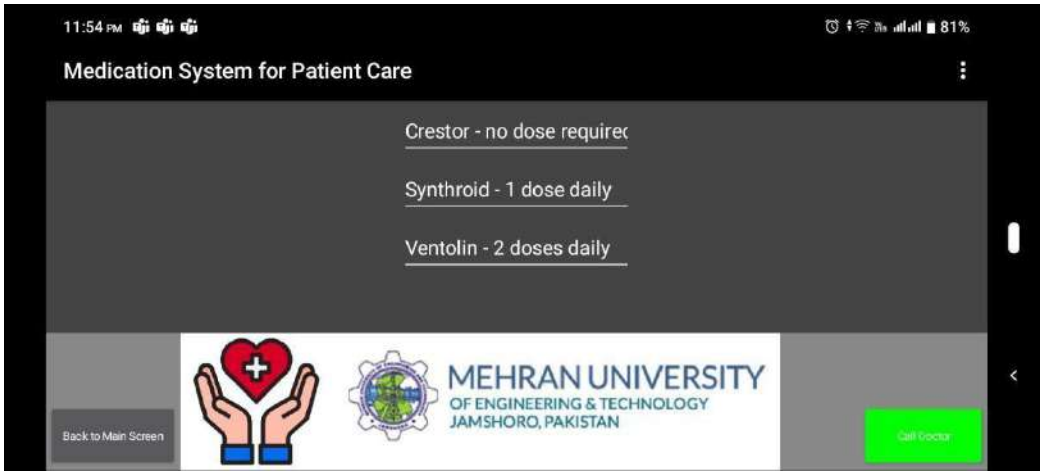


Figure 4.4: Medicines Coded in App

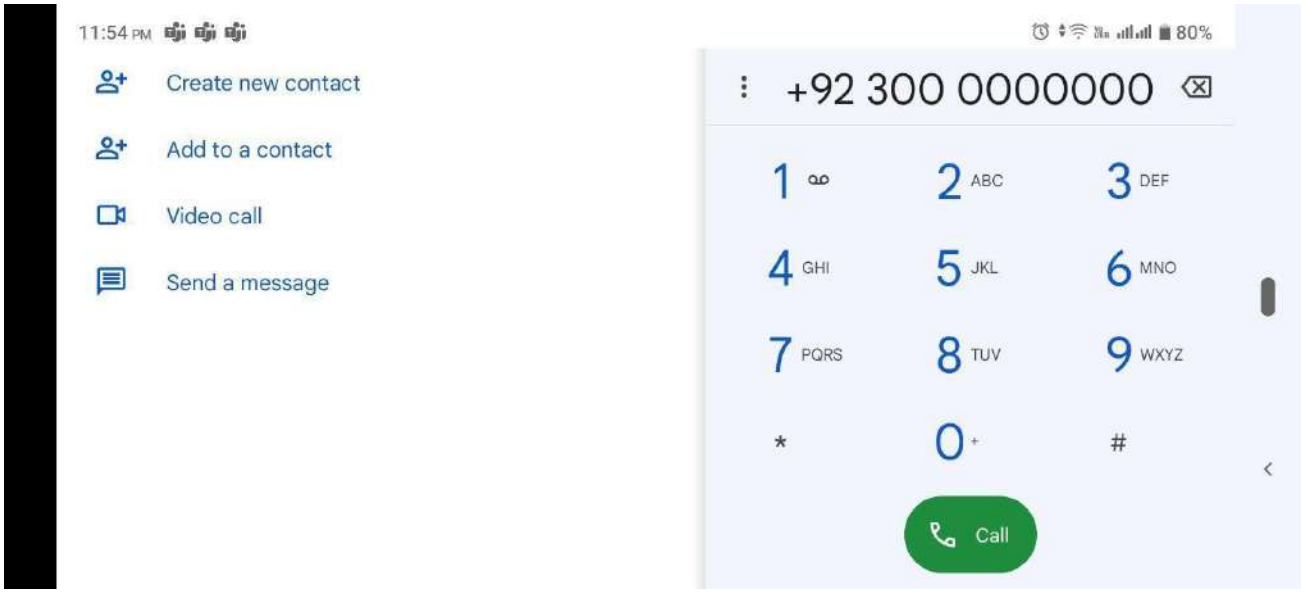


Figure 4.5: Call the doctor by clicking the below button

CHAPTER-5 CONCLUSION AND FUTURE RECOMMENDATIONS

The project layout is designed, implemented, and tested successfully. The automatic medication system completely provide medication to the project who don't take their medicine at time and this system tells the dosage of medicine that how many doses you must take.

5.1 Future Work:

The Automatic medication system for patient care works efficiently as it provide medication system that showing on OLED display. Some of the work will relate to this that we can add speaker for medicine and also the record or medicine of (15)fifteen days or even (1)one month record will go to doctor when medicine prescription is complete.The other work related to that we can add robotic arm that work to scan medicine and give it to patient.If the patient is uneducated and dumb then we can make a system who locally provide medicines to those patients.

REFERENCES:

[1] *IEEE Healthcom : final program & book of abstracts : 12th International Conference on E-Health Networking, Application & Service, 1-3 July 2010, Lyon, France*. IEEE, 2010.

[2] *2018 International Conference on Emerging Trends and Innovations In Engineering And Technological Research (ICETIETR)*. IEEE, 2018.

[3] "C-CODE.2019.8681047".

[4] M. Nabri, A. Mohammed, A. Hassan, M. A. #2, and M. Salih, "2013 INTERNATIONAL CONFERENCE ON COMPUTING, ELECTRICAL AND ELECTRONIC ENGINEERING (ICCEEE) 357 Designing Low Cost Digital Dose Reminder System."

[5] International Islamic University Chittagong, Institute of Electrical and Electronics Engineers. Bangladesh Section, and Institute of Electrical and Electronics Engineers, *2018 International Conference on Innovations in Science, Engineering and Technology : ICISET 2018 : International Islamic University Chittagong, Chittagong, Bangladesh : 2728 October 2018*.

[6] S. A. Saudi Computer Society. National Computer Conference (21st : 2018 : Riyadh, Institute of Electrical and Electronics Engineers. Saudi Arabia Section., and Institute of Electrical and Electronics Engineers, *21st Saudi Computer Society National Computer Conference : SCS-NCC' 2018 : Riyadh, Kingdom of Saudi Arabia, 25-26 April, 2018.*

[7] Saveetha Engineering College and Institute of Electrical and Electronics Engineers, *IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI) - 2017 : 21st & 22nd September 2017*.

[8] Saudi Computer Society., Institute of Electrical and Electronics Engineers. Saudi Arabia Section, Institute of Electrical and Electronics Engineers. Region 8, and Institute of Electrical and Electronics Engineers, *2nd International Conference on Computer Applications & Information Security (ICCAIS' 2019) : 01-03 May, 2019 Riyadh, Kingdom of Saudi Arabia*.

[9] A. Banerjee, R. A. Ramanujan, and S. Agnihothri, "Mobile health monitoring: Development and implementation of an app in a diabetes and hypertension clinic," in *Proceedings of the Annual Hawaii International Conference on System Sciences*, Mar. 2016, vol. 2016-March, pp. 3424–3436. doi: 10.1109/HICSS.2016.427.

[10] M. Hamim, S. Paul, S. Iqramul Hoque, M. Nafiur Rahman, and I.-A. Baqee, "IoT Based Remote Health Monitoring System for Patients and Elderly People."