Artificial Intelligence based Medical Humanoid Cov-Rob

Final Year Project

Session 2018-2022

A project submitted in partial fulfillment of the degree of

BS in Computer Science

Department of Computer Science

Faculty of Computer Science & Information Technology

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*The candidates confirm that the work submitted is their own and appropriate credit has been given where reference has been made to work of others

Plagiarism Free Certificate

This is to certify that, I M Huzaifa Imran S/D of M Imran Zulfiqar, group leader of FYP under registration no bcsm-f18-373 at Computer Science Department, The Superior University, Lahore. I declare that my FYP report is checked by my supervisor.

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Project Report

Artificial Intelligence based Medical Humanoid Cov-Rob

Change Record

Author(s)	**Version**	**Date**	**Notes**	**Supervisor's Signature**
	1.0			

APPROVAL

PROJECT SUPERVISOR	
Comments: ____	
____	
Name:______________________	
Date:______________________	Signature:____________________

.

PROJECT MANAGER	
Comments: ____	
____ _	
Date:______________________	Signature:____________________

HEAD OF THE DEPARTMENT	
Comments: ____	
____	
Date:______________________	Signature:____________________

Dedication

This work is dedicated to Society. To bring ease in society and providing facilities to other people should be the first priority as a human and as a Muslim

Acknowledgements

I am really thankful to my supervisor for their acknowledgement and constant supervision as well as for providing important information about the project and also for the support in completing my project.

Executive Summary

This is the basic need of the society. Our project is Humanoid Robot in the field of medicine because in this pandemic condition it is not safe for doctors to check patients manually so we proposed a solution in the form of a COV Robot. COV Robot will be a multi task robot. But for now it will help doctors in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data. In short It will be an all in one machine. Our targeted market is Hospitals and all the common people who can afford this robot. It is very easy to use because it is fully automated. The strategy we are using is online advertising which includes Digital marketing, Billboards, Awareness campaigns and ads. There is no such competitor In the market till now but in future if there are some competitors we can deal with it with full awareness. The total expense is 20k USD but this is not a fixed amount anymore. The team members include CEO, COO and designer, developer, Marketing Manager, tester and other staff which is essential for our business strategies. Our plan will be highlighted in the world if it is worked properly and the campaign is in the right direction. For the first year our priority is to make people aware and for the 2nd year we will implement the plan and for the 3rd year our priority is to start the idea and deal with the people.

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Chapter 1

Introduction

Chapter 1: Introduction

COV Robot will be a multi task robot. But for now it will help doctors in examining the patients manually in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data. In short It will be an all in one machine.

1.1. Background

During COVID’19(Pandemic Condition) it is not safe for doctors to examine patients manually and most of our young Doctors and Nurses put their lives in danger just to serve humanity and that's why COV-ROB will save the lives of patients as well as doctors and nurses and secondly it will replace nurses to assist doctors for more quick and accurately task accomplishment *[1]*

1.2. Motivations and Challenges

The desire to serve humanity with our expertise motivates us a lot so we can make a difference in our society. The real challenge is the implementation of this robot in the market and getting positive feedback . We are highly motivated to accomplish all the challenges that we are going to face. *[2]*

1.3. Goals and Objectives

Our Goal is to serve humanity with as much ease and safety.

Objectives of Cov-Rob are follow as:

- Reduce Healthcare Cost
- Gain accuracy in readings.

- Robot will be a multi task robot.
- All basis apparatus in one robot.
- Containing a medical arm having all the basic apparatus attached on it.
- Using Sonar Sensor for robotic wheel movement.
- Wirelessly camera attached with LCD.
- Compact size humanoid robot.

1.4. Literature Review/Existing Solutions

In Pakistan there is no such direct competitor/solution available but indirectly noorani surgicals and medical solutions Pakistan are developing scattered bp, temperature, ecg, apparatus but we are combining all the apparatus on a single platform/belt. [3]

1.5. Gap Analysis

There is no humanoid Robot in Pakistani Market available that measures simultaneously reading and display it on a screen and no any assistance available that follows doctors and properly assist them during their operational routine

1.6. Proposed Solution

During COVID’19(Pandemic Condition) it is not safe for doctors to examine patients manually and most of our young Doctors and Nurses put their lives in danger just to serve humanity. So to answer this problem we developed Cov-Rob. For all the health service providers including Hospitals and Dispensaries my company is developing a medical robot which will help doctors in examine the patients manually in this Pandemic Condition containing a medical arm having all the basic apparatus attached on it including (bp sensors, temperature sensor, Pulse-oxy, heartbeat measurement and ECG sensors). The main goals of our project are:

- Reduce Healthcare Cost
- Gain accuracy in readings.
- Robot will be a multi task robot.
- All basis apparatus in one robot.
- Containing a medical arm having all the basic apparatus attached on it.
- Using Sonar Sensor for robotic wheel movement.
- Wirelessly camera attached with LCD.
- Compact size humanoid robot.

Other benefits of Cov-Rob in the medical field are assistance robots. These robots provide support to sick, disabled or elderly people and allow them to have continuous care and supervision

1.7. Project Plan

It is a six month project plan and we will follow the Incremental methodology of computer science.

1.7.1. Work Breakdown Structure

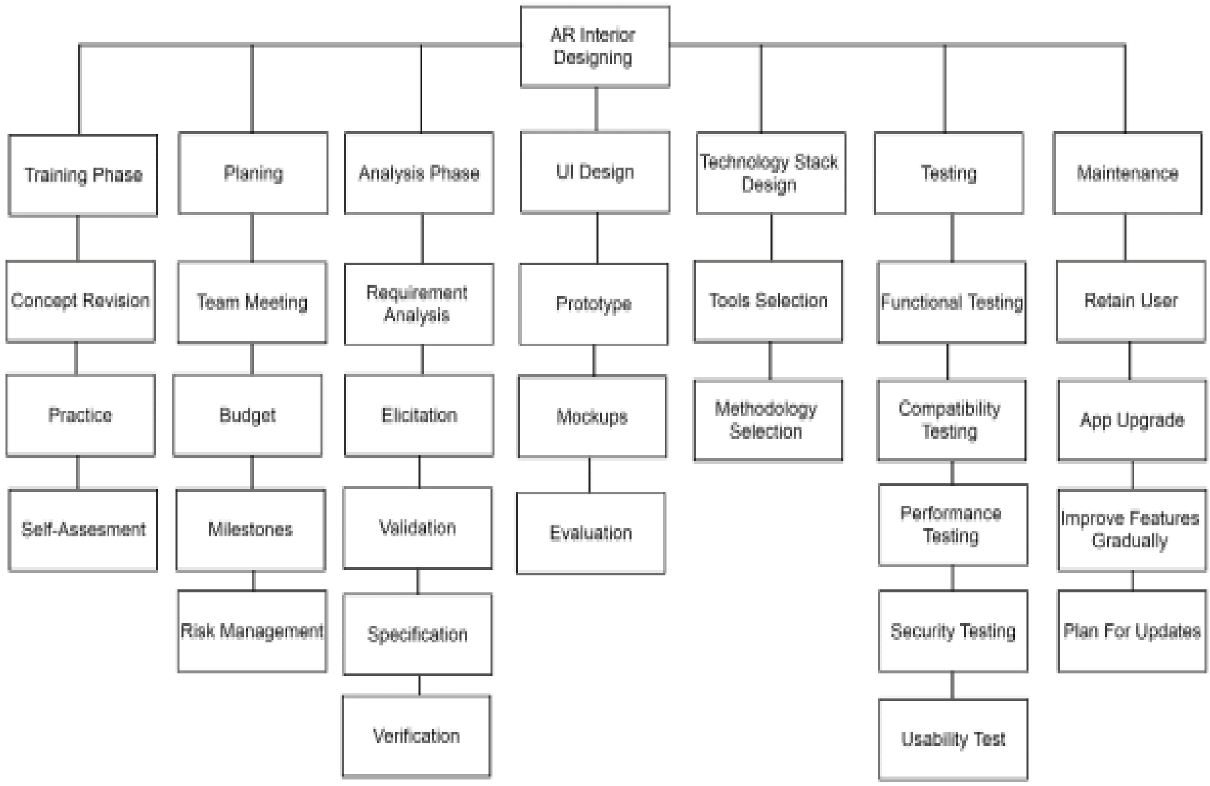


Figure 1.7.1 Work Breakdown Structure

1.7.2 Roles & Responsibility Matrix

WBS#	WBS Deliverable	Activity #	Activity to Complete the Deliverable	Duration (# of Days)	Team Member Names
1	Training Session	1	Consult Professor	1 week	M Huzaifa Imran Tayyab Shabbir Abdul Hhadi
2	Hardware Gathering	2	Consult and Visit market	1 month	M Huzaifa Imran
2	Hardware Order	2	Search websites and order placement	1 month	M Huzaifa Imran
3	Robot Structure designing	3	Consult and tool usage	2 weeks	Tayyab Shabbir
4	backend Capability	4	Proper Research and Compatibility	1 month	M Huzaifa Imran Tayyab Shabbir Abdul Hhadi
4	Modules Installation	4	Consult Professor	1 week	M Huzaifa Imran
4	Broachers	5	Designing	2 days	Tayyab Shabbir
5	Poster	5	Designing	2 days	Tayyab Shabbir
6	Flex	6	Printing	3 days	Abdul Hadi
6	Sensors Importing	6	Importing from Amazon	1 week	M Huzaiaf Imran
7	Documentation	7	Document the given template	1 month	M Huzaifa Imran Tayyab Shabbir Abdul Hhadi
8	Assembling of Structure	8	Assembling all parts of the roboit	1 month	M Huzaifa Imran Tayyab Shabbir Abdul Hhadi

Table 1 Roles & Responsibilities

1.8. Report Outline

Chapter 1 is a complete and defined introduction of our final year project.

1- Background:

Cov-Rob led us to develop something really interesting and challenging.

2- Motivations and Challenges:

We are the motivations of each other and together as a team we are ready to face every challenge. To do something unique is actually our motivation.

3- Goals and Objectives:

There should be pre-defined goals and objectives and we also had already set our goal for which we have defined some objective. We can achieve these objectives and goals as a team.

4- Literature Review/Existing Solution:

We analyze the market and currently there is no such active product in the Pakistani Market based on our idea.

5- Gap Analysis:

Scattered Apparatus is available but no simultaneously working machine is available in market

6- Proposed Solution:

For all health service providers including hospitals and dispensaries who are having issues in examining the patients manually in this pandemic condition we designed Cov-Rob for them.

7- Project Plan:

We created a work breakdown structure through which we are clearly aware of the development flow. We also distributed roles to each team member and for this purpose we created a R&R Matrix through which every team member is aware of every team member's task. We divided the number of days according to the intensity and load of a particular task through the Gantt Chart.

Chapter 2

Software Requirement Specifications

Chapter 2: Software Requirement Specifications

2.1 Introduction

2.1.1 Purpose

During **COVID'19** (Pandemic Condition) it is not safe for doctors to examine patients manually and most of our young Doctors and Nurses put their lives in danger just to serve humanity. For all the health service providers including Hospitals and Dispensaries my company is developing a medical robot. Which will help doctors in examining the patients manually in this Pandemic Condition. *Containing a medical arm having all the basic **apparatus** attached on it including (bp sensors, temperature sensor, Pulse-oxy, heartbeat measurement and ECG sensors).* [4]

2.1.2 Document Conventions

This Document is following the international standard of IEEE for SRS Documentation. Important things, functions and workings are written in bold. This document describes all the features of the product, working of the product and also how to use the product in the right manner.

2.1.3 Intended Audience and Reading Suggestions

This document is written for developers of the product, project manager and clients. who will look after the product after it is installed and start its working. Document is written in the proper manner so the reader should read this document in the defined order.

2.1.4 Product Scope

Cov-Ribs in the medical field are assistance robots. These robots provide support to sick, disabled or elderly people and allow them to have continuous care and supervision.

2.2 Overall Description

2.2.1 Product Perspective

COV Robot will be a multi task robot. But for now, it will help doctors in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data. [6]

2.2.2 Product Functions

- Robot will be a multi task robot.
- All basis apparatus in one robot.
- Containing a medical arm having all the basic apparatus attached on it.
- Using Sonar Sensor for robotic wheel movement.
- Wirelessly camera attached with LCD.
- Compact size humanoid robot.

2.2.3 User Classes and Characteristics

This product will be available for hospitals and also for homes. We will customize according to their needs and demands. it will help doctors in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data.

2.2.4 Operating Environment

Robot will operate in normal home level temperature between (10c to 30c). Requires Smart Android LCD having bluetooth driver compatible with module hc-05 installed in LCD.

2.2.5 Hardware Used

Following Hardware is Used in our Project

1. **Arduino UNO R3 SMD Board Kit:**

Fig 2.2.5(i) Arduino UNO R3 SMD Board Kit 1

2. BP Sensor (BMP280 Barometric Pressure Sensor Module):

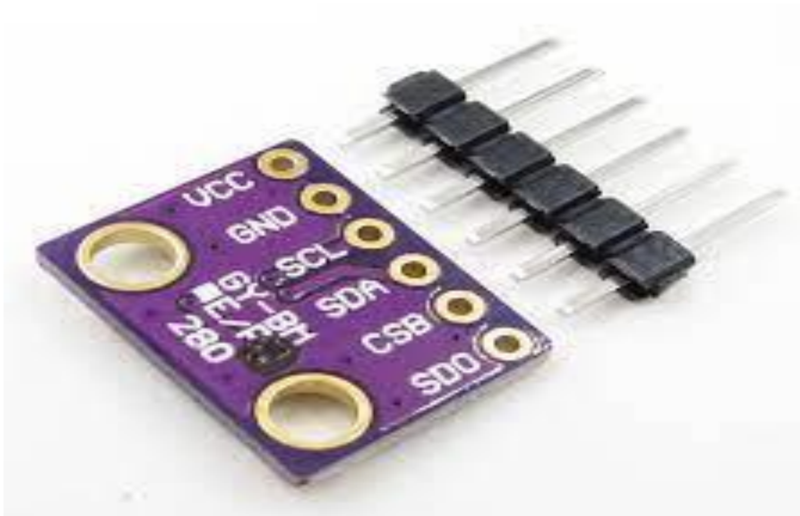


Fig2.2.5(ii)BP sensor (BMP280 Barometric Pre 1

3. Temperature Sensor (DS18B20)

Fig2.2.5(iii) Temperature Sensor (DS18B20)

4. Heart Beat Detector (Module KY 039)

Fig2.2.5(iv) Heart Beat Detector (Module KY 0 1

5. Pulse Oximeter (Module Max30100)

Fig2.2.25 (v) Pulse Oximeter (Module Max30100

6. Sonar Sensor (HC-SR04 ultrasonic sensor)

Fig2.2.5 (vi) Sonar Sensor (HC-SR04 ultrasonic sonar)

7. Jumper Wires Male to Male 20 centimeter

Fig2.2.5 {vii) Jumper Wires Male to Male 20 centimeter

2.2.6 Design and Implementation Constraints

Hardware Limitations:

The Design considerations are as follows.

1) Height of the Humanoid

2) Angle of body in frontal plane

3) Angle of body in lateral plane

4) Position of feet with respect to body

5) Position of feet with respect to floor

6) Speed of robot movement

Interfaces to Other Applications

Kinematic Model is the mapping of Cartesian space from Joint space. This mapping is necessary, as it determines the orientation of the foot and to calculate the positions of the Center of Mass of the links. Generalized position vector (q), generalized velocity vector ( ) and generalized acceleration vector ( ) are the net result of the kinematic model .

2.2.7 User Documentation

Cov-Robs in the medical field are assistance robots. These robots provide support to sick, disabled or elderly people and allow them to have continuous care and supervision.

2.2.8 Assumptions and Dependencies

COV-ROB is a medical Assistance robot purely designed for hospitals so local people are not able to deploy this version of Robot in their homes.

2.3 External Interface Requirements

2.3.1 User Interfaces

COV-ROB Humanoid medical robot contains multiple functions.

- Medical Arm having basic sensors attached
- Sonar Sensors for Robotic wheels movement
- Lcd attached for result display
- Wirelessly display attached with lcd
- Cameras attached in robot eyes

2.3.2 Hardware Interfaces

Figure 2.2.8 shows configuration of links and joints of the proposed robot with respect to yaw, pitch and roll rotation axes. The shoulders of the left and right arm of the robot have 1 DOF each with a pitch rotation axis. Rotation axis of the elbows are rolled. At the lower limbs, the hips exhibit yaw and the ankles exhibit roll rotation axes. Figure 3 gives a detailed idea on the joint structure of the leg and arm of the humanoid robot. *[15]*

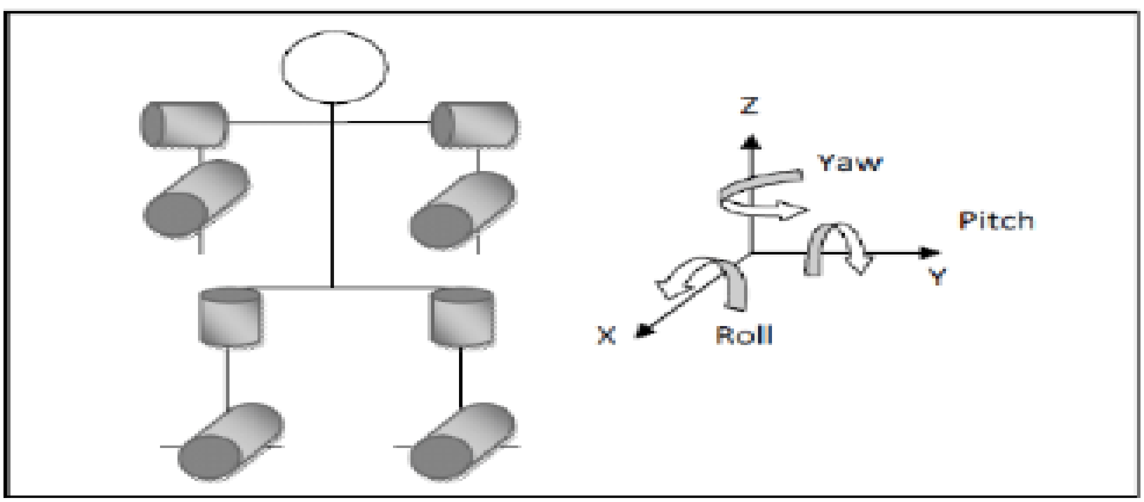


Fig. 2 : Configuration of Links and Joints

Figure 2.2.8

2.3.3 System Features

Humanoid Robots basically resemble human physical structure. Humanoid Robotics is an attempt to design a tool that works with humans and is specifically not an attempt to recreate human beings. Humanoids are expected to co-exist and work together with humans in environments which are meant for human beings. Such Robots have to interact with humans, who live a social life. Simulation of human body gives a better idea about Humanoids

2.4 Other Nonfunctional Requirements

2.4.1 Performance Requirements

Extreme care should be taken while designing the lower body of a humanoid robot. Stability is the major problem that arises during robot walking. For a biped robot to walk, it stands on a single leg and swings the other leg forward. When both the legs come to footing, in other words, if it is in double support phase, then the robot is said to be in a stable condition. To provide stability in the single support phase, the concept of a moving „Dead Weight" is utilized. According to this concept, the upper body weight is moved, so as to bring the center of gravity on the axis of the footing leg. By this the momentum during the single support phase is balanced. *[18]*

2.4.2 Safety Requirements

No such safety requirements are needed for cov-rob because it is a humanoid robot and used only to assist doctors.

2.4.3 Security Requirements

As Robot follows the instructions that are installed in it using an Ai Chip so that chip should not be replaced and no external program should be uploaded to robot driver unless a new version is released by us.

2.5 Robot Quality Attributes

Following are the initially known Robot quality attributes

1. Robots must always be fully charged.
2. No strong magnetic fields should be placed near to the robot.
3. always sanitize the robot arm after usage.
4. must not be placed in a high temperature.

2.6 Business Rules

We are developing a medical humanoid robot which will help doctors in examining the patients manually in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data. In short It will be an all in one machine. *[27]*

Chapter 3

Use Case Analysis

Chapter 3: System Analysis

This is the basic need of the society. Our project is Humanoid Robot in the field of medicine because in this pandemic condition it is not safe for doctors to check patients manually so we proposed a solution in the form of a COV Robot. COV Robot will be a multi task robot. But for now it will help doctors in checking up the patients in this pandemic condition (COVID'19).

3.1. Use Case Model

It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it.

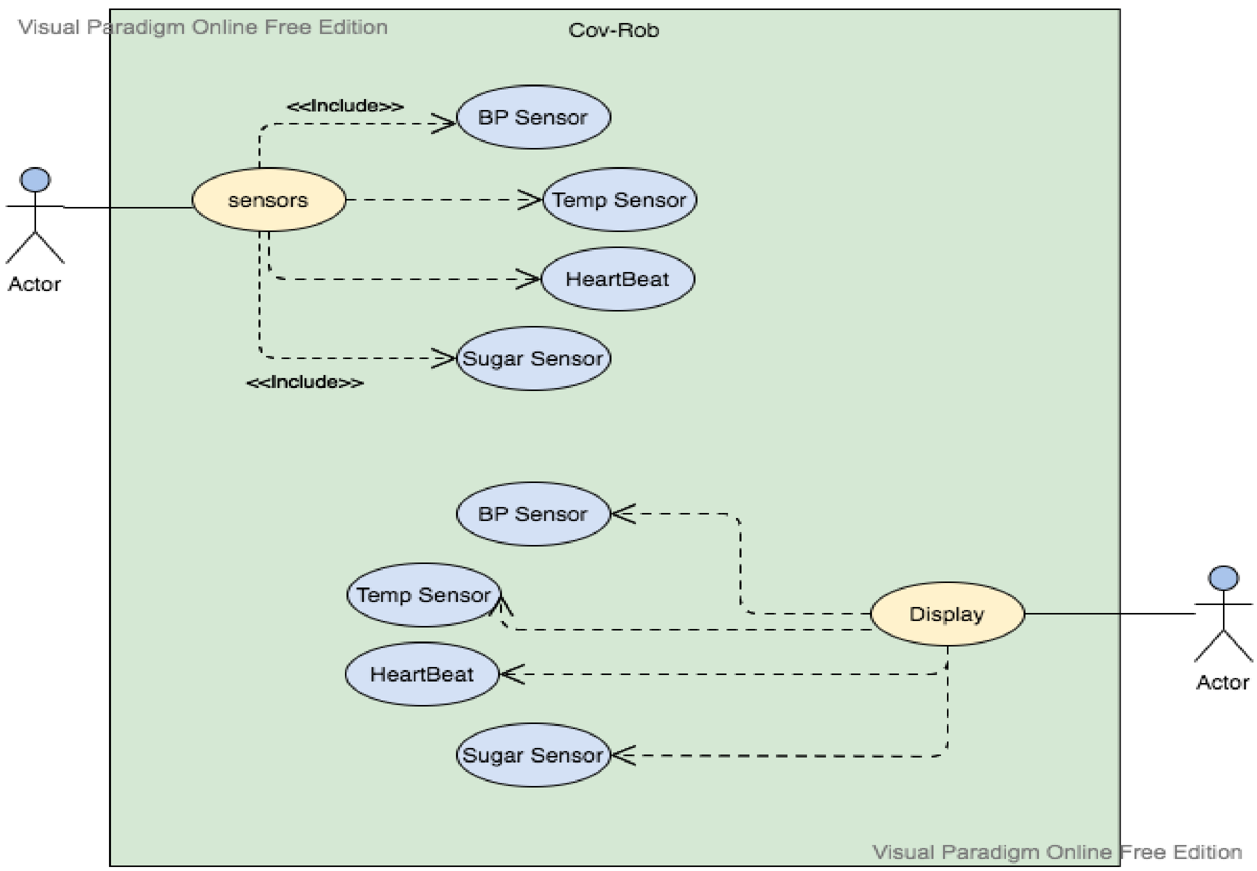


Figure 3.1 Use Case Model

3.2. Use Case Descriptions

First it detects the person's presence then identifies it and then it measures the readings. It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data. In short It will be an all in one machine.

Chapter 4

System Design

Chapter 4: System Design

The creation of a plan or convention for the construction of a Cov-Rob. System design refers to the graphical or diagrammatic representation of various system components or system as a whole.

4.1. Architecture Diagram

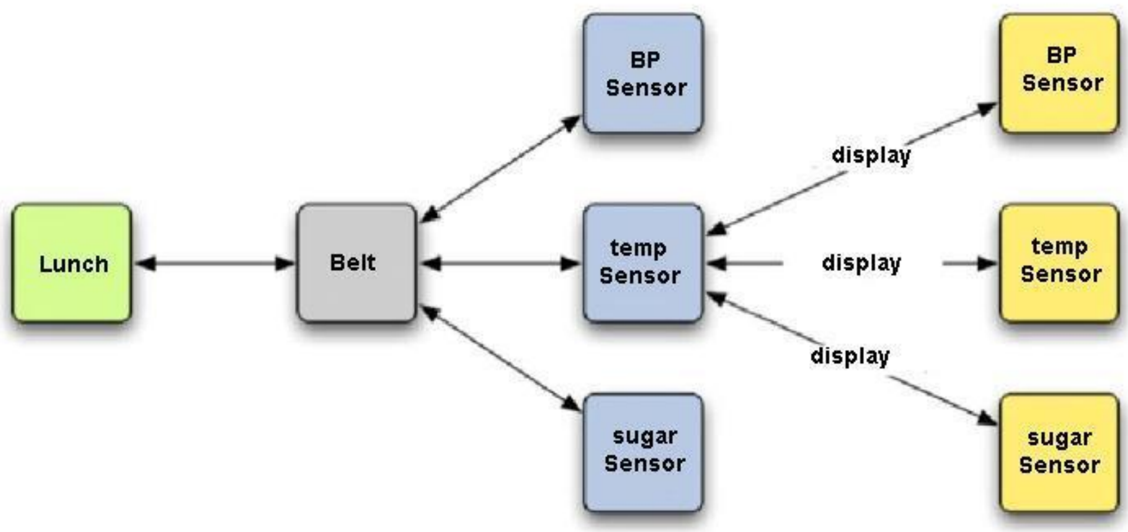


Figure 4.1 Architecture Diagram

4.2. Domain Model

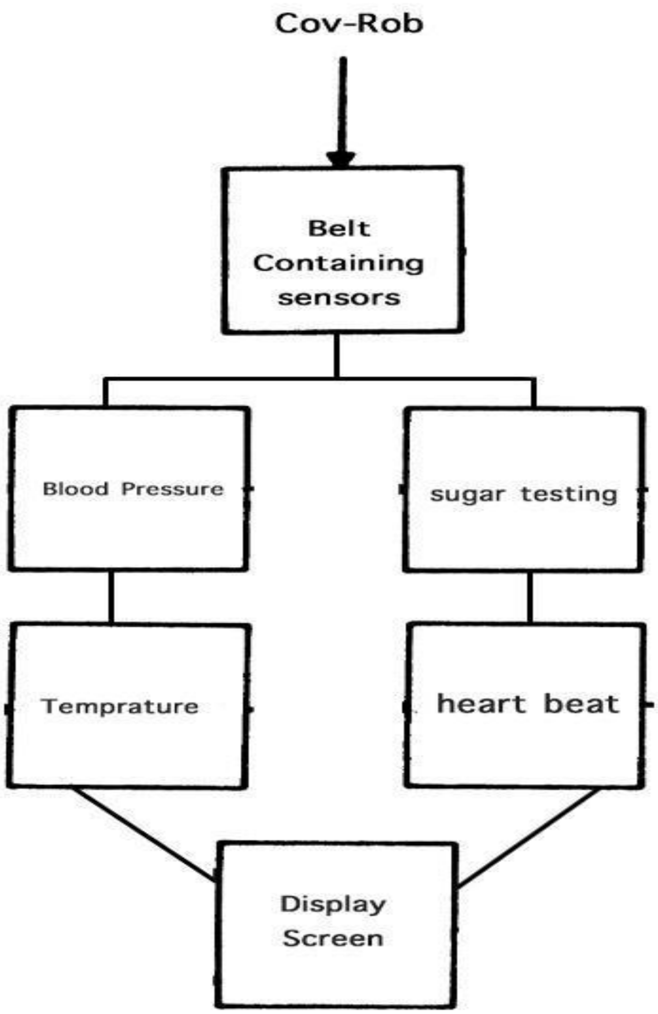


Figure 4.2 Domain Model

4.3. Entity Relationship Diagram with data dictionary

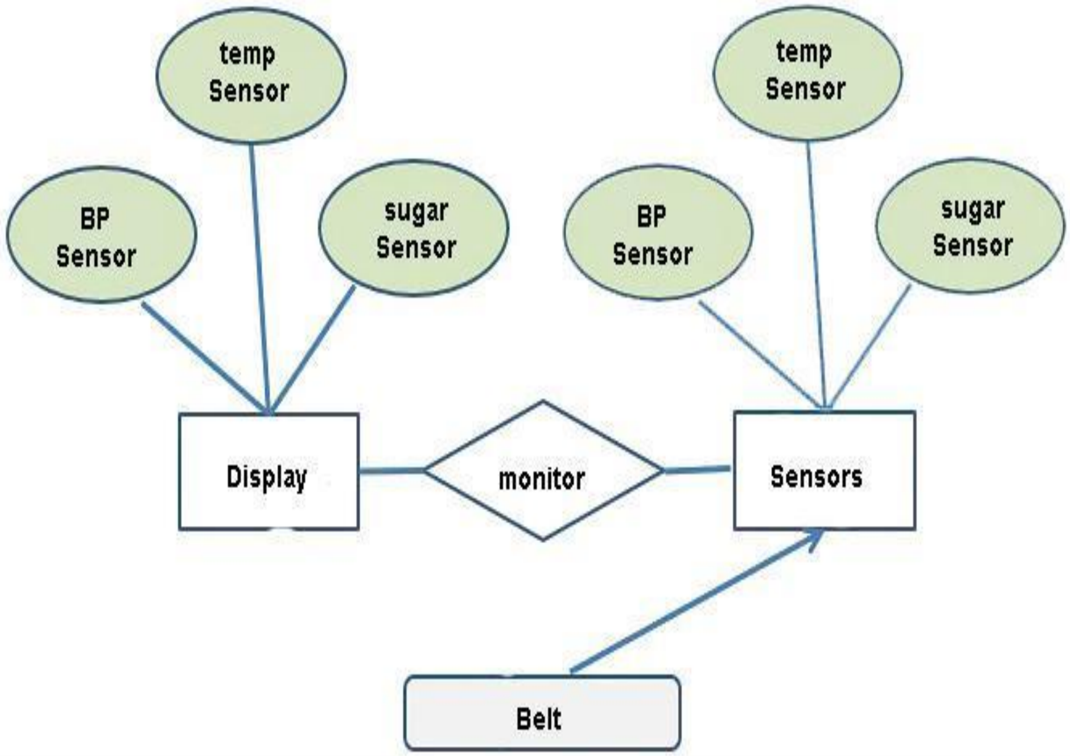


Figure 4.3 Entity Relationship Diagram

4.4. Class Diagram

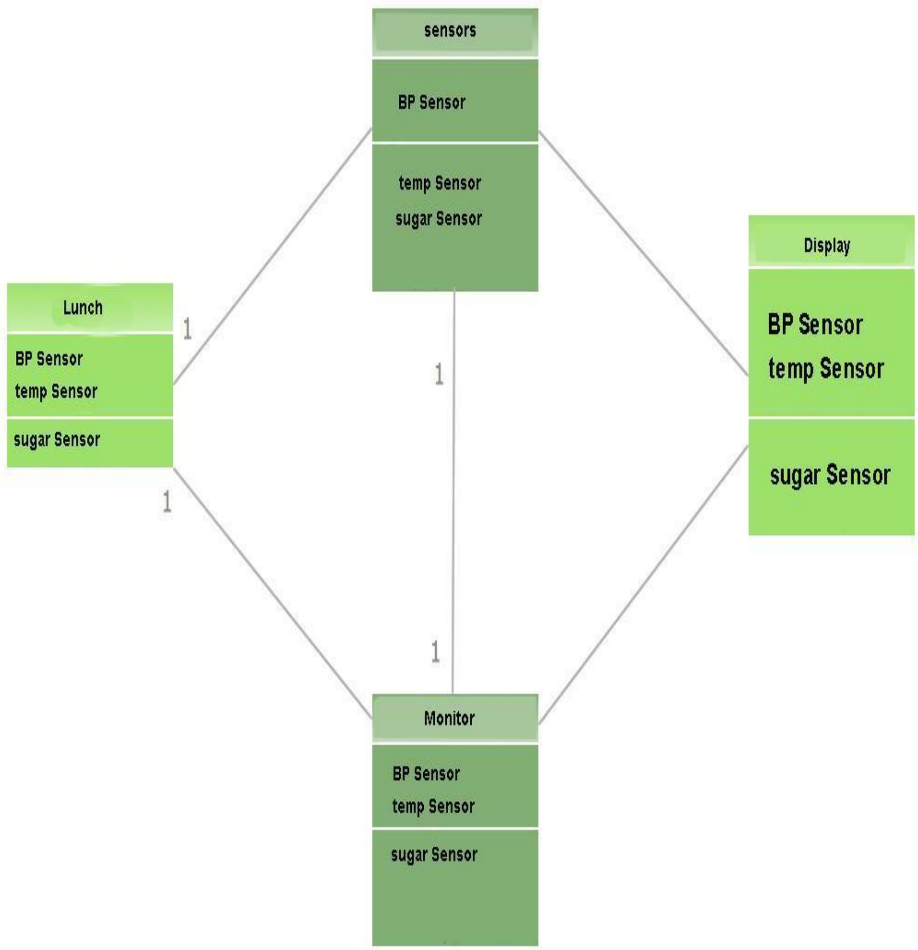


Figure 4.4 Class Diagram

4.5. Flow Chart

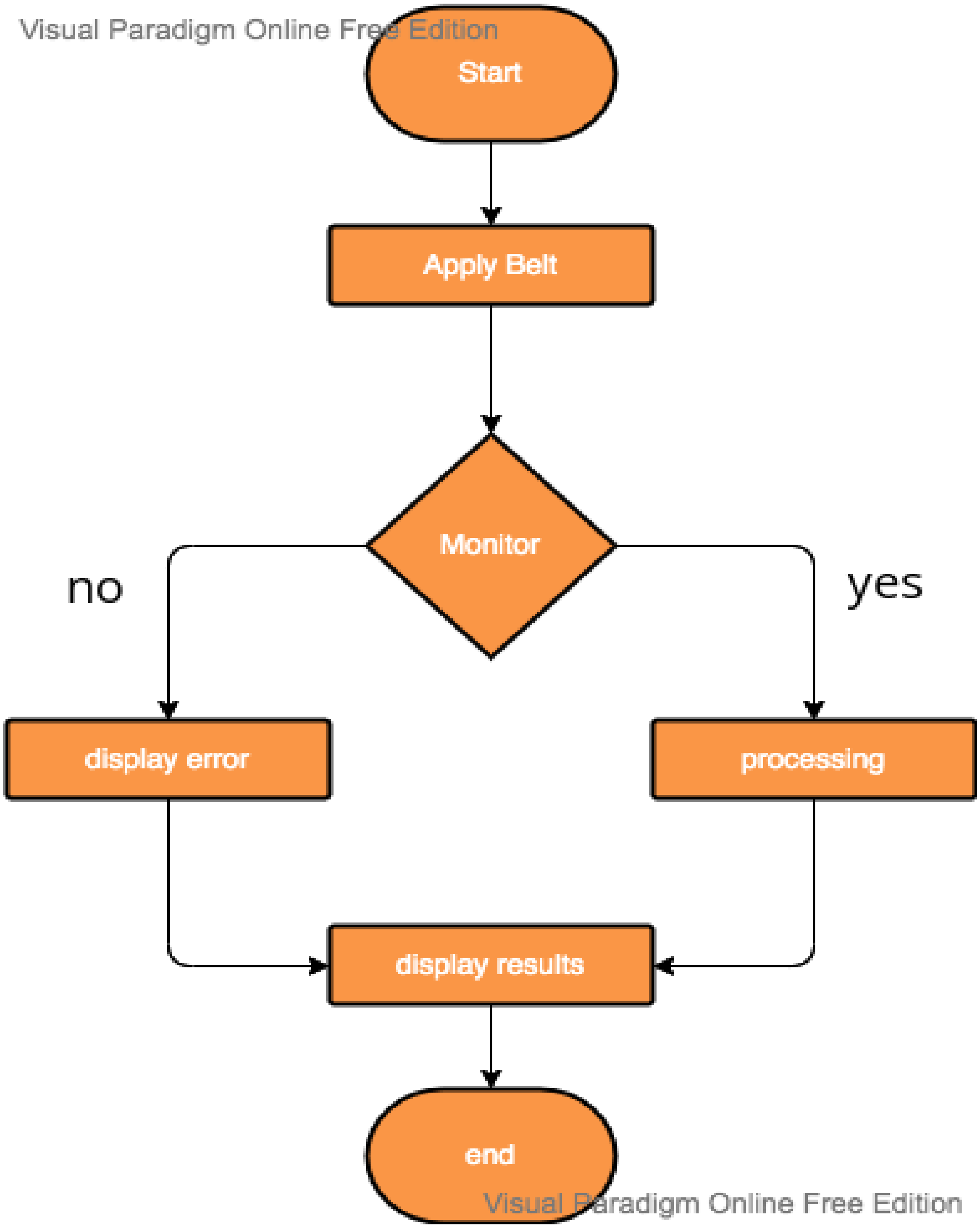
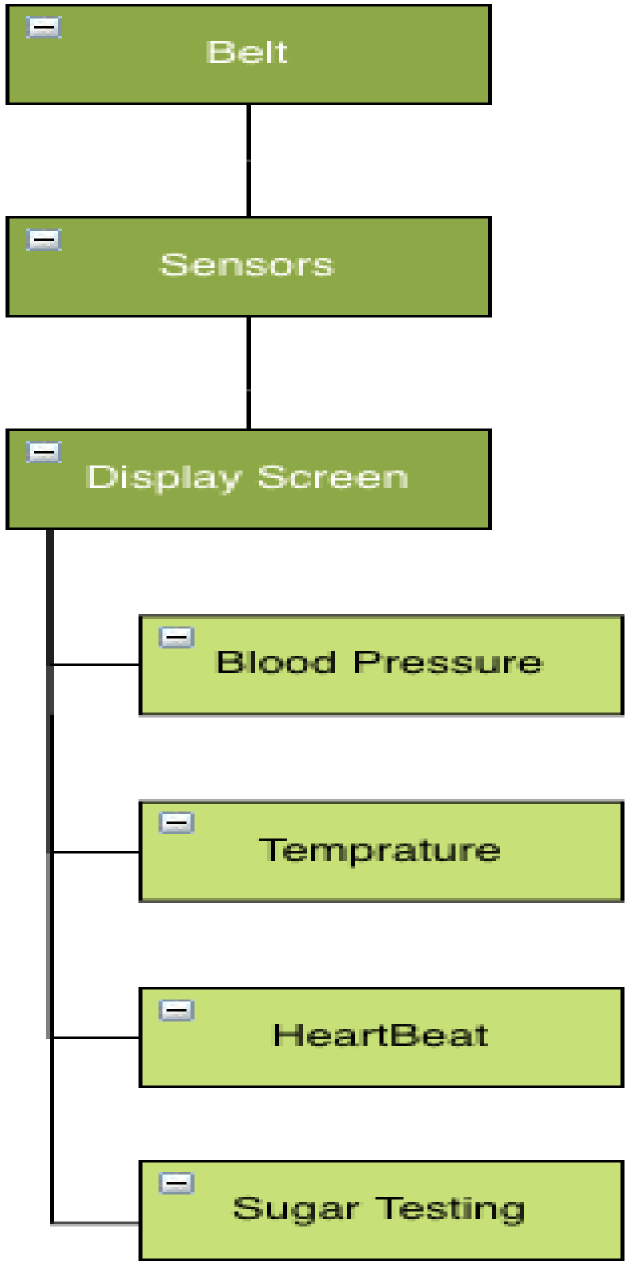


Figure 4.5 Flow Chart

4.6. Sequence / Collaboration Diagram



`Figure 4.6 Sequence/Collaboration Diagram

4.7. Activity Diagram

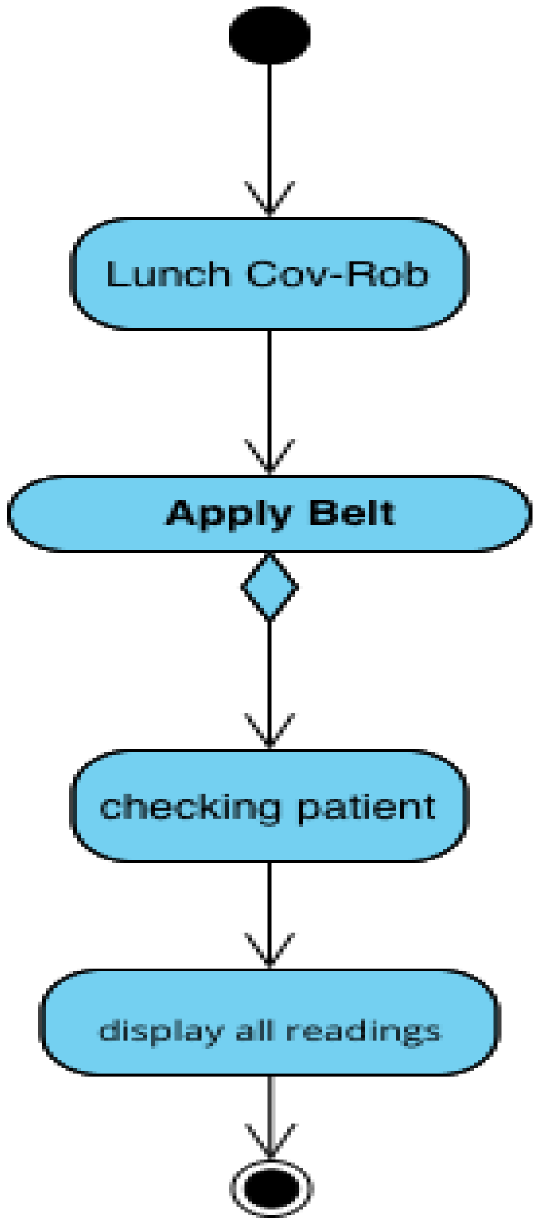


Figure 4.7 Activity Diagram

4.8. State Transition Diagram

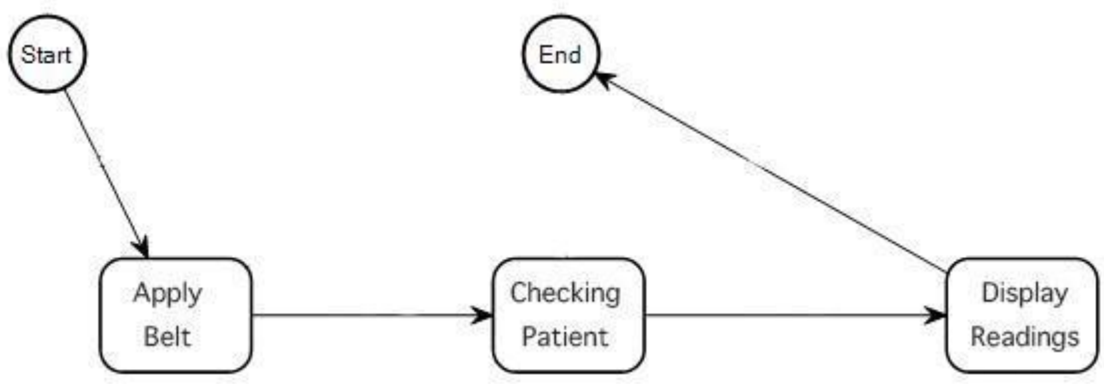


Figure 4.8 State Transition Diagram

4.9. Component Diagram

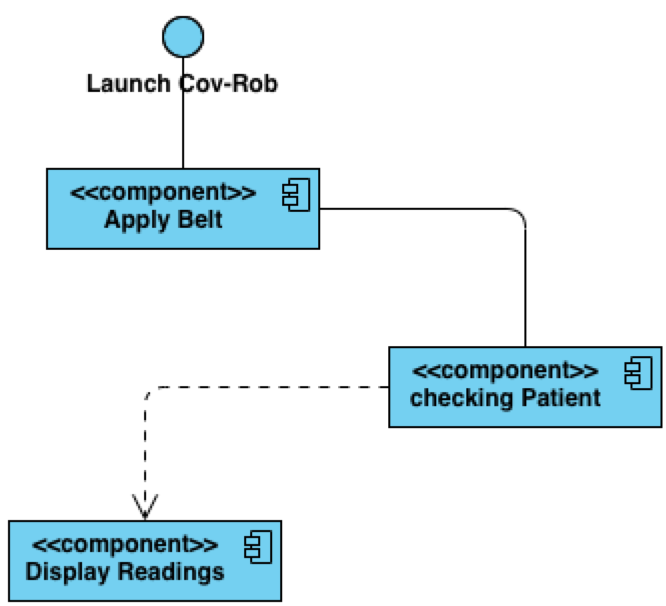


Figure 4.8 Component Diagram

4.10. Deployment Diagram

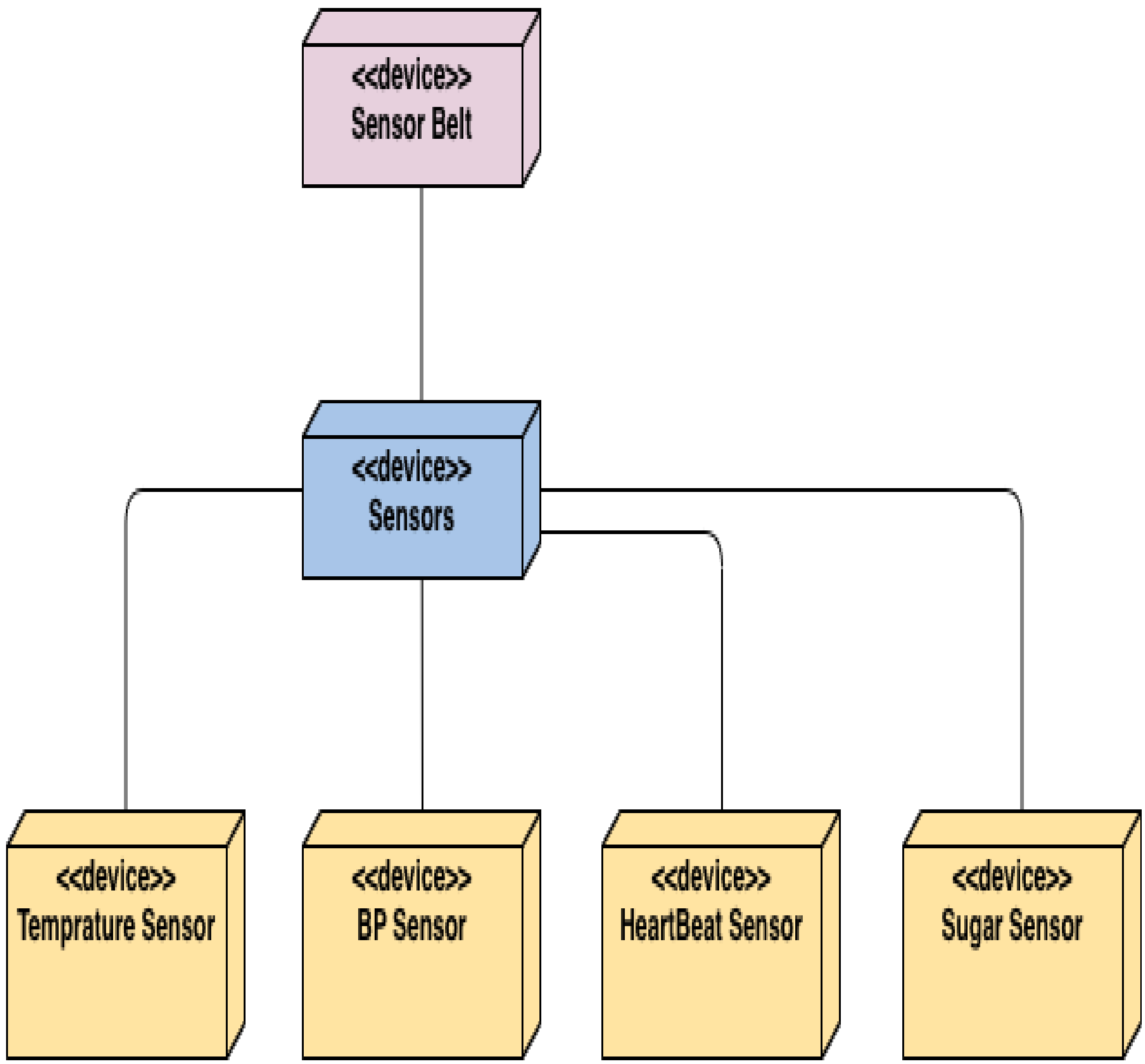


Figure 4.9 Deployment Diagram

Chapter 5

Implementation

Chapter 5: Implementation

This chapter describes how the application and back-end functionalities will be implemented practically. We will go for the start of manufacturing of products, we will buy basic Apparatus/Sensors and all the required materials, when the product will finally complete, we will start advertising the products to hospitals and pharmacies etc, whenever we receive any order we will start delivering the product free of cost. If it gets success we will go for further production.

5.1. Pseudo code :

If you have Sparkfun's MAX30105 breakout board , try #define MAX30105

```
int i = 0
int Num = 100
int Temperature
int temp
float ESpO2
double FSpO2 = 0.7
double frate = 0.95
#define TIMETOBOOT 3000
#define FINGER_ON 30000
#define USEFIFO
#define Green Led 8
#define Redled 9
void setup()
{
Serial.begin(115200)
lcd.init()
lcd.backlight()
lcd.setCursor(3,1)
```

```
lcd.print("Running......")
delay(3000)
lcd.clear()
ESpO2 = readEEPROM()
Temperature = EEPROM.read(6)
pinMode(Green Led,OUTPUT)
pinMode(Redled,OUTPUT)
digitalWrite(Greenled,LOW)
digitalWrite(Redled,LOW)
while (!particleSensor.begin(Wire, I2C_SPEED_FAST))
{
Serial.println("MAX30102 was not found. Please check the wiring/power/solder jumper at MH-
ET LIVE MAX30102 board. ")
}
byte ledBrightness = 0x7F
byte sampleAverage = 4
byte ledMode = 2
int sampleRate = 200
int pulseWidth = 411
int adcRange = 16384
particleSensor.setup(ledBrightness, sampleAverage, ledMode, sampleRate, pulseWidth,
adcRange)
particleSensor.enableDIETEMPRDY();
 mlx.begin();
}
if (ir < FINGER_ON)
temp = Temperature
lcd.setCursor(0,2)
lcd.print(temp)
lcd.print(" ")
lcd.print("*C")
```

```
lcd.print("Temperature: ")
lcd.setCursor(11,2)
lcd.print(ESpO2_ROM)
lcd.print(" ")
lcd.print("% ")
break
if ((i % Num) == 0)
double R = (sqrt(sumredrms) / avered) / (sqrt(sumirrms) / aveir)
Serial.println(R)
SpO2 = -23.3 * (R - 0.4) + 100
ESpO2 = FSpO2 * ESpO2 + (1.0 - FSpO2) * SpO2
Serial.print(SpO2)
Serial.print(",")
Serial.println(ESpO2)
sumredrms = 0.0; sumirrms = 0.0; i = 0
break
particleSensor.nextSample()
Serial.println(SpO2)
else
lcd.print("Put Your Finger On Sensor")
```

5.2. Important Flow Control

- Avoid invoking methods within a conditional expression.
- Avoid creating recursive methods. Use loops or nested loops instead.
- Avoid using foreach to iterate over immutable value-type collections. E.g. String arrays.
- Do not modify enumerated items within a foreach statement.
- Only use switch/case statements for simple operations with parallel conditional logic.
- Prefer nested if/else over switch/case for short conditional sequences and complex conditions.
- Prefer polymorphism over switch/case to encapsulate and delegate complex operations.

5.3. Components, Libraries, Web Services and stubs

PyRobot , Robot Framework, Spybotics, and Kalmp't are the libraries used for our Robot. We are using the Python library to develop our robot and for its functionality. Mainly, Blood Pressure , Heartbeat, pulse oxy, ecg , image processing and wireless camera display sensors are the components of our project.

5.4. Algorithm

Include MAX3010X library
if you have Sparkfun's MAX30105 breakout board , try #define MAX30105
calculate SpO2 by this sampling interval
initial value of estimated SpO2
filter factor for estimated SpO2
low pass filter for IR/red LED value to eliminate AC component
wait for this time(msec) to output SpO2
adjust to display heart beat and SpO2 in the same scale
if you want to see heart beat more precisely , set SAMPLING to 1
if red signal is lower than this , it indicates your finger is not on the sensor

Set up the wanted parameters
Setup to sense a nice looking saw tooth on the plotter
Set ledBrightness = 0x7F //Options: 0=Off to 255=50mA
Set ledMode = 2 //Options: 1 = Red only, 2 = Red + IR, 3 = Red + IR + Green
Set sampleRate = 200 //Options: 50, 100, 200, 400, 800, 1000, 1600, 3200
Set pulseWidth = 411 //Options: 69, 118, 215, 411

raw SpO2 before low pass filtered
Check the sensor, read up to 3 samples
Check whether do we have new data
why getFOFOIR output Red data by MAX30102 on MH-ET LIVE breakout board
why getFIFORed output IR data by MAX30102 on MH-ET LIVE breakout board
average red level by low pass filter
average IR level by low pass filter
square sum of alternate component of red level
square sum of alternate component of IR level
slow down graph plotting speed for arduino Serial plotter by thin out

transaction for Serial plotter's autoscaling
goes to function that makes Serial Monitor Visualizer
Code to Make the Serial Monitor Visualizer Work
Print all the attributes (Temperature , Bp , Sp02 , Heart Rate)

5.5. Deployment Environment

We present a complete framework for the safe deployment of humanoid robots in environments containing humans. Proceeding from some general guidelines, we propose several safety behaviors, classified in three categories, i.e., override, temporary override, and proactive. Activation and deactivation of these behaviors is triggered by information coming from the robot sensors and is handled by a state machine. The implementation of our safety framework is discussed with respect to a reference control architecture. In particular, it is shown that an MPC-based gait generator is ideal for realizing all behaviors related to locomotion. Simulation and experimental results on the HRP-4 and NAO humanoids, respectively, are presented to confirm the effectiveness of the proposed method.

5.6. Tools and Techniques

Following are the tools and techniques of our project

Heart-Beat Sensor

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy.

Temperature Sensor

The basic principle of working of the temperature sensors is the voltage across the diode terminals.

We are placing this sensor separately on the belt to get more précised readings

Blood Pressure measurement

With an oscillatory device, a cuff is inflated over the upper arm or wrist. The new models use “fuzzy logic” to decide how much the cuff should be inflated to reach a pressure about 20 mmHg above systolic pressure for any individual. When the cuff is fully inflated to this pressure, no blood flow occurs through the artery. As the cuff is deflated below the systolic pressure, the reducing pressure exerted on the artery allows blood to flow through it and sets up a detectable vibration in the arterial wall.

ECG Sensor

The electrodes are connected to an ECG machine by lead wires. The electrical activity of the heart is then measured, interpreted, and printed out. No electricity is sent into the body. Natural electrical impulses coordinate contractions of the different parts of the heart to keep blood flowing the way it should.

- As we want to work regarding COVID-19 that's why we search for the basic facilities for treatment and we find the lack of Medical assistants and high cost for these particular Medical equipment.
- We find that the main gap in the market is the unavailability of Robots and the high cost of Robots.
- Basically the need of medical assistants increases day by day in this covid-19 situation.
- Existing system providing services to the patients when they are in a very critical situation. And sometimes the number of Medical workers is lower than the number of patients.
- So, that's why we are developing a medical robot which will assist doctors in checking up the patients manually especially in this pandemic condition

We introduce the ARTIFICIAL INTELLIGENCE MEDICAL HUMANOID COV-ROB to fill this particular gap.

5.7. Best Practices / Coding Standards

5.1 Coding Conventions

- Use the default Code Editor settings (smart indenting, four-character indents, tabs saved as spaces).
- Write only one statement per line.
- Write only one declaration per line.

- If continuation lines are not indented automatically, indent them one-tab stop (four spaces).
- Add at least one blank line between method definitions and property definitions.
- Use parentheses to make clauses in an expression apparent.
- Use a try-catch statement for most exception handling.

5.2 Commenting Conventions

- Place the comment on a separate line, not at the end of a line of code.
- Begin comment text with an uppercase letter.
- End comment text with a period.
- Insert one space between the comment delimiter (//) and the comment text.
- Use block commenting for multiple lines at once /*commenting the block*/.

5.8. Version Control

Git version control technique is used for version control of our project. Git is software for tracking changes in any set of files, usually used for coordinating work among programmers collaboratively developing source code during software development. Its goals include speed, data integrity, and support for distributed, non-linear workflows.

Chapter 6

Testing and Evaluation

Chapter 6: Testing and Evaluation

Test & Evaluation (T&E) is the process by which a system or components are compared against requirements and specifications through testing. The results are evaluated to assess progress of design, performance, supportability, etc

6.1. Use Case Testing

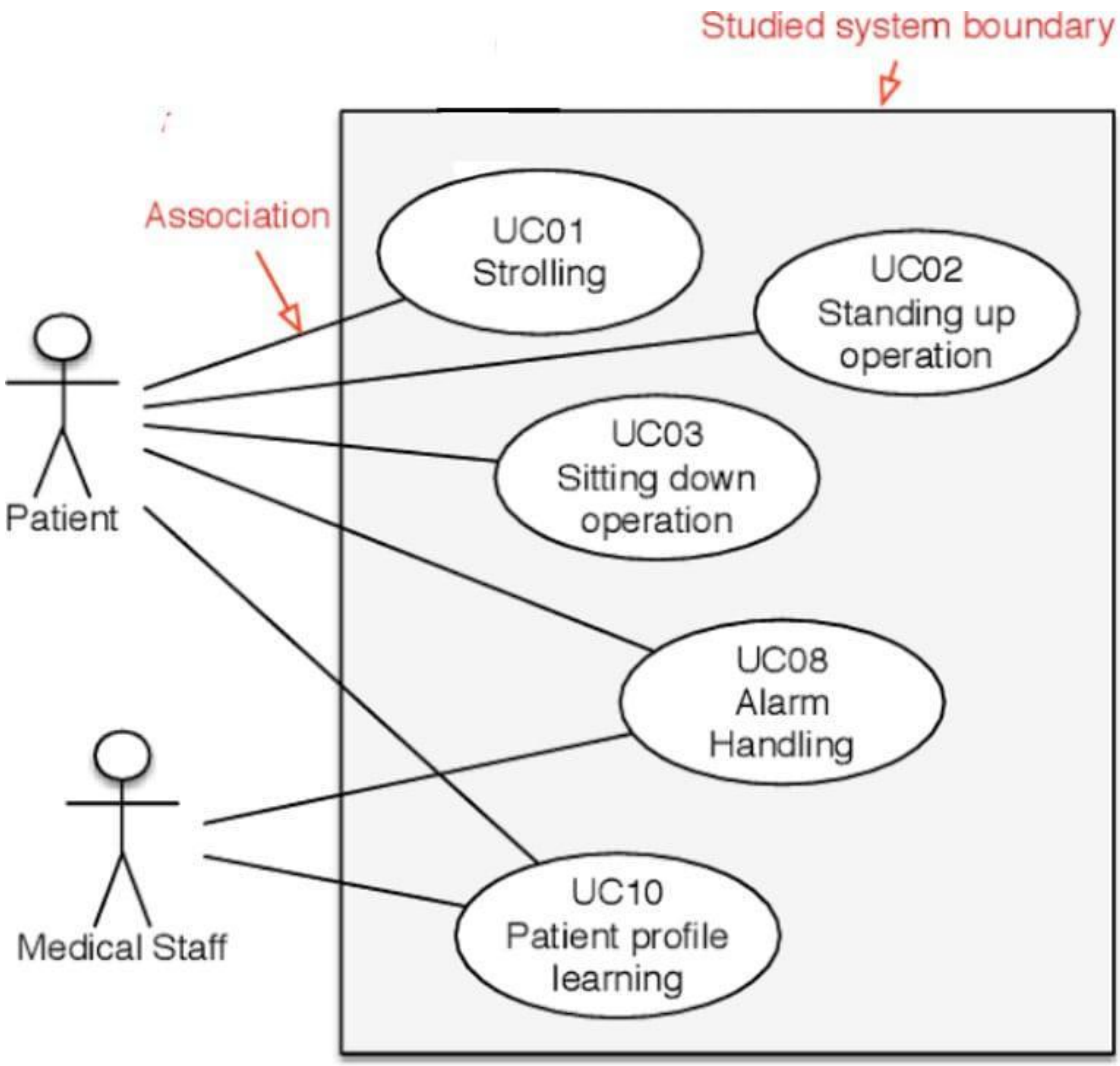


Figure 6.1 Use case testing diagram for Humanoid Robot

6.2. Equivalence partitioning

In this technique, the data fed into the software to be tested is divided into partitions of equal sizes. From each partition of data, one test case is needed. We use different test cases to test the classes of the software continuously. *[35]*

6.3. Boundary value analysis

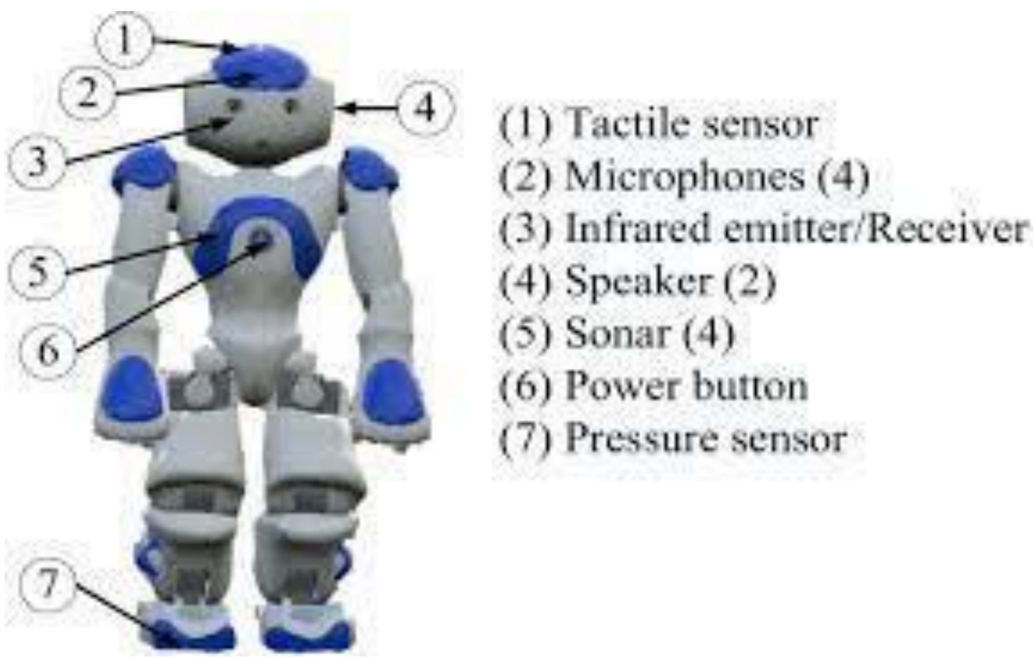


Figure 6.3 Boundary value analysis of Humanoid robot

6.4. Data flow testing :

Data flow diagram, showing the data exchange between the robot, the artificial skin, the long term memory and the controller sub-blocks. The state machine controls sub-block activity and parameter distribution.

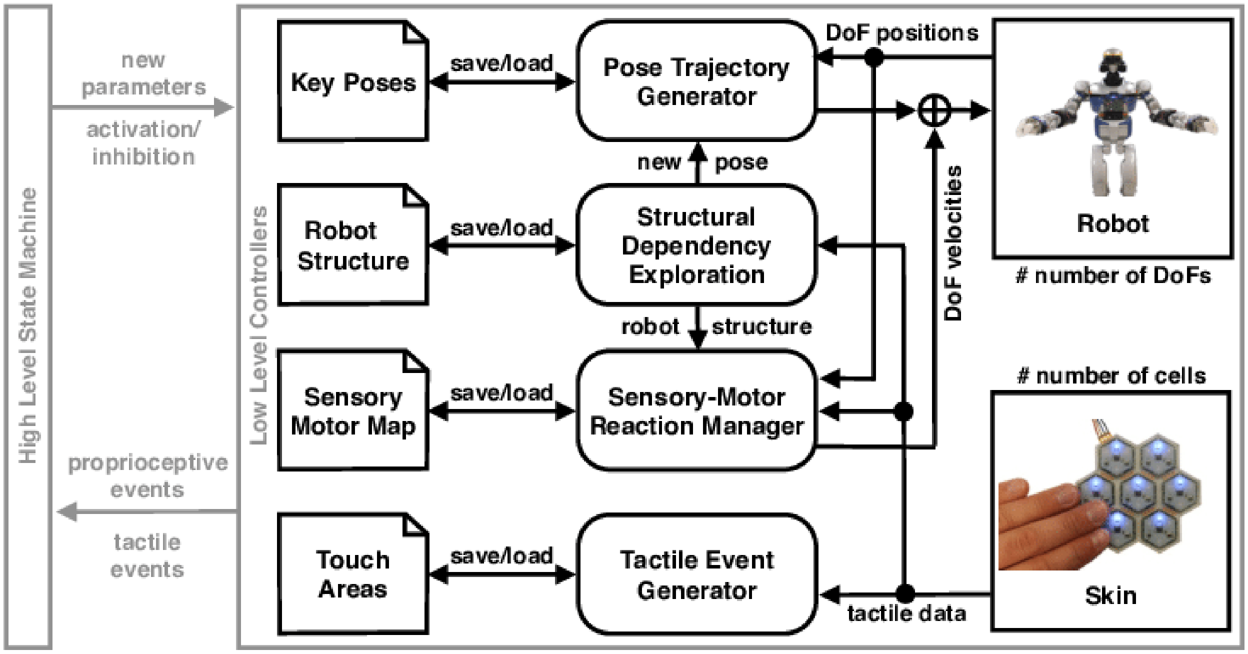


Figure 6.4 Data Flow Testing of Humanoid Robot

6.5. Unit testing :

Unit testing of a Cov Rob program is done in its software development process in which the smallest testable parts of an application, called units, are individually and independently scrutinized for proper operation. This testing methodology is done during the development process by the software developers and sometimes QA staff.

6.6. Integration testing :

Integration testing is also known as integration and testing (I&T) -- in this type of software testing the different units, modules and components of our robot software are tested as a combined entity. However, these modules of our project are coded by different programmers.

6.7. Performance testing:

Performance testing of Cov Rob is done at different organizations for testing measures that evaluate the speed, responsiveness and stability of a Robot, software program or device under a workload. Organizations run performance tests in order to identify performance-related bottlenecks.

6.8. Stress Testing :

Stress testing (sometimes called torture testing) of Cov Rob is performed to test deliberately intense or thorough testing used to determine the stability of a given system, critical infrastructure or entity. In this we involve testing beyond normal operational capacity, often to a breaking point, in order to observe the results.

6.9. Result Table :

Test #	BP (mm Hg)	Heart Beat (BPM)	Temperature (F)	Pulse-Oxy (SPO2)
1	110/77	190	99.8F	96-79
2	122/81	195	97.6F	97-76
3	118/78	186	99.5F	93-84
4	108/75	177	98.8F	98-68
5	113/82	183	100.4F	99-65
6	122/80	198	97.3F	98-87
7	120/79	184	101.2F	96-78
8	114/76	188	99.6F	95-81
9	118/81	199	99.2F	94-76
10	109/76	194	100.7F	97-82

Table 2 Result Table

Chapter 7

Summary, Conclusion and Future Enhancements

Chapter 7: Summary, Conclusion & Future Enhancements

7.1. Project Summary

This is the basic need of the society. Our project is Humanoid Robot in the field of medicine because in this pandemic condition it is not safe for doctors to check patients manually so we proposed a solution in the form of a COV Robot. COV Robot will be a multi task robot. But for now it will help doctors in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data. In short It will be an all in one machine. Our targeted market is Hospitals and all the common people who can afford this robot. It is very easy to use because it is fully automated. The strategy we are using is online advertising which includes Digital marketing, Billboards, Awareness campaigns and ads. There is no such competitor In the market till now but in future if there is some competitor who comes we can deal with it with full awareness. The total expense is 20k USD but this is not a fixed amount anymore. The team members include CEO, COO and designer, developer, Marketing Manager, tester and other staff which is essential for our business strategies. Our plan will be highlighted in the world if it is worked properly and the campaign is in the right direction. For the first year our priority is to aware the people and for the 2nd year we will implement the plan and for the 3rd year our priority is to start the idea and deal with the people

7.2. Achievements and Improvements

- The team of Cov-Rob secured funding of 500$ (USD) from the Techno Entrepreneurship Event held at Superior University and got the runner-up position.
- Cov-Rob was among the top 10 finalists around the world and 1 from Pakistan in a competition named QEC(Queens Entrepreneur Competition) held in Canada.
- Cov-Rob was the finalist of a competition named National Idea bank.
- Cov-Rob participated in the Istanbul Youth Summit 2021 held in turkey.

7.3. Critical Review

• As we want to work regarding COVID-19 that's why we search for the basic facilities for treatment and we find the lack of Medical assistants and high cost for these particular Medical equipment.

• We find that the main gap in the market is the unavailability of Robots and the high cost of Robots.

• Basically the need of medical assistants increases day by day in this covid-19 situation.

• Existing system providing services to the patients when they are in a very critical situation. And sometimes the number of Medical workers is lower than the number of patients.

• So, that's why we are developing a medical robot which will assist doctors in checking up the patients manually especially in this pandemic condition

7.4. Lessons Learnt

Identify: Make a list of the comments and suggestions. These might be a significant source of information for future initiatives.

Document: Note down all information in a file and allow participants to comment on it and highlight the specific lessons learned during the conversation.

Analyze: Analyze and arrange the lessons learned to be used and shared with other teams. They could be used in training or to enhance project management processes.

Store: Keep a copy of the lessons learned reports on a shared disk or in the cloud, so they are accessible to all project teams.

Retrieve: You retrieve the lessons learned from the archive to be used for your current project.

7.5. Future Enhancements/Recommendations

This is the basic need of the society. Our project is Humanoid Robot in the field of medicine because in this pandemic condition it is not safe for doctors to check patients manually so we proposed a solution in the form of a COV Robot. COV Robot will be a multi task robot. But for now it will help doctors in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen fixed in it and also contains a mic for speak up purposes other than it, it will save all user data. In short It will be an all in one machine. Our targeted market is Hospitals and all the common people who can afford this robot. It is very easy to use because it is fully automated. The strategy we are using is online advertising which includes Digital marketing, Billboards, Awareness campaigns and ads. There is no such competitor In the market till now but in future if there is some competitor who comes we can deal with it with full awareness. The total expense is 20k USD but this is not a fixed amount anymore. The team members include CEO, COO and designer, developer, Marketing Manager, tester and other staff which is essential for our business strategies. Our plan will be highlighted in the world if it is worked properly and the campaign is in the right direction. For the first year our priority is to make people aware.

7.6 Measuring pulse oxy :

Figure 7.6 Sensor used for measuring pulse oxy

7.7 Measuring heart rate and body temperature :

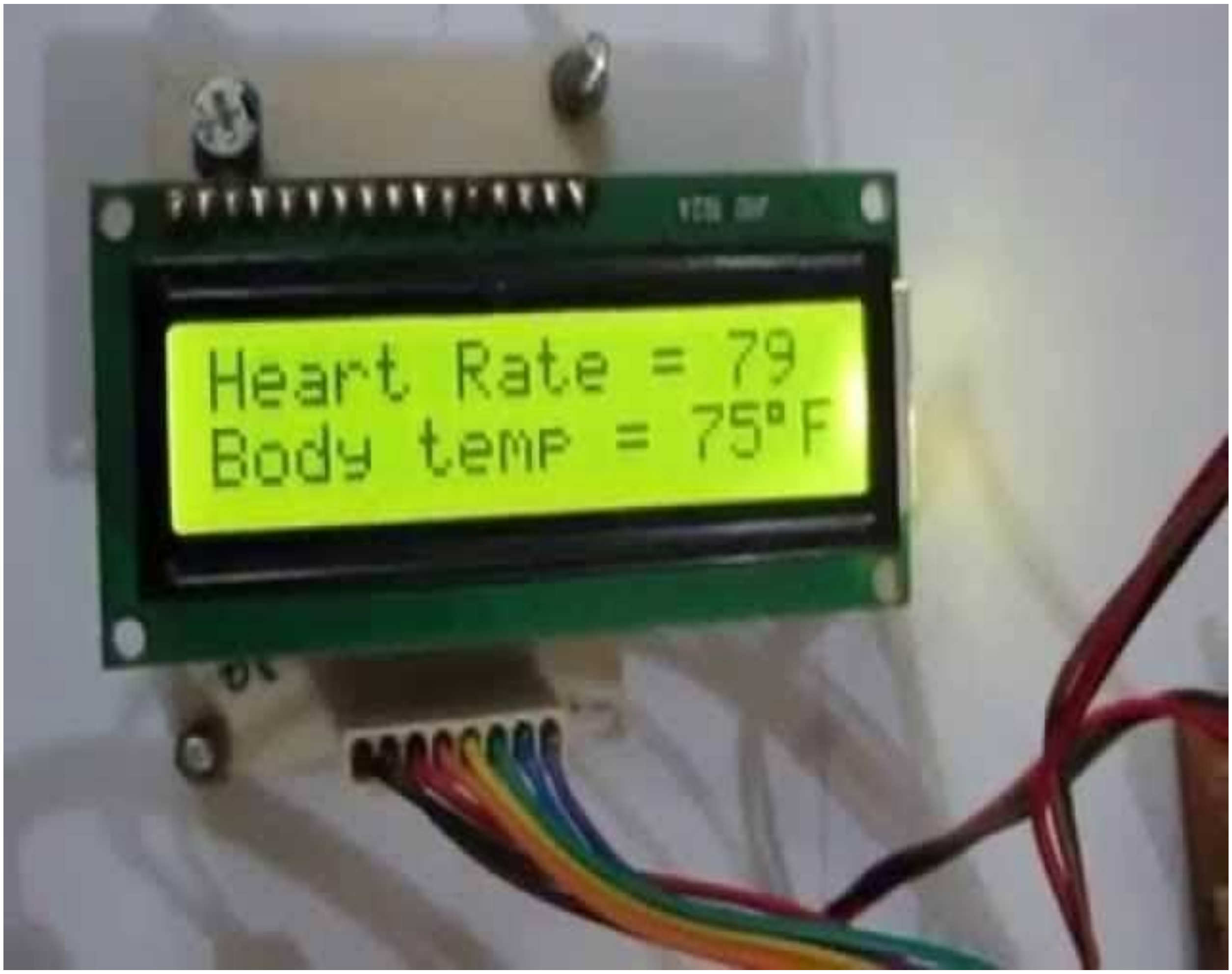


Figure 7.7 Sensor used for measuring heart rate and body temperature

7.8 Circuit Diagram :

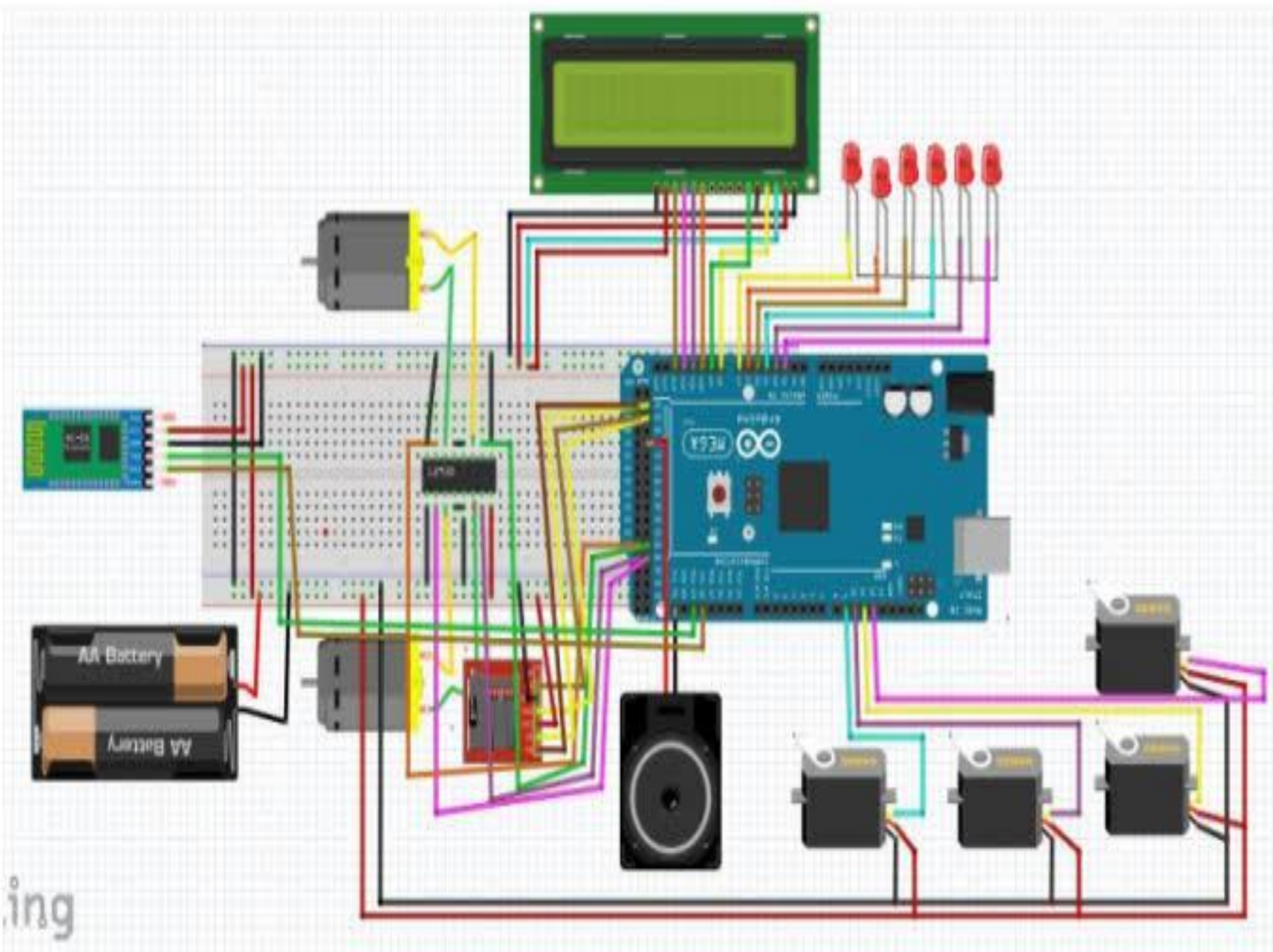


Figure 7.8 Circuit used for the Medical Sensors (Also includes battery)

Appendices

Appendix A: Admin Manual

For the operation of Robot first of all keep the robot in normal room temperature, then apply the belt to the patient's hand and place the sensors accordingly on the finger as shown on the belt. There is a button attached on the body of Robot, switch it on and wait for one minute the robot will measure all the readings accordingly and then display the results on the lcd attached to it. Now remove the belt from the patient's hand and note all the results as displayed on the lcd and switch the robot off back.

Appendix B: Prototype/Physical Structure

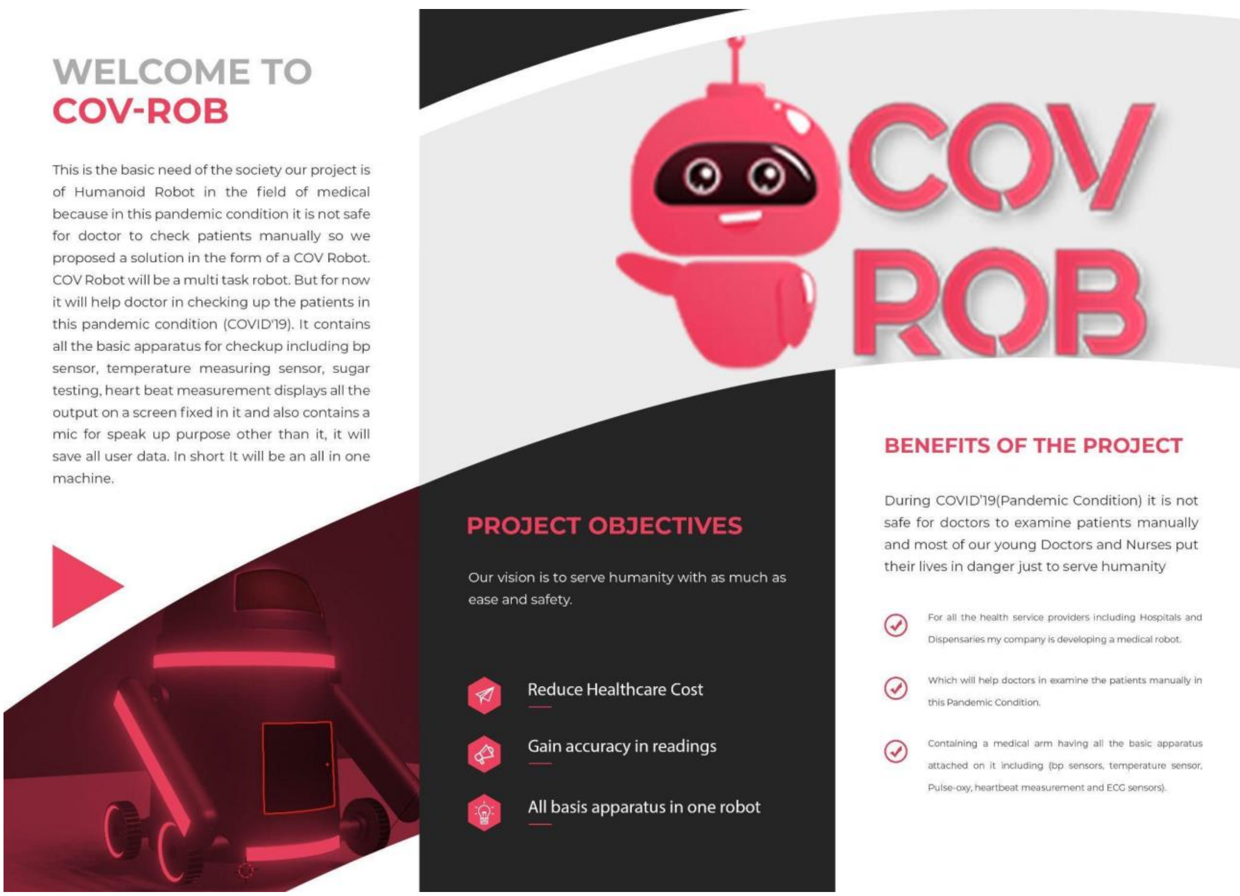
B.2. ProtoType

B.1. ProtoType Working

Appendix C: Information / Promotional Material

For Marketing and Promotional Purpose we have designed Brochures, Standees, Flyers and Banners.

C.1. Brochure



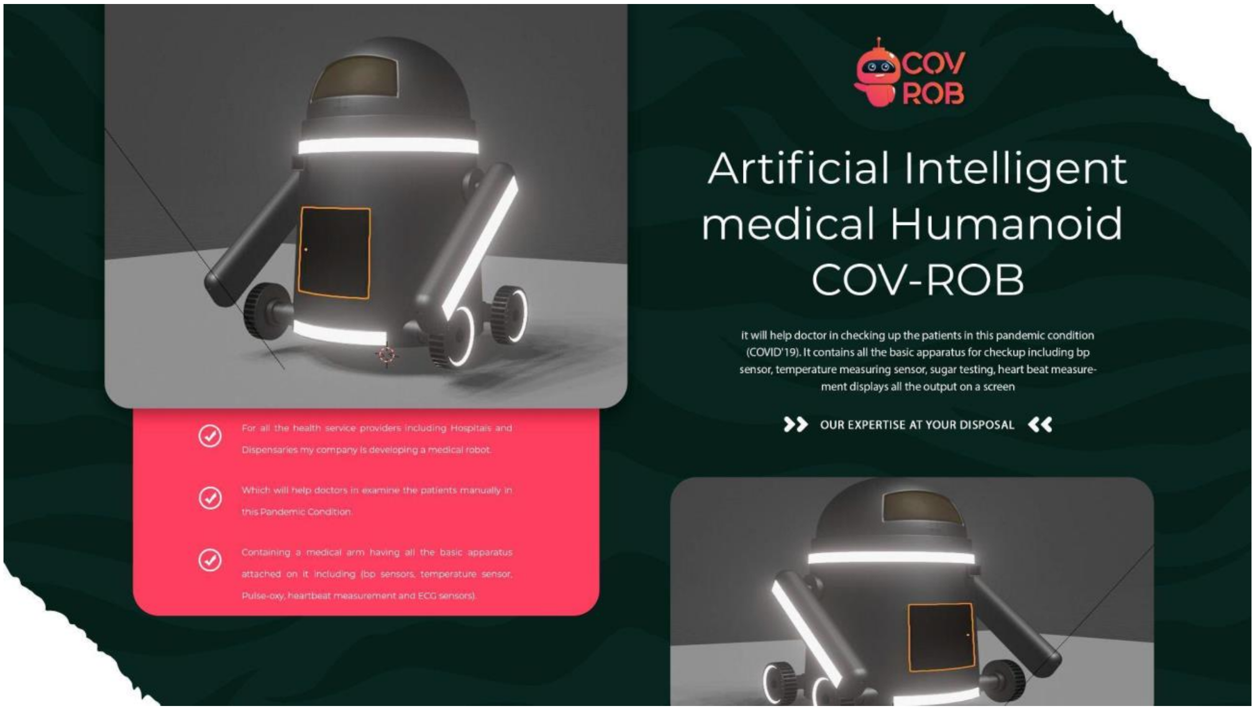
C.2. Standee


SUPERIOR UNIVERSITY
COV ROB
FYP-BCSM-F21-002
Supervisor
HAMAYUN KHAN
Project lead
M HUZAIFA IMRAN
Member
TAYYAB SHABBIR
Member
ABDUL HADI
COV-ROB is a multi task robot. But for now it will help doctors in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including blood pressure sensors, temperature measuring sensors, sugar testing heart beat measurement.
PROJECT OBJECTIVES
1 Attaching all the sensors/apparatus on a single belt, Camera Wirelessly attached with Lcd.
2 Testing BP, Temperature, ECG Simultaneously, Displaying all results on Display Monitor attached on it
3 Automatic Movement of Humanoid Robot Using Sonar Sencor. Our targeted market is Hospitals and people.
PROJECT ACHIVEMENTS
1 COV-ROB is the only project from pakistan selected at Istanbul Youth Summit 2021.
2 COV-ROB was amongst the top 15 finalist around the globe at Queen's Entrepreneur's Competition in Canada.
3 In Pakistan, COV-ROB was the finalist in National Idea Bank Competition.
DEPARTMENT OF COMPUTER SCIENCE

C.3. Flyer


COV
ROB
COV-ROB
This is the basic need of the society our project is of Humanoid Robot in the field of medical because in this pandemic condition it is not safe for doctor to check patients manually so we proposed a solution in the form of a COV Robot. COV Robot will be a multi task robot. But for now it will help doctor in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen.
OUR EXPERTISE AT YOUR DISPOSAL
COVROBOFFICAL

C.4. Banner


COV ROB
Artificial Intelligent medical Humanoid COV-ROB
it will help doctor in checking up the patients in this pandemic condition (COVID'19). It contains all the basic apparatus for checkup including bp sensor, temperature measuring sensor, sugar testing, heart beat measurement displays all the output on a screen
OUR EXPERTISE AT YOUR DISPOSAL
For all the health service providers including Hospitals and Dispensaries my company is developing a medical robot.
Which will help doctors in examine the patients manually in this Pandemic Condition.
Containing a medical arm having all the basic apparatus attached on it including (bp sensors, temperature sensor, Pulse-oxy, heartbeat measurement and ECG sensors).

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