IoT based Hand Posture Recognition and Bluetooth Controlled Robot for Hospital

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Computer Science and Engineering

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APPROVAL

This Project titled "**IoT based Hand Posture Recognition and Bluetooth Controlled Robot for Hospital"** submitted by Mosharof Hossain and Khadizatul Kubra to the Department CSE at Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 24 September 2020

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DECLARATION

We hereby declare that, this project paper has been finished by us underneath the supervision of **Tajim Md. Niamat Ullah Akhund, Lecturer, Department of Computer Science and Engineering** in Daffodil International University. We also announce that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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Abstract

This work will result a robot that can collect the figure posture from any person and patients with raspberry pi and camera. It can also be able to receive data from smart phones via Bluetooth. Both Bluetooth and finger posture can move it in 360 degrees. In today's modern era IoT and Robotics may help man kind in different ways. This work may help virus affected people and helpless patients in hospitals. It may go to the patients with the instruction given it by the figure posture and smartphone instruction from the patients and virus affected people without harming any other non-sick people. The proposed system can detect 1 to 5 fingers of a person and also be able to communicate via smart phone with Bluetooth sensor. Arduino, Motor driver, raspberry pi, pi camera, Bluetooth sensor these are the main components to make it.

Keywords: Smartphone-controlled robot, IoT, Robotics, Raspberry pi, Arduino.

Table of Contents

Contents **Page**

Chapter 4: Result and Outcome

Chapter 5: Conclusion and Future work

List of Figures

Figures

Chapter 1
Introduction

1.1 Introduction

It is a hand posture recognition robot. This robot is able to recognize posture from humans and move towards the human. This robot can detect hand posture from humans by a pi camera then this robot converts this posture in commands and then does work as like as command. This robot can move 360 degrees. Humans can command this robot by hand posture. It also works by image processing. It will process the image to detect posture command. This robot will have a special feature: it can work in virus detected areas. Where man can't work this robot can work easily. The robot will help patients be friendly

1.2 Motivation

Motivation of Hand posture recognition robot
1. This robot work Virus detected area (where the environment is dangerous for Human the robot will work there easily.
2. Humans can call the robot by hand posture to move 360 degree angle. It Will work by human posture command.
3. This robot will be friendly especially to the patient.

1.3 Objective

There are three objective in Hand posture Robot Such as:
1. Humans can call the robot by hand posture to move 360 degrees.
2. Human can also give posture commands to the robot to do some other Particular work.
3. This robot can work Virus detected area and communicate with patients in Hospital.

1.4 Features

There are some features of hand posture recognition Robot.
1. It can detect hand posture from humans.
2. The robot can move by detecting hand posture.
3. It can work at a hospital in a dangerous Environment such as a virus Detected Area.
4. It will work as a nurse.
5. The robot can reduce medical cost.
6. The robot can help patients be friendly.

1.5 Social Impact

1. It can work 24 hours without boring that's why patients will be under Observation.
2. The robot is ecofriendly so that it will be very helpful for patients.
3. The hand posture robot will be friendly in that case patients will never feel bored.
4. It will reduce the cost of patients.

1.6 Expected Outcome

Expected Outcome of This project:-

1. The robot will be able to recognize the posture of a patient and move towards The patient.
2. The robot will have 360 degree movement.
3. It also works by image processing.
4. It will collect the image of a patient's posture and process the image to detect The posture command.
5. After detecting it will work by following the posture command.

1.7 Report Layout

In this section shows the layout of the report. The whole project reports contents shown below by a simple layout. This report contains several chapters. Outline of all chapters and summary of all chapters discussed briefly below through the layout presentation.

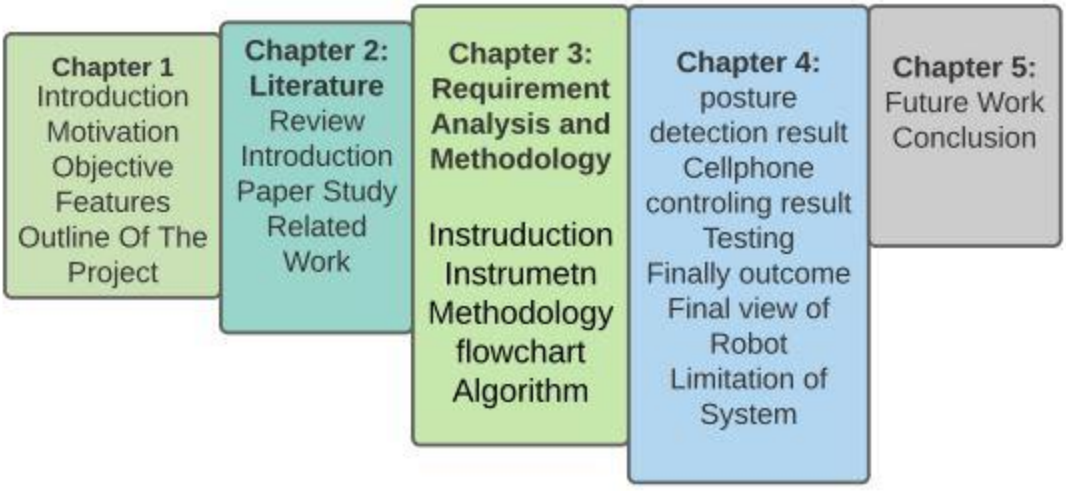

Fig: 1.1 Project Outline

Chapter 2

Literature Review

2.1: Introduction

In our modern era robot and robotics is the part and parcel in modern science. In this current world we see robot working lot of sector where environment is harmful for human robot can work easily. It is a gift of modern artificial Intelligence. In this modern era people implemented different type of robot for different work. All of this for the welfare of people. After studying the lot of paper we become to know it.

2.2 Background Study

Authors **[1]** proposed to tackle SIFT features using discrete adaboost learning Algorithm. Authors applied sharing feature to increase multiclass hand posture recognizing the outcome of proposed method is perspective successfully recognizing three hand posture classes which can deal with the background clop. Viola face detectors detect face same approach are applied for hand detection but it failed because of its representative limits. They applied an Algorithm with SIFT to achieve plane spin in hand detection. Using SIFT features background noise is reduced in the training stage. After training, detectors use sharing and non-sharing features to detect robustly and increase recognition Accuracy. For choice the best weak classifier and combining the weak classifier form the strong classifier Adaboost learning algorithm are used. Authors are shown three advantages of their proposed method. Hand posture is accomplished by SIFT features. These features are extracted from text images. By computing distance between the extracted SHIFT features and text image to hand detection. Sharing and non-sharing concept image for multiclass recognition. If an image doesn't match share and non-share concept image will be discarded. Non-share concepts are used for posture recognition. Authors **[2]** hand posture recognition implemented on real humanoid service robot. These systems applied to the RCE neural network. To get the accurate image from the complex background color segmentation algorithm is used. To separate the hand image form the complex background they applied hand image segmentation. Color cues and motion cues both cues are applied. Color segmentation is applied for the skin color identification. Topological features are extracted by the RCE neural network. Finding the number and position of the finger an algorithm are used. Hand mass is calculated from the binary image. Where background represents by 0 and hand is represented using binary 1.a circle for search with the position of center of the weight and find out the point where the search circle indicates the branch of the number of hand posture. To hand detection they determined the branch number. After that finding the middle one of branch number which obtains the branch phase. A good feature of the proposed algorithm extracts the branch Number and phase reliably from hand segmentation. After determining the beach phase width can be determined from the branch phase. Base branch used to calculate the distance between the arm and finger. And then the hand posture is recognized accurately. The features of topological use for hand posture the hand can be found. Authors **[3]** worked on 2D materialization based method to estimate 3D hand posture. Sequential posture estimation is done by the tracking posture in LCM. After tracking input image of hand to one on finger is discarded and it mismatch of output result to solve this problem LCFM method is used.

Eight posture parameters are used around the prototype and it is named a class. Posture of the hand is divided into two levels. First one is behind the joint angle, another one is open that is quantized in 3 levels. It has a weak point if the appearance changes in 3-D posture and view point. This method is weak to change appearance. There is no suitable method to recover this weak point Authors **[4]** use 3-D sensors to generate the dense range of image scene. Proposed method can utilize the 3D hand geometry. It does not depend on color information. Authors of this paper applied an image analysis algorithm in complete processing chain. An advanced interface developed for the interactivity with virtual images. User can be manipulate objects by moving his/ her hand. To be able of real time possession a smart sensor used which is construct on low cost devices. The resulting image is captures by color camera. The resolution of color camera and the special resolution of rage image are equal.3D data acquisition achieves 12 frames per second. Different type segmentation are shown such as Arm segmentation estimation and compensation which is 3D pose. Hand posture classification also showed where the classification of hand posture is achieved by the representing of range images. By the discriminative features that incorporate 3D shapes. Authors **[5]** Implemented humanoid robot based on hand posture recognition. To separate hand image from the compound background RCE neural network based on color segmentation algorithm are used. For the restricted environment system is implemented. For segment hand image, a color segmentation algorithm (RCE) is applied. For describe the skin color (RCE) method also applied. Hand segmentation is the most important of every hand gesture recognition. Color cues and motion caused both are used for hand image segmentation. Edge point finger is the most useful feature to fine the number and position of finger. This features is used on this paper. Falsely detected edge removed. To find the possible presence of finger used circle search. Selected middle of the search circle. After trained RCE properly the robot recognized posture successfully. Authors **[6]** based on depth information hand posture recognition and automatic finger detection has been implemented. Using furrier description hand posture recognition is achieved to get high recognition result the global features of finger used. Using viola Jon's face detector used to detect user face. After detect user first time they compute the average depth of the face region. For human hand is detected by depth threshold depth threshold it can't but perform better to do perfect segmentation. An algorithm astu's used. Which clean background noise. By subtracting minimum and maximum coordinates arm-palm separation is found. Which is Mo. In finger detection two problem is found and so i applying novel method for finger detection. Two problem has been solved merge finger problem is solved by applying novel algorithm based on finger detection hand posture is detected where furrier description is present in this paper author are used challenging data set for experiment. Author **[7]** control a while chair based on block sparce and this block sparce work by applying gesture and posture method. It is left hand base while chair to control this chair need left hand posture. A leap motion sensor has been used for left hand posture. Mat lab function is also used. A leap motion sensor used to detect hand posture and gesture recognition and it test SRC based posture and gesture recognition based algorithm by adding the additional function hand posture and gesture utilized. Free motion and posture use hand captured are used to command the while chair leap motion sensor. Leap motion sensor used left side of the while chair to protect left hand detection. User can do five commands to the while chair which is left, go, right, stop, reverse. Leap motion sensor has infrared camera which detect and position of the pointers and tracked object around 80 Hertz. Firstly posture recognition is to construct a dictionary which samples from five posture are stacked. Every posture of signal of consists of the palm. For specified posture left hand kept for 30 sec. Every time receive value and put in dictionary matrix as the matrix in two components. BS-SRC method is used for

gesture and posture sets receive and higher accuracy. Author **[8]** Based on Haar-like and topological features hand posture detection has been implement. Hand posture detection based on Haar-like features and color segmentation technique. Applying this method hand posture can detect with high recognition accuracy. Fast and robust approach recognize real time hand posture for human. Robot interaction to quickly pick up hand region boost cascade classifier trained by Aadaboost and Haar-like feature. Hand region segmentation is the primary part to detect hand posture recognition. Statistics based method and color based method both of used for hand segmentation. In hand segmentation Adaboost learning algorithm improve hand region accuracy. Haar-like features computed by subtracting black and white rectangle. Improve hand detection accuracy skin color technique applied which is YCbr color space. RGB color is separated into luminance and chrominance by YCbr color space. A common and challenging work is picked the accurate hand detection from the background. To solve this problem an algorithm used where region hand converted into binary image. Where pixel value hand area is 1 and background is 0. Centre c 0= is palm and by the search circle all changeable points are found. Applying this algorithm real time hand posture recognition has been achieved. Authors **[9]** used hidden conditional random fields to recognize hand posture. In this paper body language is used. To detect body language viola face detector skin color models are integrated. Systems false alarm are detected by skin color constraint. Posture recognitions are detected in different classes such as multi class and single class. Multiclass has two advantages. First one is Multiclass problems can be solved directly where (HCRF) formula is used. In single class recognition performance record based on HCRF. Authors **[10]** multi hand posture recognition based on a haar-like method has been implemented. Statistical method used to detect the region of hand according to haar-like features group of hand region detection defect with high recognition accuracy by haar-like features and color segmentation technique. Two hand posture recognition is the approach in this paper adaboost and Haar-like features used which can detect hand region from the image. Posture of two hands detected by haar-like. They develop hand detection algorithm where input image transfer in integral image. From the integral image to get haar-like features value select two circles where one is black circle and another is white circle. YCbr color space method has been used to detect skin color. Where RGB color transfers in YCbr color space. For posture recognition an algorithm used where the hand rigion area converts into binary image. A searching circle has been used to find out image tracking value. For hand recognition angle needed that's why calculate the gap between two fingers. A real time multi hand posture detected successfully by Haar-like features and color based method. Authors **[11]** this paper is mainly gesture and posture based on MYO armband. To get a hand gesture MYO armband has been used which collects EMG from hand. MYO band collects data from the user hand and puts the data in a dictionary. Armand detects hand gestures from hand when hand gets free position after movement. Every movement of Arm produces muscles in different signals. This signal mapped returns the hand posture to relax. Hand posture raw signal used directly by using a sliding window. Authors **[12]** used a monocular camera which is an input device that detects hand posture. Spectral embedding cluster algorithm used to track hand motion. Accurately Authors have improved the Bag-of-words algorithm which detect and hand posture and hand tracking framework has been used. Bow has some limitations it’s not properly work in non-rigid object that’s why quantization algorithm is used which working performance is standard. It can detect and recognize nor- rigid objects. Based on the background quantization algorithm is not suitable that’s why (ARDP). One against one type of multi SVM classifier to detect hand posture recognition. Split-original image to several sub-image sliding window has been used. To get the spatial information form as part of the ARDP descriptor

for every key points the image Euclidean distance. ARDP descriptor helps to find out the relative position between original points and key point ARDP. Exponential combination used to compute the similarity of different ARDP descriptors. Hand posture recognition speed increased by two approaches first one is skin- color from the skin and second one is reducing the number of candidate sub window. After speedup hand-posture recognition hand tracking is complete by applying CAMSHIFT algorithm. The CAMSHIFT algorithm has a small problem. Re-initialize tracking process is used to overcome this problem. Bow algorithm is used for detecting posture recognition. Authors **[13]** Used depth sensors and novel algorithm for hand detection. They treat hand dominate line that has been set in polar axis. To get segmentation. First they find out special point which is on the hand and nearest to kniet camera. Used border value to decide pixel value. In this paper Authors are depth image as input and get output Cartesian and H polar, both of their size of 256*128 hand map converted in Cartesian coordinates form to polar coordinates form using suitable equation. When dominate line is in wrong position the after taking help the part of arm get in right position. When DL locater in wrong position then if shifted to correct position after eroding image. Time costing is noted where 1/3 time interval between two successive frame. Algorithm tested publicly with Microsoft Kinect-Hand posture dataset. Using NTU dataset check 1000 of posture and there algorithm achieve 97.4% accuracy of posture recognition and ALS Data set also used. A proposed algorithm don't perform well in ALS data set. It is a weak point. Author **[14]** are proposed kernel descriptor. They examine the kernel descriptor different color channel to find out the more suitable color space for this kernel descriptors. Hand posture has its own color characteristic. This color is different from other skin object that's why they investigate to find out the suitable color space for hand posture recognition. A frame work for hand detection based on kernel descriptors which has for steps hand representative is one of them. For hand representation. Match kernel and extracting kernel descriptors has been describe in match kernel gradient kernel match is constructed from three kernel. Where two parameters are set for measure similarity. Two datasets are used for experiment user have to stand in front of robot the users 1m to 3m. Accuracy is defined by the ratio between the number of correct recognition and the number of test. They have two observation while working KDES. Authors **[15]** present a framework that recognize hand posture from the consecutive video frame. A model constructed for hand region detection. Authors are mainly focused on tracking hand region from monocular video and recognize posture from posture set. They concentrate on three aspects. Effectively initialize hand region and improve tracking performance is one of them. Hand posture is a compromise way that is called soft decision. In posture recognition method skin detection used. in skin detection method original image divided in two parts. Skin model constructed based on two model. In off line or online skin detection procedure can done. In offline they initial model first for detection and then captured video in different illumination. The color in RGB space is marginalized among gray axis. To detect posture recognition use HOG and soft decision. During HOG extraction procedure. Input region is first divide into 4 cells, every cell are covered into two point in gradient posture recognition mark as green signal. Using color combining and HOG features experiment has been completed.

After studying the papers, we become to know hand posture and gesture recognition robot has been implemented. Using the hand posture recognition lot of work can be done by the robot. Authors [7] control wheel chair using the hand posture recognition which is helpful for the patient. Specially trained robot can work restricted area where environment is harmful for human. Authors [5] implemented humanoid robot only for restricted area.

Chapter 3

Requirement analysis and Methodology

3.1Introduction

the research is one kind of philosophies or technique used to take, select and process, view information of point. However, research is a combine all of things such as philosophy, used of technic.

3.2 Project Research Subject and Instrument

This paper for the most part patient hand posture detection structured. Title of this paper is "IoT Based Hand Posture Recognition for Hospital". We know when a man infected any Harmful diseases he or she need to admit his/her self in hospital. If the diseases is most harmful the patient need under the observation where patient are helpless. According to the current pandemic situation off the world those who are infected the patient is more helpless and hope less. To analyzing this situation we get the idea to make Helpful robot for hospital. Which can help patient. To implement our project we utilize this component:

1. Raspberry pi.
2. Pi camera.
3. Robotic chassis.
4. Breadboard.
5. DC gear motor.
6. Motor driver L298N.
7. Battery.
8. Wires.
9. Battery charger.
10. Python programing language.
11. Arduino Micro Controller.
12. HC-05 Bluetooth Sensor.

13. C++ Programming Language

In this chapter we will discuss about required particles of our project. The main part that we have used here Raspberry pi, pi camera, Battery as power supply, DC gear motor, wires. We also use python programming language. The description all of equipment we will discuss elaborately.

3.2.1 Raspberry pi

Fig: 3.2.1: Raspberry pi board

Description:
We have used raspberry pi 3 model b+. To select this raspberry pi (low cost, credit card size computer) has some effects such as it is a powerful low cost computer. According to the requirements of our project need large storage to store data raspberry pi provide this storage. Raspberry has 1GB ram and it support 16GB external memory. Raspberry pi (Fig: 3.2.1) support HD video which is very important for our project. This pi has small (2.0 amp) power supply which supply power perfectly. Another reason to select this Raspberry pi it has "Broadcom" processor which can process data accurately. Everything is installed in this raspberry pi and it support high level programming language such as python programming language.

Specification of Raspberry pi 3 model b+

- Processor: - Bcm2837B0.
- Processor speed: 1.4 GHz.
- Ram: 1GB.
- Wireless networking 2.4 GHz.
- Memory slot.
- USB4 (2.0).

3.2.2: Raspberry pi camera

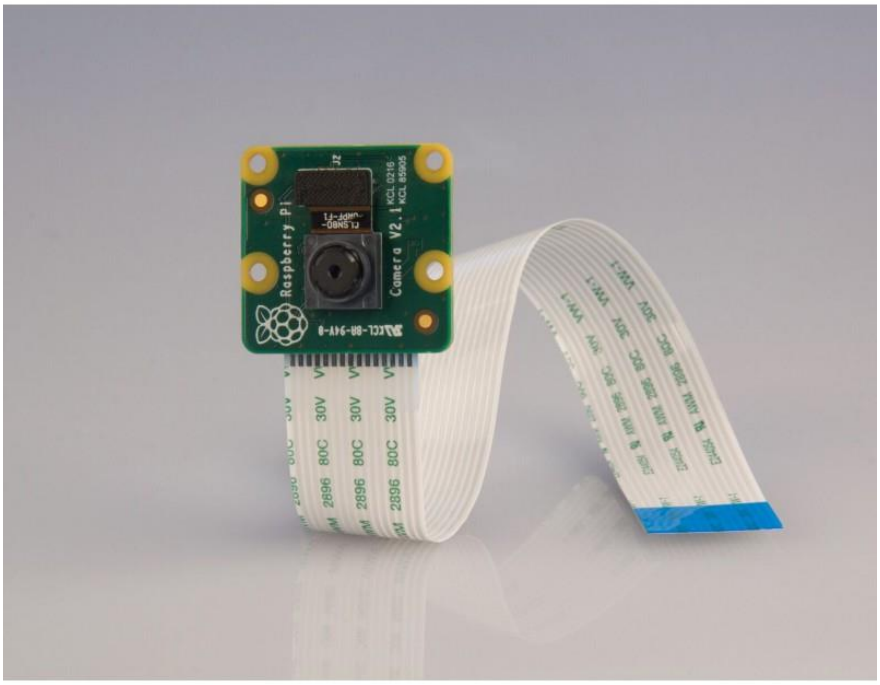

Fig: 3.2.2: Raspberry pi camera

Description:

In this part we use raspberry pi camera Fig: 3.2.2. It is one of the main part of our project. We use raspberry pi camera to detect hand posture. The raspberry pi camera are capable to take high-definition video record, stills photographs, image processing, image effects and also raspberry pi camera capable to receiving full HD 1080p photo, video that are programmatically controlled. According to our project we need to detect posture from video. According to this we used raspberry pi camera to detect posture. A special reason to select this pi camera it support all of operating system.

Specification of Raspberry pi camera

Camera 8 megapixel which is capable to taking photographs of 3280 x2464 pixels.
Video Capture: 1080p30, 720p60 and 640x480p90 resolutions.
All software is supported.

3.2.3: Robotic chassis

Fig: 3.2.3: Robotic Chassis

We have use robotic car frame (Model HC-1). Where (Fig: 3.2.3: Robotic Chassis) two wheel are connected with gear motor beside the robotic chassis. A rechargeable battery case stay on top above the robotic chassis. We also put raspberry pi and pi camera on top off the robotic chassis. This chassis is capable to take weight 450g.

3.2.4: Bread Board

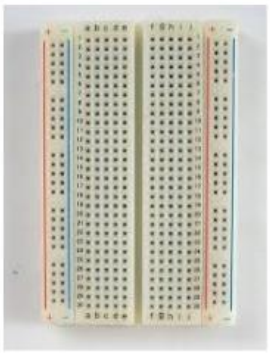

Fig: 3.2.4: Bread Board

We used medium size bread board (Fig: 3.2.4) with 320 tie points. To select this bread board have an effect: All parts of can be connect without any soldering. Special effect of this bread board can use lot of time.

Specification:

- 840 contact points
- 320 tie points

3.2.5: DC Gear Motor.

Fig: 3.2.5: DC Gear Motor

Description

DC gear motor is ideal for Hand posture recognition robot. This motor (Fig: 3.2.4) is covered with plastic and colored with bright yellow. DC gear motor measures approx. 2.5 inch long and its wide is 0.85 inch. This gear motor is also thick which is 0.7 inch. The wheel can connect beside and the Gear motor works well between 4V to 7V DC. You can get good torque in 5V.

Specification of Gear Motor

- Operating voltage : **3V ~ 6V DC**
- Max Torque : **800g.cm**
- Speed (Without load) : **90 rpm**
- No load current **Max 250mA**
- Ration of Reduction : **1:48**

3.2.6: Motor driver L298N

Fig: 3.2.6: Motor driver L298N

This is L298N Motor driver. It is a high power module driver for DC motor. This is suitable for DC motor Fig: 3.2.6: Motor driver L298N.

Specification of Motor Driver L298N

- Driver Model: L298N.
- Chip: Double H Bridge L298N.
- Motor Supply voltage: 46V.
- Motor Supply current: 2A.
- Logic Voltage: 5V.
- Driver Current: 2A.

3.2.7: Battery

Fig: 3.2.7: Rechargeable Battery

According to our project component and to run the project we need electrical DC power Supply. We use 14500 Rechargeable Lithium battery as power source Fig: 3.2.7: Rechargeable Battery. This battery gives power to run device. It is a rechargeable battery we can recharge it using rechargeable battery case. It can be recharge 500 times which is more effective.

3.2.8: Wires

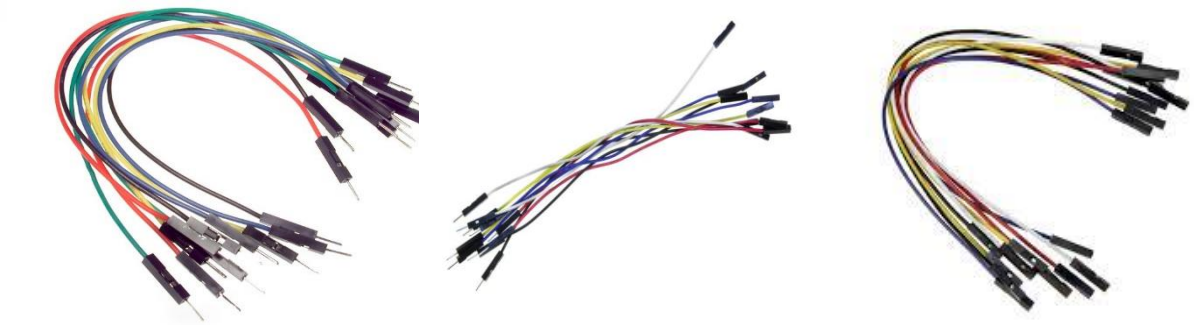

Fig: 3.2.8: Various jumper wires.

To connect component we have used three types of jumper wires here such as male to male jumper wires (Fig: 3.2.8), male to female jumper wires (Fig: 3.2.9) and female to female jumper wires (Fig: 3.2.10). All this were we have used to connect the project component according to the requirements of connection of IoT Based Posture Recognition Robot. We also used programmable

data cable to insert program (python program) in Raspberry pi board and (C++ program) in Arduino Microcontroller. Fig: 3.2.11. Shows the programmable data cable.

Fig: 3.2.11: Data cable.

3.2.9 Battery charger

Fig: 3.2.12: Battery Charger

We used battery charger to charge battery. In this charger (Fig: 3.2.12) takes AC power as input (250V) and it has converter which convert AC power to DC power and then battery take power from the charger.

Specification

- Input 250v
- Multiple time can use

3.2.10 Programmable Language Python

We used python programming language to detect hand posture and using python program we convert hand posture to command on this project**.** To control the posture recognition part Python programming language has been used.

3.2.11 Arduino Micro Controller

Fig: 3.2.13 Arduino Micro Controller

We have used Aduino (Fig: 3.2.13) Uno and node MCU in our project. To select this component has some effects. The Arduino microcontroller can sets parameters where such as CPU speed and bound Rate. This parameter are used when the sketches compiling and uploading. Arduino microcontroller has digital and analog input/output pin which can used when necessary. Most effects of this board is Arduino Software includes the built in support the boards.

Specification

- An ATmega32u4 Running at 16 MHz with auto reset.
- 6 Analog In.
- 20 Digital I/O and 7 PWM.
- Dc current on 3.3V pin 50 mA.
- Flash Memory 32 KB.
- Dc current I/O pin 40 mA.

3.2.12 HC-05 Bluetooth Sensor

Fig: 3.2.14 HC-05 Bluetooth Sensor

HC-05 Bluetooth Sensor we have used to control our project from the mobile phone. HC- 05 Bluetooth sensor is need to fulfil the requirement of our project. To select this sensor has some effects. It has red LED indicator which indicate the connection status. If the sensor is connected the LED blinking slows down in two seconds otherwise it gives the red signal. This sensor (Fig: 3.2.14) has Two modes. First one is data mode and second one is command mode. This device can

easily find from the mobile phone using Bluetooth. It can connect easily with mobile phone or other Bluetooth Device.

Specification

- Two modes (Data mode which exchange Data another is Command Mode).
- Connect 5V or 3.3 V to this pin (VCC).
- Ground Pin of module.
- Transmit Serial data.
- Receive Serial Data.
- Range up to <100m.

3.2.13 C++ Programming Language

We also used C++ programing language to command and control the IoT Based Posture Recognition Robot. C++ programing language control the Bluetooth part of this robot.

3.3 System Methodology

Diagram of the System methodology by which following this the robot move. Descried the diagram in Fig: 3.3.1 System Methodology:

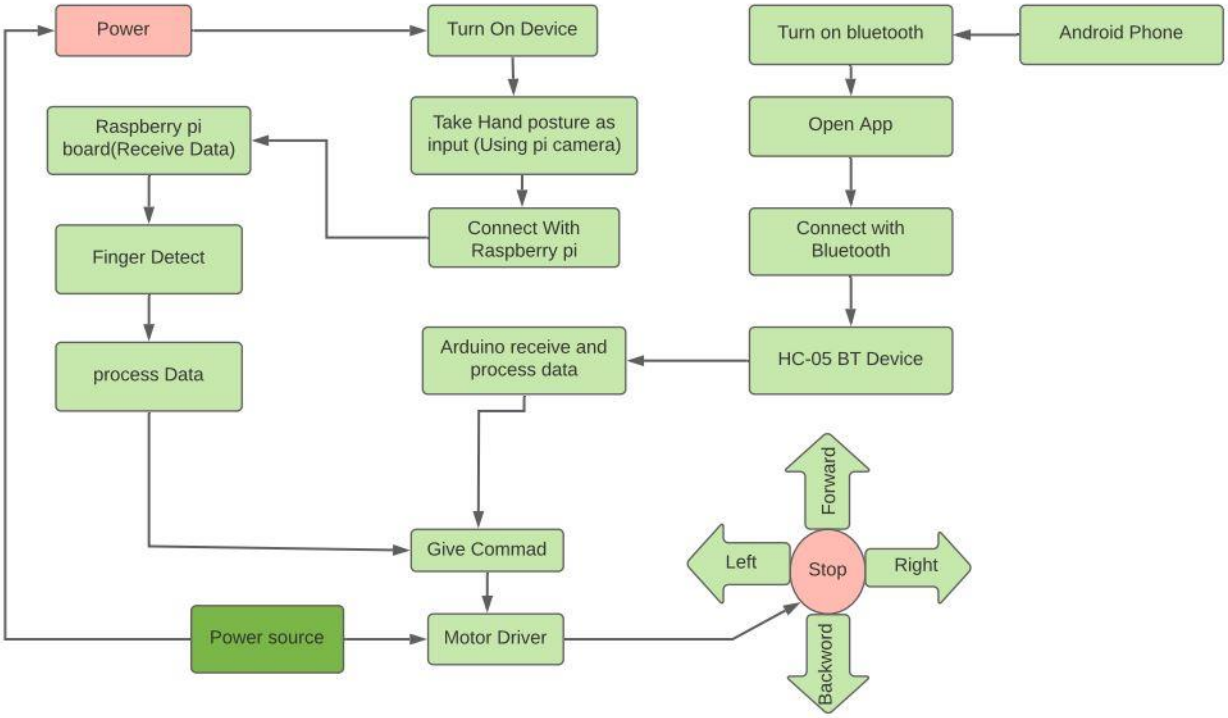

Fig: 3.3.1 System Methodology

3.3.1 Posture Detection part.

Posture detection is the main part of our project. To detect the hand posture use python programing language. First we download python37 and install on raspberry pi board. We also download pycharm IDE community version and installed on raspberry pi. Before make the hand posture detection python program code we need to install two library function (numpy, opencv) of python language. Before plugin library function we updated the pip version 2 to version 3. After that we command on pycharm terminal “pip3 install numpy” and “pip3 install opencv”. After completing installation we import two library in hand detection programing code. Then we write code for captured video (while (cap.isOpened)) for capture reading. Then we crop correct image size. Then we convert color in gray scale and we create window for mapping the picture. After that we set condition to find motion from the window. If the motion found then motion pixel detect. And then we plot detected motion in window map. Send data as motion and posture detected to command the robot to movement. If the motion not found then the from turn in while loop.

3.3.2 Bluetooth Sensing part.

Bluetooth sensing part is another part of our project. The robot can move using Bluetooth sensor which is receive data from the connected mobile phone. we used the arduino IDE as cod editor we write our code here using C++ programing language. We set motor driver pin as variable and we set direction using digital write command for the motor. For forward direction we set (HIGH, LOW, HIGH, LOW). Then we set the backward function (LOW, HIGH, LOW, HIGH). Then we set right function (LOW, LOW, HIGH, LOW), we also set left function (HIGH, LOW, LOW, LOW). And finally we set stop function (LOW, LOW, LOW, LOW). After that we set condition and take user input from the android phone. By checking condition the robot complete its movement.

3.4 Algorithm

We have use two algorithm in our project. First one is applied for Bluetooth part of our project which is controlled by C++ program. Second one is applied for the posture recognition part. Which is controlled by python programming language.

3.4.1 Algorithm 1

1. If receive data = = image (finger 1) Then Forward function work.
2. If receive data = = image (finger 2) Then backward function work.
3. If receive data = = image (finger 3) Then Left function work.
4. If receive data = = image (finger 4) Then right function work.
5. If receive data = = image (finger 5) then Stop function work.

6. By a loop raspberry camera take posture image.
7. Pi camera make connection with pi board.
8. Send data to pi board storage.
9. Process data and take actions.

3.4.2 Algorithm 2

Step 1: Power up the system

Step 2: Establish communication

Step 3: Importing Library

Step 4: Capturing Video

Step 5: while (cap.isOpened()): Capture Reading

Step 6: Image crop in correct size

Step 7: Color converting to gray scale

Step 8: Mapping the picture into window

Step 9: If (Motion found in window) Then Detect motion pixel with the code given in Appendix 1.

Step 10: Plot detected motion in the window map.

Step 11: Send data as the motion and posture detected to robot movement part.

Step 12: If no motion found then stop Else go to step 1.

3.5.1 Conceptual Circuit Diagram 1

The posture detection part follow this circuit diagram

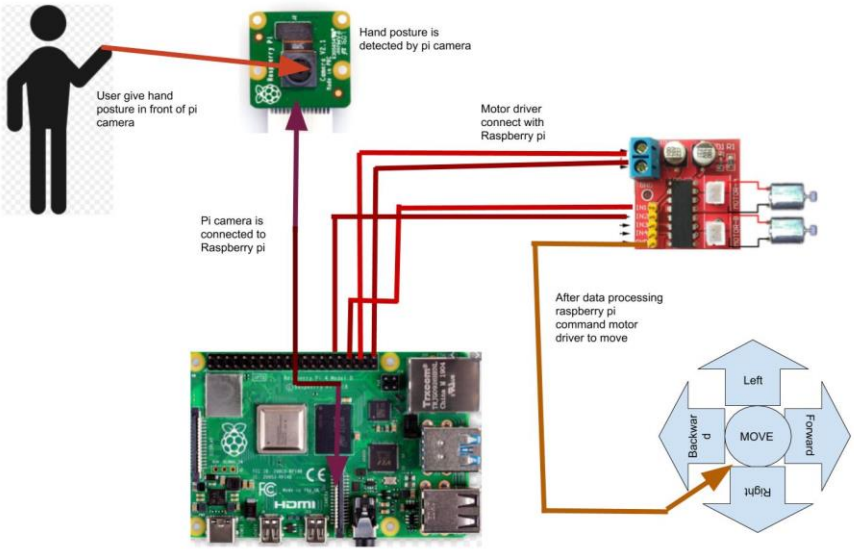

Fig: 3.5.1: conceptual circuit Diagram 1

3.5.2 Conceptual diagram 2

Bluetooth part of this project follow this circuit diagram

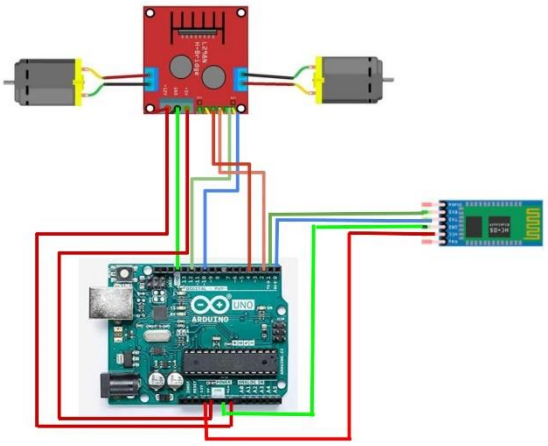

Fig: 3.5.2 Conceptual circuit diagram 2

3.6 Flow chart

Flow chart of the Hand posture recognition and finger detection part of Hand posture recognition Robot for hospital.

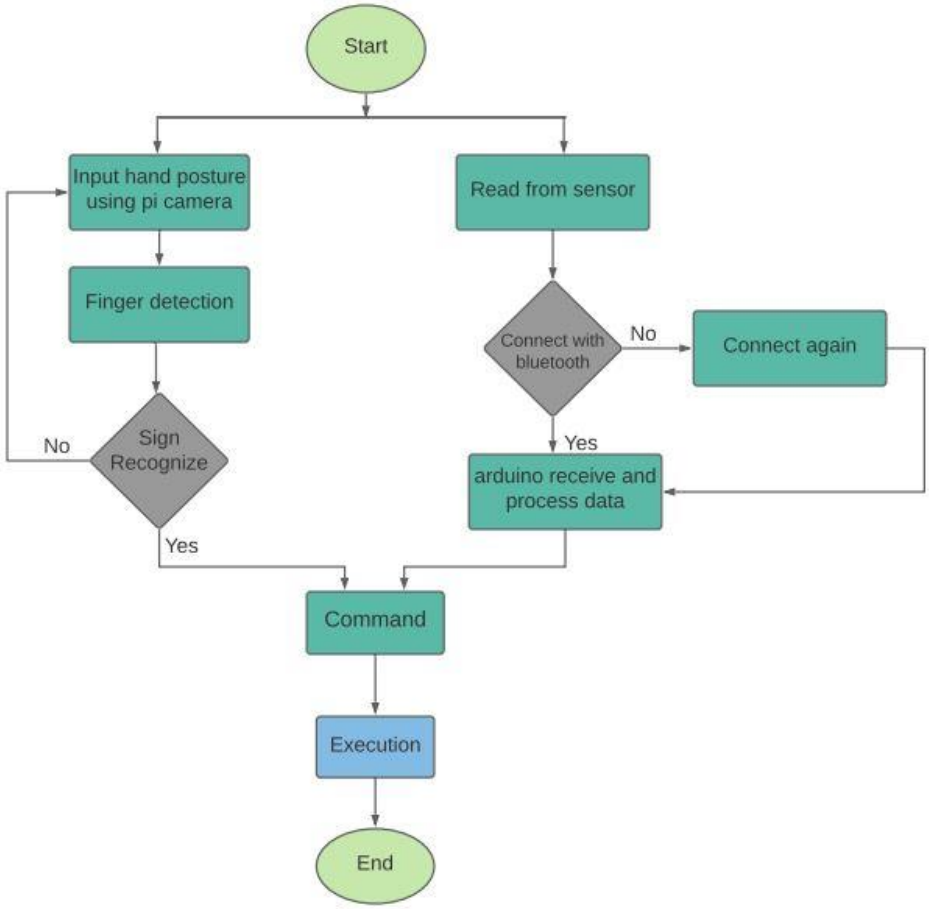

Fig: 3.6.1: Flow chart of Hand posture recognition and finger detection.

Chapter 4

Result and Outcome

4.1 Posture Detection Result

We have got experimental result of this Hand posture recognition robot. When it detect finger one it comes forward. When the pi camera detect two fingers of hand then it go backward according to this rule detect finger three then the robot move its right side and fingers four the robot moves its left side. Finally when the camera detect five fingers of hand then the robot don't move any side still stand on its current position.

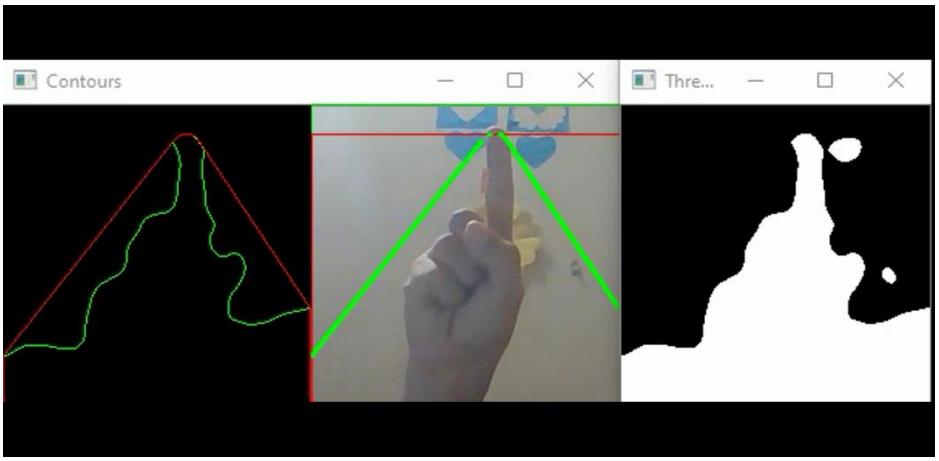

Fig 4.1.1 Detect one finger

We use python programming language to detect finger in Fig 4.1.1 shows detect finger one successfully.

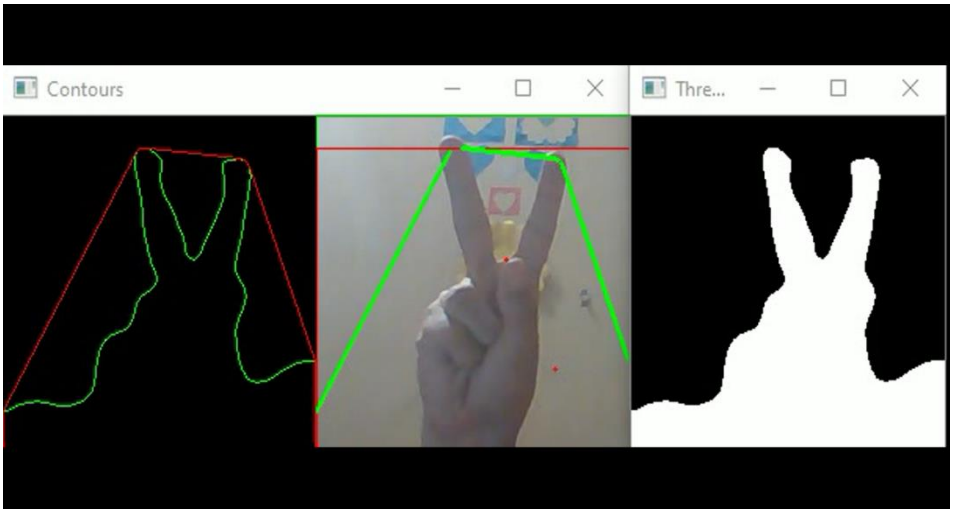

Fig 4.1.2 Detect Two fingers

The system can detect two finger successfully. Fig 4.1.2 shows our system detect two fingers successfully.

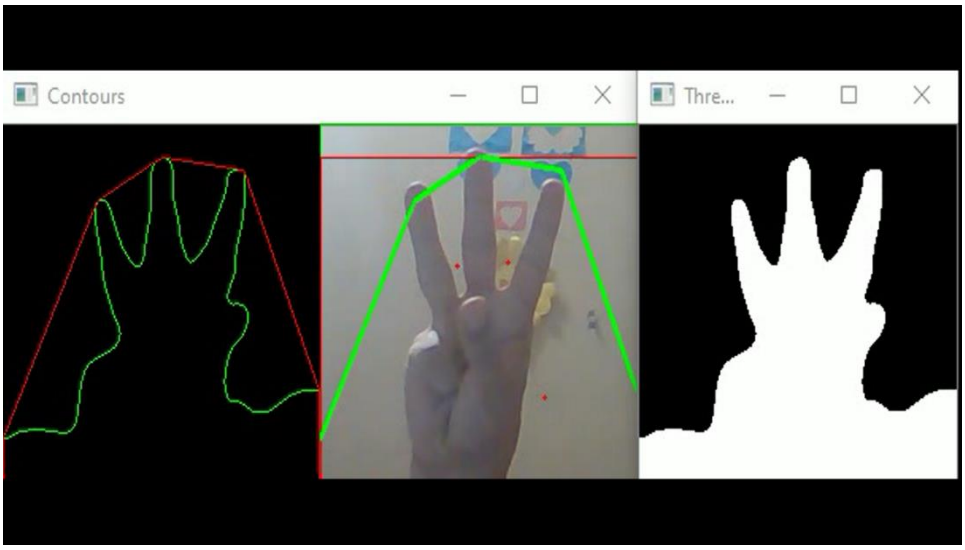

Fig 4.1.3 Detect Three fingers

In Fig 4.1.3 shows hand posture recognition robot can detect successfully.

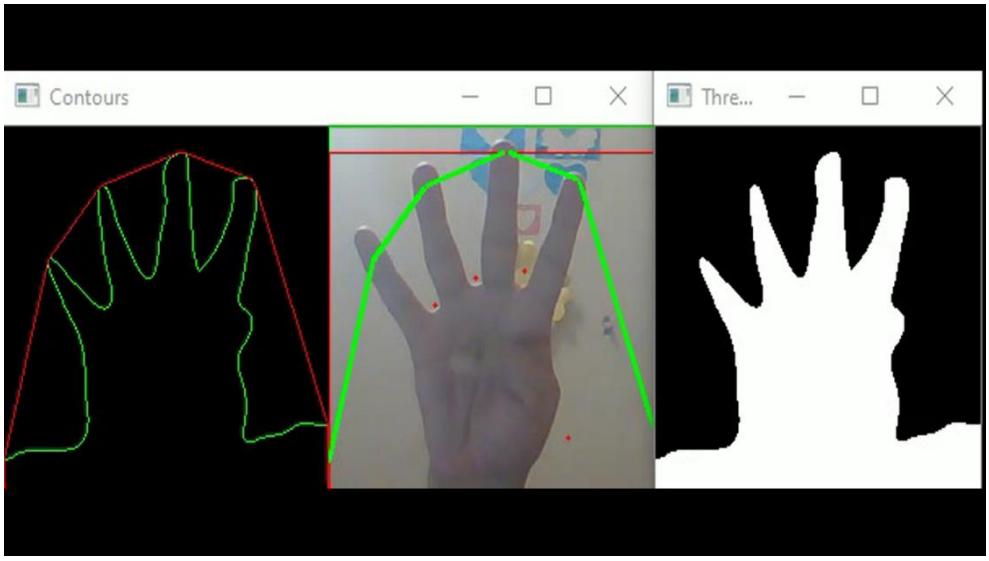

Fig 4.1.4 Detect one fingers

Fig 4.1.4 shows the system detect 4 finger successfully.

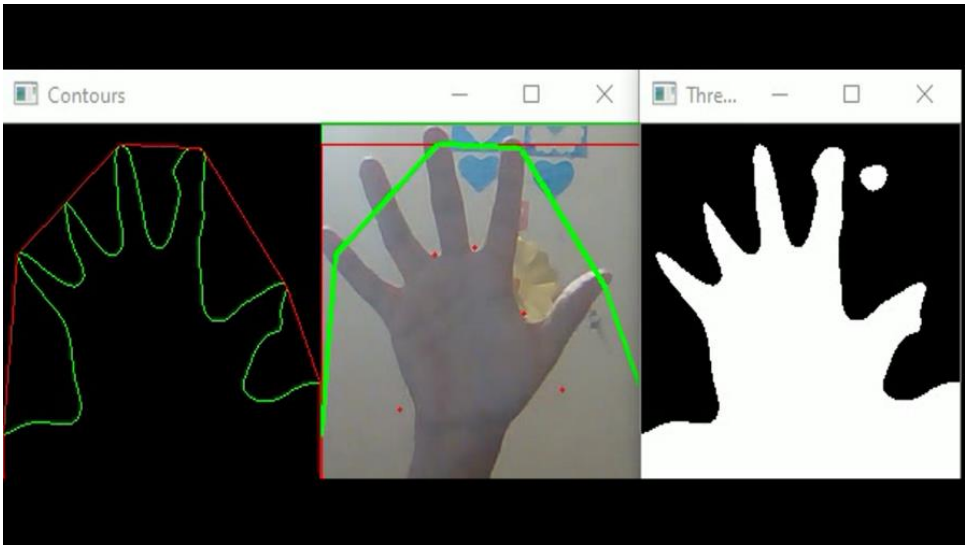

Fig 4.1.5 Detect five fingers

Finally, our system detects five fingers form human hand. Fig 4.1.5 shows our system detect five fingers accurately.

4.2 Testing

We tested our system posture detect and Bluetooth controlling part. Both of this section we get desired result. In posture detection we part we test 1000 times we get 93% accuracy of this section. On the other hand we tested 1000 times. During the tested period we get 95% accurate result.

4.3 Finally Outcome of System.

1. The robot able to recognize the posture of a patient and move towards the patient.
2. The robot has 360 degree movement power.
3. It also work by image processing.
4. It can collect the image of a patient's posture and process the image to detect the posture command.
5. After detecting it will work by following the posture command.
6. It also detect Finger.
7. The robot also work using Bluetooth sensor.
8. System can control successfully from mobile phone.

4.4 Final view of Robot

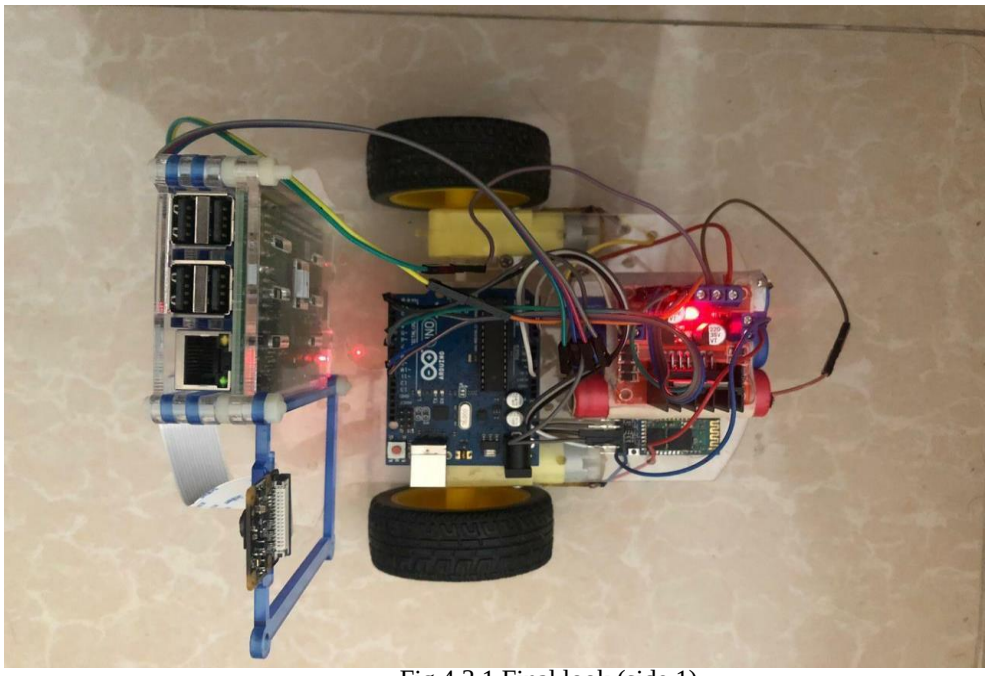

Fig 4.3.1 Final look (side 1)

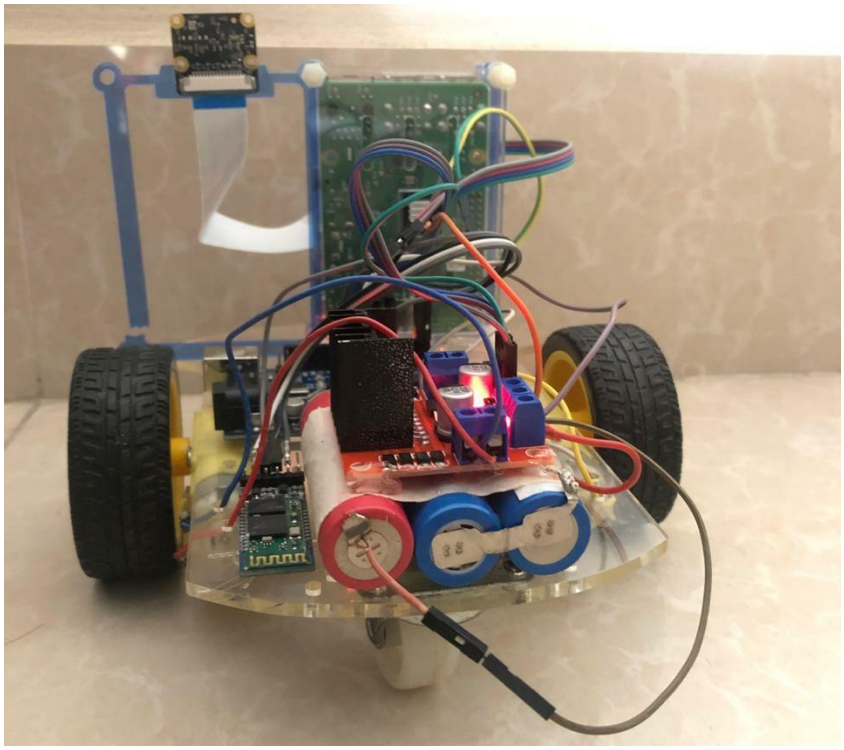

Fig: 4.3.2 Final look (side 2)

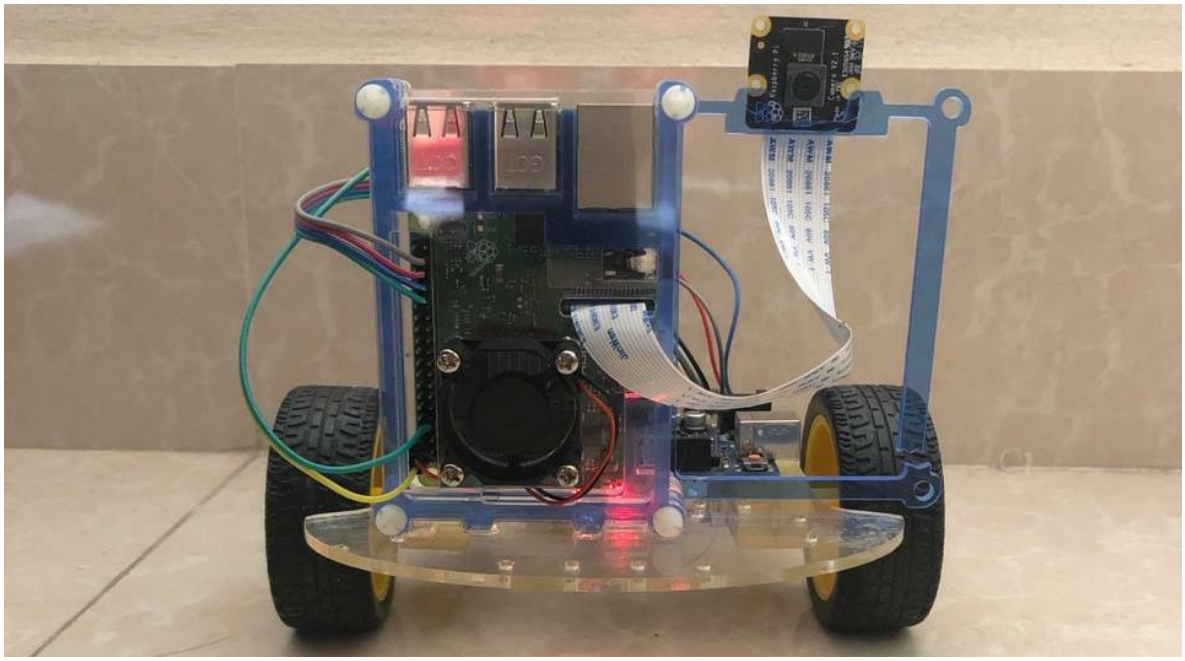

Fig 4.3.3 Final look (side 3)

4.4 Limitation

1. The system is not water proof. If the system in contact with water it can be disable.
2. The system is fully depend on technology any time sensor or other part of this project can be Disable.
3. The robot should be maintain carefully. Otherwise it can't be work.

Chapter 5

Future Work and Conclusion

5.1: Future work

In our modern era robots are appointed lot of sector. Such as iron factory, nuclear workstation and so on. We implemented the IoT Bases Posture recognition robot for hospital. This will help patient. In the mean future robot will work in hospital as nurse. Which can provide service to patients. Patient call the robot with hand posture and then the will go to the patient and wait for commands patient can command the robot by hand posture or voice. According to command the robot will work as like as trained it. The robot will detect temperature, blood pressure, heart bit after monitoring the patient's data the robot will provide medicine. And all of data will store the database. And the doctor can observe this data from his chamber.

5.2: Conclusion

In this project (Hand posture recognition robot) we used Raspberry pi which is a powerful small computer to process and store data. We also used pi camera which is able to detect high resolution image from user. After completing our project we analyze that in different places and different users. Our project detect hand posture successfully and convert it in command mod. So we can say that our project is effective for the patient in hospital.

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