

Design and control of war field spying wireless Robot

**A Research submitted in partial fulfilment for the requirements of the degree of
B.Sc (Honor) in Electrical Engineering**

Submitted by:

Abdullah Maarof Awod Mosafer
Ahmed Ahmed Redman Abdulhabebe
Mohammed Elfatih Mohammed Elnour
Mohammed Elsamani Elkhader

Supervised by:

Mr. Ibrahim Ahmed Ibrahim

Department of Electrical Engineering

Faculty of Engineering

Elshaikh Abdallah Elbadri University



Jan 2021

الآية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(وَقُلْ اَعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ

وَالْمُؤْمِنُونَ وَسَتُرَدُّونَ إِلَىٰ عَالِمِ الْغَيْبِ

وَالشَّهَادَةِ فَيُنَبِّئُكُمْ بِمَا كُنْتُمْ تَعْمَلُونَ)

آية (105) سورة التوبة

Acknowledgements

In the name of Allah, Most Gracious, Most Merciful.

We would like to thank Allah without whom nothing is possible.

We would like to extend our gratitude to a number of people whose help was very valuable in this project.

Special thanks to our parents who kept backing us up in all the times, both financially and morally.

We are deeply indebted to our supervisor Mr. Ibrahim Ahmed whose stimulating, motivation and valuable ideas helped us to complete this work. Thanks to our doctors, teachers, and tutors for their support.

Thanks to our classmates and friend for every advice they gave for the sake of improving this project.

Thank you all,

Abstract

An intelligent unmanned robot (IUAR) is actively being developed for both civilian and military use to mainly perform in dangerous activities. Predominantly these vehicles are used to replace human in hazardous. Lately IUAR are the focus of many research projects for military and civilian applications like military, surveillance, security service, riot control, hostage situation, police, law enforcement, border patrol, etc. Example is explosives and bomb disabling vehicles. IUARs in varying sizes to meet mission capability requirements are today saving lives and providing critical supporting capabilities in military operations worldwide. The main issue in every country is border problems due to this problems border guarding force of army men are implemented for guarding land border during peace time and surveillance of border preventing transnational crime and to monitor intruders like terrorist, and civilian of other nation. During surveillance operation many army men wounded and shot dead in borders by the attack of terrorist and army of opponent country, so to protect the precious life of army men and women. The robot was implemented provider camera and gun that is controlled by Wi-Fi through the PC, The robot sends a live broadcast to the military command to collect information about the target area, and the robot can also carry out the attack by aiming the gun at the enemy, implementing robotic technology for border surveillance and guard the boarder from enemy. This robotic technology will be very useful for army of every country so that the lives of many army men/women's are protected. We expect that the intelligent unmanned army robot plays an important role in the future military operation.

المستخلص

يتم تطوير روبوت ذكي غير مأهول بشكل نشط للاستخدام المدني والعسكري على حد سواء لأداء الأنشطة الخطرة بشكل أساسي. تستخدم هذه المركبات في الغالب لتحل محل الإنسان في حالة خطرة. في الآونة الأخيرة، تم التركيز على العديد من المشاريع البحثية للتطبيقات العسكرية والمدنية مثل الجيش والمراقبة وخدمة الأمن ومكافحة الشغب ووضع الرهائن والشرطة وإنفاذ القانون ودوريات الحدود وما إلى ذلك. ومن الأمثلة على المتفجرات ومركبات تعطيل القنابل. تعمل الروبوتات بأحجام مختلفة للوفاء بمتطلبات قدرة المهمة على إنقاذ الأرواح وتوفير إمكانات دعم مهمة في العمليات العسكرية في جميع أنحاء العالم. القضية الرئيسية في كل بلد هي المشاكل الحدودية بسبب هذه المشاكل يتم تنفيذ قوة حراسة الحدود من رجال الجيش لحراسة الحدود البرية أثناء أوقات السلم ومراقبة الحدود لمنع الجريمة العابرة للحدود ومراقبة المتسللين مثل الإرهابيين والمدنيين من دولة أخرى. خلال عملية الاستطلاع، أصيب العديد من رجال الجيش وقتلوا بالرصاص على الحدود بهجوم إرهابي وجيش دولة معارضة، وذلك لحماية الحياة الغالية لرجال ونساء الجيش. تم تنفيذ روبوتًا مزودًا بكاميرا وبندقية يتم التحكم فيهما عن طريق واي فاي من خلال الكمبيوتر الشخصي، ويعمل الروبوت على إرسال البث المباشر إلى القيادة العسكرية لتجميع المعلومات حول المنطقة المستهدفة وكما يمكن للروبوت تنفيذ الهجوم من خلال تصويب البندقية على العدو ونطبق تقنية روبوتية لمراقبة الحدود وحراسة الحدود من العدو وستكون هذه التكنولوجيا الروبوتية مفيدة جدًا للجيش في كل بلد بحيث تتم حماية أرواح العديد من رجال / نساء الجيش نتوقع أن يلعب روبوت الجيش الذكي غير المأهول دورًا مهمًا في العملية العسكرية المستقبلية.

List of Contents

الآية	I
ACKNOWLEDGEMENTS.....	II
ABSTRACT	III
المستخلص	IV
LIST OF CONTENTS	V
LIST OF FIGURES	VII
LIST OF TABLES	IX
LIST OF ABBREVIATIONS.....	X

Chapter One – Introduction

1.1	OVERVIEW.....	2
1.2	PROBLEM STATEMENT	3
1.3	RESEARCH OBJECTIVES.....	3
1.4	RESEARCH METHODOLOGY	3
1.5	RESEARCH OUTLINES.....	3

CHAPTER TWO - LITERATURE REVIEW

2.1	OVERVIEW.....	6
2.2	IOT	6
2.3	HTML PAGE	6
2.4	ANDROID	6
2.5	PYTHON LANGUAGE	7
2.6	OPENCV.....	7
2.7	RELATED WORKS.....	7

CHAPTER THREE - SYSTEM DESIGN

3.1	OVERVIEW.....	14
3.2	ROBOTIC SYSTEMS.....	14
3.3	EXISTING ROBOTS	15
3.4	ARTICULATED ROBOTS	15
3.5	EXISTING WEAPON-MOUNTED ROBOTIC SYSTEM	17
3.6	ELECTRICAL DESIGN FOR ROBOTICS SYSTEM.....	17
3.6.1	POWER SUPPLY.....	19
3.6.2	EMBEDDED SYSTEM.....	19
3.6.3	RASPBERRY PI 3.....	19
3.6.4	MOTOR DRIVER IC L293D	21
3.6.5	DC MOTOR	22

3.6.6	STEPPER MOTOR.....	22
3.6.7	IC DRIVER - ULN2003	23
3.6.8	LOGITECH HD PRO WEBCAM	24

Chapter Four - Results and Discussion

4.1	OVERVIEW	26
4.2	CONFIGURE RASPBERRY PI (JUST FIRST TIME).....	26
4.2.1	STEP 1: DOWNLOADING REQUIRED SOFT WARES	26
4.2.2	STEP 2: WRITE RASPBERRY OS TO SD CARD	27
4.2.3	STEP 3: CREATING "SSH" FILE IN SD CARD	27
4.2.4	STEP 4: POWER UP PI.....	28
4.2.5	STEP 5: SHARING NETWORK	28
4.2.6	STEP 6: ENTERING PI TERMINAL THROUGH SSH	29
4.2.7	STEP 7: RASPBERRY PI SETTING	29
4.2.8	STEP 8: DESIGN THE TKINTER AND MAKE THE PROGRAM	31
4.3	SYSTEM FLOW CHAR	32
4.4	SYSTEM OPERATION.....	34
4.4.1	STEP 1: TURN-ON DEVICES AND CONNECT THEM TOGETHER.....	34
4.4.2	STEP 2: RASPBERRY PI VIEWER IN COMPUTER	34
4.4.3	STEP 3: OPEN USER INTERFACE PROGRAM.....	35
4.4.4	STEP 4: OPEN VIDEO LIVING:.....	35
4.4.5	STEP 5: READ COMMAND.....	36
4.5	RESULT	37
4.5.1	ROBOT MOVEMENT.....	37
4.5.2	ROBOT ARM MOVEMENT	38
4.5.3	THE SCOPE OF WORK OF THE ROBOT.....	38
4.5.4	LIVE BROADCAST TRANSMISSION.....	39
4.5.5	SITE TO SHOOT	39
4.5.6	CONTROL INTERFACE.....	40
4.5.7	DESIGN THE ROBOT	40
4.5.8	THE LINK FOR THE RECORDER VIDEO	41
4.5.9	THE SUCCESS RATE OF THE ROBOT	41

CHAPTER FIVE - CONCLUSION AND RECOMMENDATIONS

5.1	CONCLUSION	43
5.2	RECOMMENDATIONS.....	43

REFERENCES

REFERENCES.....	45
-----------------	----

List of Figures

Figure(2.1): OpenCV Logo.....	7
Figure (3.1): Schematic Diagram of an Articulated Robot and its Symbol.....	16
Figure (3.2): Articulated Robot.....	16
Figure (3.3): QinetiQ/Foster Miller Talon Robot with a Benelli M4 Moun	18
Figure (3.4): System Block Diagram	18
Figure (3.5): Raspberry Pi 3.....	20
Figure (3.6): Raspberry pi Technical Characteristics	20
Figure (3.7): Raspberry Pi 3 GPIO pin Layout.....	21
Figure (3.8): IC Driver L293.....	22
Figure (3.9): Motor DC.....	22
Figure (3.10): Stepper Motor	23
Figure (3.11): IC Driver ULN2003	23
Figure (3.11): Webcam	24
Figure (4.1): Download Page for Raspberry Pi Imager (OS).....	26
Figure (4.2): The Method of Writing the Program in the SD Card.	27
Figure (4.3): How to Create "SSH" File and Peace it.....	27
Figure (4.4): How to Insert the SD Card, Connect Pc and Plug in Power Supply.....	28
Figure (4.5): How to Set Network.....	28
Figure (4.6): How to Inter Raspberry Pi By PuTTY Program.....	29
Figure (4.7): How Enabled VNC Server.	29
Figure (4.8): Automatic Link Program.....	30
Figure (4.9): How to Install GPIO Library.....	30
Figure (4.10): How Start Server and IP Address for it.	31
Figure (4.11): Control Interface.....	32
Figure (4.12): System Flow Char	33
Figure (4.13): Setting Up The Network Point.....	34
Figure (4.14): How to Entering to Raspberry Pi By VNC Viewer.	34
Figure (4.15): How to Open Interface Control and it.....	35
Figure (4.16): Live Broadcast Transmission in VLC Player.....	35

Figure (4.17): Live Broadcast Transmission in Opera.36
Figure (4.18): Robot Movement.....37
Figure (4.19): Robot Arm Movement.....38
Figure (4.20): The Scope of Work of the Robot38
Figure (4.21): Live Broadcast Transmission39
Figure (4.22): Site to Shoot39
Figure (4.23): Control Interface40
Figure (4.24): Design the Robot.....40
Figure (4.24): QR for Link The Recorder Video.....41

List of Tables

Table No. (2.1) The titles of scientific papers, their purpose and results.....	11
Table No. (4.1) The relation between a command and state electric robot:	37
Table No. (4.2) The the Success Rate of the Robot:	41

list of Abbreviation

SSH	Secure Shell
SD card	Secure Digital Card
VNC	Virtual Network Computing
IP	Internet Protocol
Tkinter	Python's de-facto standard GUI
GUI	Graphical User Interface
SSID	Stands for Service Set IDentifier
IOT	Internet of Things
HTML	Hyper Text Markup Language
OpenCV	Open Source Computer Vision Library
I/O	Input/Output.
IDE	Integrated Development Environment.
ADHD	Attention Deficit Hyperactivity Disorder
PC	Personal Computer.
GPIO	General Purpose Input Output
OS	Operating System
HDMI	High-Definition Multimedia Interface
DSI	Display Serial Interface
CSI	Camera Serial Interface
LAN	Local Area Network

Chapter One

Introduction

Chapter One

Introduction

1.1 Overview

Earlier the robots were controlled through wired networks but recent years, Wireless system has been under rapid development. Communication without wiring makes a control system very compact and robust. The key feature of this technology is that it reads a signal (Transmitting/Encoding Circuit) and processes it into a wave (low frequency) form which is then sent into a specified signal receiver (Receiver/Decoding) which then decrypt the signal into the previously transmitted signal resulting in a successful wireless data communication. [1]

In robotics, this technology is of heavy demand. By applying a wireless signal communication, a robotic system can be made more efficient and compact. Wireless Robotic systems are also less prone to error. They can be applied successfully in the industry, where a very little mistake can make a huge problem. By using robot labor cost of the industries can be reduced considerably. At present many countries use robot in the battle field for assisting their soldiers. Robots can also be used for lifting mine in the war field and can also be used as a perfect soldier. Mobile robots have the capability to move around in their environment and are not fixed to one physical location. An example of a mobile robot that is used commonly today is the Automated Guided Vehicle (AGV). An AGV is a mobile robot that follows markers or wires in the floor or uses vision or lasers. [2]

Mobile robots are also found in industry, defense and security environments. They also appear as consumer products, for entertainment or to perform certain tasks like vacuum cleaning. Mobile robots are the focus of a great deal of current research and almost every major university has one or more laboratories that conduct researches on mobile robot. General-purpose autonomous robots can perform a variety of functions independently.[3]

This project can be used for security purposes where we need to get information about some suspicious area/people. We can do this by sitting at a far secure place and safely devise a plan to tackle their activities It acquires image from cameras through PC.

The sentry gun model suggested in this project has two degrees of freedom; one degree allows the gun turret to scan the area along the horizontal axis (azimuth) while the other degree allows the gun turret to move up and down (elevation). These two degrees allow the gun turret to move in any direction in a 2D plane. The most important part of this project was that the aim of the turret should be accurate i.e. the sentry is able to detect and locate intruders effectively [4].

1.2 Problem Statement

To protect the soldiers from the enemies and ambushes in wars and confrontations with the enemy, which results in a loss of soldiers' lives, due to the insufficient information gathered about the enemy, which causes the ambushes to occur.

1.3 Research Objectives

1.3.1 Main Objective

Design and implement robot with camera and gun (laser) that is controlled by Wi-Fi through the PC.

1.3.2 Specific Objective

- i. Implementation and evaluation of the robot's work by programming the Raspberry chip in Python.
- ii. practically, Implement the robot action.

1.4 Research Methodology

Raspberry Pi The latest version of Raspberry Pi Imager was downloaded and installed, and memory card was connected and formatted FAT32, the image file was wrote to memory by win32diskimager program, a SSH file created in memory, the computer and raspberry pi were connect by ethernet cable, the IP address "169.254.121.187" was created for raspberry pi and interred raspberry pi by PUTTY program and enabled VNC viewer, to connect raspberry pi with network made small program contain name SSDI "Abdulla" and password "12345678", The Wi-Fi Raspberry address was searched by an advance scanner IP program, a Raspberry Pi was entered through VNC viewer program by IP address "192.168.43.60", Software has been updated and installed same library (GPIO, apach2, Tkinter and motion) for raspberry pi, The control interface was designed, tested and tested, and the robot body was designed and tested.

1.5 Research Outlines

Chapter One: Covers the research Introduction, Problem Statement ,Research Objectives, Research Methodology followed herein and also Research Outlines.

Chapter Two: Covers the related works and Explanation of scientific terms.

Chapter Three: System design, how they work, how far they can really go, what are the systems stages and steps which by the both systems turned to a practical science, and also illustrate the control technology that is followed in our proposed.

Chapter Four: This chapter provides the stages and steps by which the proposed system can be implemented and turned into being a practical model, and discuss the obtained results.

Chapter Five: The conclusions of the project and the future developments are suggested for better plan and execution of this project.

Chapter Two

Literature Review

Chapter Two

Literature Review

2.1 Overview

With advancements in technology, there has also been vast renovation in the field of robotics. Robotic mechanisms are used in inspection and control tasks in various engineering sciences including agriculture, bio-technology, chemical, defense, electronics, food-processing, fusion sciences and so on.

2.2 IOT

The Internet of Robotic Things is an emerging vision that brings together pervasive sensors and objects with robotic and autonomous systems. This survey examines how the merger of robotic and Internet of Things technologies will advance the abilities of both the current Internet of Things and the current robotic systems, thus enabling the creation of new, potentially disruptive services. We discuss some of the new technological challenges created by this merger and conclude that a truly holistic view is needed but currently lacking.[5]

2.3 HTML Page

HTML is the Standard Markup Language. It is used for developing Web Pages. HTML is Hyper Text Markup Language and is used for describing the structure of web pages. Various Tags are used in HTML like "heading", "paragraph", "table", and so on. This paper discusses various HTML tags that are must for developing web pages.[6]

2.4 Android

Android is described as a mobile operating system, initially developed by Android Inc. Android was sold to Google in 2005. Android is based on a modified Linux 2.6 kernel. Google, as well as other members of the Open Handset Alliance (OHA) collaborated on Android (design, development, distribution). Currently, the Android Open Source Project (AOSP) is governing the Android maintenance and development cycle.[7]

2.5 Python Language

Created in late 1980's, python is a high level, multipurpose, programmer - friendly language. It has a huge compendious standard library. Its ease of use helps to integrate systems effectively.[8]

2.6 OpenCV

OpenCV, short for Open Source Computer Vision, is a project launched in 1999 by the Intel Corporation. It was first announced as an optimization research aiming for advancing CPU-intensive application, part of a series of projects including real-time ray tracking and 3D display walls. The initial public release of OpenCV was in 2000 at the IEEE Conference on Computer Vision and Pattern Recognition. Until 2005, there were another five beta versions released. However, the first major version of OpenCV was released in 2006, labeled as the 1.0 version of OpenCV. The second primary release, i.e. OpenCV 2, was on October 2009, which contained major changes to the C++ interface. The official release of OpenCV now occurs about every 6 months and the OpenCV has already been taken over by OpenCV.org, a non-profit organization as shown in figure (2.1).[9]



Figure(2.1): OpenCV Logo

2.7 Related Works

Smartphone Control Robot with Automatic Firing Gun

R.Hema, M.Sundararajan, S.Balaji; July 2019. The task of this project is intended to build up a mechanical vehicle utilizing the cell phone for remote activity, joined with camera and firearm. The robot alongside weapon is utilized to shoot consequently in a particular district by identifying the obscure picture of person and different questions through the assistance of camera with night vision capacities. This is somewhat robot is useful to Arm Forces for security framework. [10]

IOT Based Surveillance Robot

G.Anandravisekar, A.Anto Clinton, T.Mukesh Raj, L.Naveen; March-2018. The purpose of this robot is to roam around and provide audio and video information from the given environment and to send that obtained information to the user. In this project, one can control the robot with the help of mobile or laptop through Internet of Things (IoT) and also can get the live streaming of video both in daytime as well as at night with the help of wireless camera from the robot. The robot can be controlled both in manual as well as in automated mode with the help of Arduino microcontroller. This robot also uses various sensors that collect data and send it to the Arduino microcontroller which controls the robot behavior. Along with the obtained live streamed video output, user can also obtain the presence of metal bombs using metal detectors. Thus, the action of surveillance can be performed. [11]

Surveillance Robot Using Raspberry Pi-IOT

Mr. T.Saravanakumar, D.Keerthana, D.Santhiya, J.Sneka, D.Sowmiya; March 2018; The main objective of this paper is to develop a virtual environment for detecting suspicious and targeted places for user without any loss of human life. It is based on development of a robot vehicle for observing/spying the suspicious objects. It can continuously monitor the objects. Robot can move in every direction (left, right, forward and backward). It is used for video surveillance and remotely control the particular place using Wi-Fi as medium. The webcam which is placed on the robotic unit will capture the video and it transmits live to the remote end. The major application of this paper can be analyzed using HTML web page which can be used to control the movement of the robot. L293D is quadruple dual H-Bridge motor driven IC. [12]

Design and Implementation of Image Capture Sentry Gun Robot

Muhammad Kashif, Muhammad Arslan, Rocky Chakma, Farhad Banoori, Abdullah Al Mamun, Ganantu Lal Chakma; 2018. This paper is about the development and design of semi-autonomous sentry robot using arduino controller. This robot called Sentry Gun, because it consists of a Gun mounted on a stand and an operator can also operate it from a secure location. Sentry Gun is based on latest research, it uses high resolution camera to scan the target area and movement can be detected by using software i.e processing .org As compare to humans it can perform far better while operating in autonomous mode in red zones, it will bring a significant

fall in the death toll, if installed outside every check post, law enforcement agencies and borders, to stop illegal intrusions.[13]

Review Paper on Wi-Fi Surveillance Robot using Raspberry pi

Prof. I. Y. Sheikh, Ms. Jaya S. Vyawahare, Ms. Sampada B.Mahajan, Ms. Prachi R. Bal; April 2016; India. In this paper is proposed robotic system whose working based on Raspberry pi, which provide us with the information in the form of live videos of the locations. When someone enters such highly secured places, the camera mounted on the robot will keep on capturing the videos from the surroundings to keep a record of the details of the incident happened and this is readily available to the user and only the authenticated users can see the recorded details. It can also find the number of persons located with the help of the Infrared sensor. This review paper gives a peculiar approach towards surveillance system. [14]

War field spying robot with wireless camera and firing system

Prof.S. G.Galande, Pawar Yogesh, Korade Amit, Chavan Jalindar; 2016. In this paper on robotic vehicle using mobile application or TV for remote operation attached with wireless camera for monitoring purpose. The robot along with camera can wirelessly transmit real time video. This is kind of robot can be helpful for spying purpose in war fields. An 8051/PIC series of microcontroller is used for the desired operation. By using android application device, commands are sent from transmitting side to the receiver side for control the movement of the robot either to move forward, backward, left or right etc. At the receiver side two motors are interfaced to the microcontroller where they are used for the movement of the vehicle. Remote operation is achieved by any RF transmitter and receiver. Data from input is processed to the microcontroller and it controls/drives DC motors via motor driver IC for necessary work. A wireless camera is mounted on the robot body for spying purpose even in complete darkness by using infrared signal. This proposed system also having a firing mechanism to fire the target object The proposed system accept the camera video input of the remote place if any human is detected and seems like an enemy/terrorist then this input is given to the controller to shoot the target object by using simply press the fire button of the remote then the gun will fire to the target object. The target object can be search by moving the robot left or right, up or down. The limitation of this proposed system is that the range of camera is 100 meters only, but this can be improve by using high frequency camera.[15]

Automatic Robot Gun

Prof. Pokharkar Sagar B., Ashutosh V. Deoghare, Bhushan V. Khurge; March 2015. In this project which proposes an innovative design for military application. They are used proximity sensors to sense the human being and they are also introducing an automatic as well as manual mode in it. The manual mode can be controlled through any portable device by using Zigbee and in automatic mode the gun will shoot in the direction of the proximity sensor. After being implemented it will be a successful war field machine. [16]

Surveillance Robot for Military Application

Prof. S. A Joshi, Aparna Tondarkar, Krishna Solanke, Rohit Jagtap; 2015. This project presents a modern approach for surveillance at remote and border areas using multifunctional robot based on current IOT used in defense and military applications. This robotic vehicle has ability to substitute the soldier at border area to provide surveillance. The robotic vehicle works both as autonomous and manually controlled vehicle using internet communication medium. This multisensory robot used to detect presence of enemy capture it in camera and give the live streaming to the authorized person Surveillance is major role while we work in on border area for this there is robot for surveillance purpose. This paper presents a smart surveillance robot for military application by using Raspberry Pi for security purpose. A field Raspberry pi sends a wireless command which is received by Authorized person on web Page and accordingly robot moves. The Video Streaming is done using Raspberry pi camera. The Raspberry pi programming is done in python language. The experimental result shows that the video streamed up to 15 frames per second.[17]

An Intelligent Robot System for Spraying Pesticides

Peng Jian-sheng; 2014; In order to reduce pesticides in agricultural production caused by direct contact with the human body injury, and improve the efficiency of agricultural spraying operations, this paper proposes the design of intelligent Wi-Fi wireless controlled spraying pesticides robots. For monitoring the microcontroller core, a wireless router for the network connection point is employed. The camera captures video, Android phones and smart monitoring system operation. Test results show that the design realizes spraying pesticides by robot to replace staff job, and achieves good results.[18].

Table No. (2.1) shows the titles of scientific papers, their purpose and results

Table (2.1)

Paper title	Objective	Outcome
Smartphone Control Robot with Automatic Firing Gun	Build up a mechanical vehicle utilizing the cell phone for remote activity, joined with camera and firearm	A robot identifying the obscure picture of person and different questions through the assistance of camera with night vision capacities.
IOT Based Surveillance Robot	The purpose of this robot is to roam around and provide audio and video information from the given environment and to send that obtained information to the user.	one can control the robot with the help of mobile or laptop through Internet of Things (IOT) and also can get the live streaming of video both in daytime as well as at night with the help of wireless camera from the robot.
Surveillance Robot Using Raspberry Pi-IOT	Develop a virtual environment for detecting suspicious and targeted places for user without any loss of human life	Robot can move in every direction (left, right, forward and backward) It is used for video surveillance and remotely control the particular place using Wi-Fi as medium
Design and Implementation of Image Capture Sentry Gun Robot	Development and design of semi-autonomous sentry robot using Arduino controller.	Made robot consists of a Gun mounted on a stand and an operator can also operate it from a secure location.
Review Paper on Wi-Fi Surveillance Robot using Raspberry pi	robotic system whose working based on Raspberry pi, which provide us with the information in the form of live videos of the locations	When someone enters such highly secured places, the camera mounted on the robot will keep on capturing the videos from the surroundings to keep a record of the details of the incident happened

War field spying robot with wireless camera and firing system	robotic vehicle using mobile application or TV for remote operation attached with wireless camera for monitoring purpose	The robot along with camera can wirelessly transmit real time video.
Automatic Robot Gun	Proposes an innovative design for military application used proximity sensors to sense the human.	
Surveillance Robot for Military Application	Design modern approach for surveillance at remote and border areas using multifunctional robot based on current IOT used in defense and military applications	
An Intelligent Robot System for Spraying Pesticides	proposes the design of intelligent Wi-Fi wireless controlled spraying pesticides robots	

Chapter Three

System Design

Chapter Three

System Design

3.1 Overview

This chapter intends to provide a literature review of the robotics which is introduced in our research, and also give a literature background of the military detection system based on wireless communication. Besides, it gives a background for different control systems for both vehicle prototyping and PC which are going to be the proposed applications in this research. Also, this chapter is basically to understand the main concepts and works that are related to our research.

3.2 Robotic Systems

The trends of robotics research are changed very rapidly in the last decades due to significant changes in information technology. The evolution of new applications of robots and robotic devices are always influenced by the current need of the society. It was around 1960 when industrial robots were first introduced in the production process, and until the 1990s industrial robots dominated robotics research [19]. From this time the development in robotics sector has been increased very rapidly. Cyprian M. Wronka et al., 2006 developed a concept of Internet remote control interface for a multipurpose robotic arm. In their work authors proposed a tele operated model for controlling a robotic arm [20]. Az kiyuki Minamide et al., 2007 proposed a distant control robot model where game robots are controlled from long distance through internet. They practically implemented the concept and arranged robot gaming competition between the children of a Japanese school and of a Singapore school [21]. C. Pacchierotti et al., 2015; B. Fang et al., 2015 and S. Chatel et al., 2016 made different researches on teleoperation system for robotics and found great success on respective fields and also describing an available public implementation of an Internet robot controller [22-24]. A. Hiyama et al., 2017 implemented a robotic system for telecommunication by using remote wireless system [25]. L. J. Williams took a patent on a method and system for determining position and/or pose of an object and showed that signal can be transmitted with quite low distortion by applying RF on a moving robotic system [26]. O. Javed et al., 2003; O. Javed and M. Shah, 2008; A. A. Altahir et al., 2018 and G. Verma et al., 2018 published detailed and well experimented researches on applying and controlling surveillance-based robots which are capable of capturing and sending

real-time image to a operator MCU with lowest delay time along with high performance output. [27-30]

3.3 Existing Robots

Robots are used in different fields such as industrial, military, space exploration, and medical applications. These robots could be classified as manipulator robots and cooperate with other parts of automated or semi-automated equipment to achieve tasks such as loading, unloading, spray painting, welding, and assembling. Generally robots are designed, built and controlled via a computer or a controlling device which uses a specific program or algorithm. Programs and robots are designed in a way that when the program changes, the behavior of the robot changes accordingly resulting in a very flexible task achieving robot. Robots are categorized by their generation, intelligence, structural, capabilities, application and operational capabilities. [31]

- Linear Robots (including Cartesian and gantry).
- Cylindrical Robots
- Parallel Robots.
- Spherical Robots.
- SCARA Robots.
- Articulated Robots.

3.4 Articulated Robots

Articulated robots (also known as revolute robots) which our research classifies under of it. These robots have three fixed axes connected to two revolute bases. All joints of an articulated arm are revolute and most likely represent the human arm. Figure (3.1) shows the schematic diagram and symbol of an articulated robot figure (3.1): Schematic diagram of an articulated robot and its symbol (on the right).[23].

The moving rigid objects are called links, revolute joints are called hinges and prismatic joints are called sliding joints. Each joint defines the relative motion of the other two object it links which determines the subset of the whole configuration space. Each configuration subset is a different position for each link. These subsets are simple to measure by considering a distance or an angle with each joint. A robotic arm can be said to be a typical example for articulated robot. An important matter which should be considered is that the dimension of the

configuration space increases with the number of joints however the operation speed is limited due to the different payloads at the manipulator and nonlinear environment. Almost 80% of the registered robots are articulated and up to 20% are linear robots as shown in figure (3.2) [33].

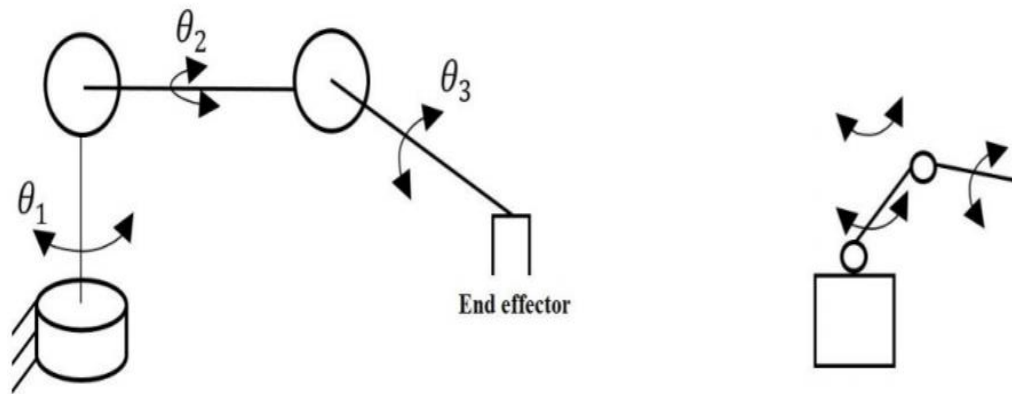


Figure (3.1): Schematic Diagram of an Articulated Robot and its Symbol (on the right)



Figure (3.2): Articulated Robot

The advantages and disadvantages of articulated robots are Advantages: [14]

- Superb structural flexibility.
- Compatible with other robots operating in common workspace.
- High rotation speed.

Disadvantages:

- Low accuracy and resolution because of rotary joints and positional errors.
 - Counter balancing difficulties due to the large and variable torque .
 - High chance of collision.
 - Dynamic instability due to higher moment of inertia and gravity
- 21 With investigating the properties and specification of each robot, a table can be illustrated to show the main differences between these robots in a general form. If a robot is to be chosen and used for a specific task, this comparison can lead to have a better understanding and decision. [34].

3.5 Existing Weapon-Mounted Robotic System

There are a variety of weaponized robotic systems available to law enforcement and military personnel on the market today. The major problem with these systems is their excessive complexity for the required set of tasks that they are performing. Many of the systems are optimized for military applications and are overkill for most law enforcement applications. These systems often carry a price tag that reflects their over-engineered and over specified designs and overall, are not practical for widespread use in law-enforcement settings. QinetiQ North America makes a robotic system called the TALON which is a 135 lb, all terrain and all-weather robotic system. The TALON has the ability to carry a 100 lb payload and boasts a wide variety of cameras and sensors. The option to mount a shotgun to the system is available, and the photograph of the robot below shows an M4 Benelli Shotgun mounted to the robot as shown in figure (3.3).

3.6 Electrical Design for Robotics System

A prototype has been designed to simulate an electrical car movement. This prototype is divided electrically into five parts:

- Power Supply.
- Embedded System – Raspberry pi.
- Motors and Driver.
- Camera.
- Communication Part (Wi-Fi).

- Leaser.

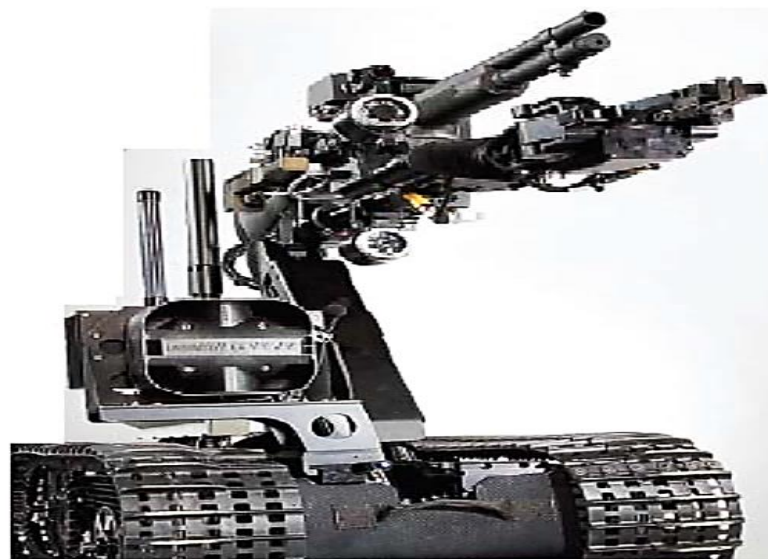


Figure (3.3): QinetiQ/Foster Miller Talon Robot with a Benelli M4 Moun

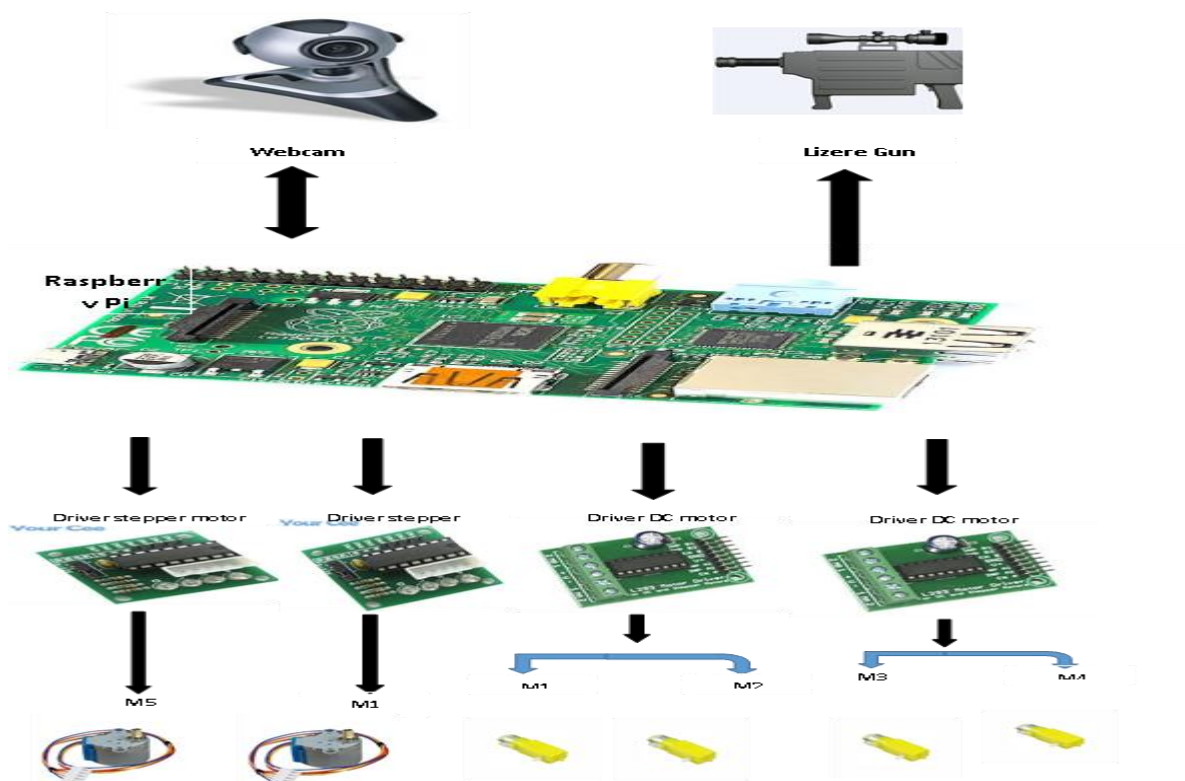


Figure (3.4): System Block Diagram

3.6.1 Power Supply

Power is the most important factor of the robot. Without power, the robot will not be able to detect objects, navigate around the field or fire the Nerf-blasters. The entire robot is planned to be powered by a four 3.7V battery. Therefore, the power must be able to distribute to all the different components of the robot. There are motors that will need direct power from the battery.

3.6.2 Embedded System

In our proposed system we used an raspberry pi which is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Raspberry pi can be used to develop interactive objects, taking inputs from a variety of switches, ethernet, touch screen, Wi-Fi, or sensors, and controlling a variety of lights, motors, and other physical outputs. raspberry pi projects can be standalone, or they can be able to communicate with software running on your computer. the open-source IDE can be downloaded for free. The raspberry pi programming language is an implementation of Wiring, a similar physical-computing platform, which is based on the Processing multimedia programming environment.

3.6.3 Raspberry Pi 3

Raspberry Pi is used for making robot wireless and web based.ge Raspberry Pi and then the videos are transmitted wirelessly from the robot to the user's monitor, from where the user can conveniently control the robotic vehicle's movement and also the robotic arm movement.

Raspberry pi is connected with the dongle which enables raspberry pi to transmit over the web network. Raspberry-Pi Module Raspberry Pi uses an SD card for booting and for memory as it doesn't have an inbuilt hard disk for storage.

Raspberry Pi requires 5 volt supply with minimum of 700- 1000 mA current and it is powered through micro USB cable. ARM11 only requires 3.3 volt of supply which it takes with the help of linear regulator. 5 volt is required for the USB ports. It operates at 700M Hz. We use python or embedded C to write code into the raspberry pi. It has a strong processing capability due to the ARM11 architecture and Linux-based system. In terms of interface and control, it has 1 SPI, 1 UART, 1 I2C and 8 GPIO, which basically meet the control requirement. There are easy to use open-source peripheral driver libraries.[37]. As shown in figure (3.5) Raspberry Pi 3, As shown in figure (3.6) Raspberry pi technical characteristics and as shown in figure (3.7) Raspberry Pi 3 GPIO pin Layout.

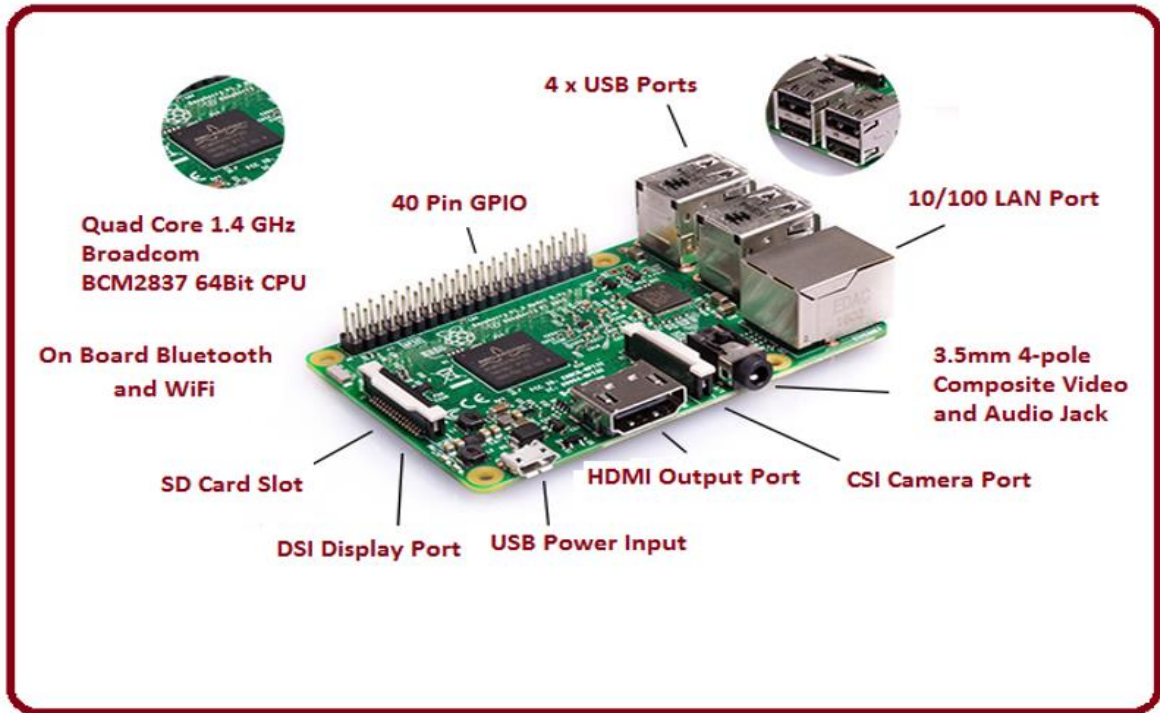


Figure (3.5): Raspberry Pi 3


	Raspberry Pi 3 Model B	Raspberry Pi Zero	Raspberry Pi 2 Model B	Raspberry Pi Model B+
Introduction Date	2/29/2016	11/25/2015	2/2/2015	7/14/2014
SoC	BCM2837	BCM2835	BCM2836	BCM2835
CPU	Quad Cortex A53 @ 1.2GHz	ARM11 @ 1GHz	Quad Cortex A7 @ 900MHz	ARM11 @ 700MHz
Instruction set	ARMv8-A	ARMv6	ARMv7-A	ARMv6
GPU	400MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV
RAM	1GB SDRAM	512 MB SDRAM	1GB SDRAM	512MB SDRAM
Storage	micro-SD	micro-SD	micro-SD	micro-SD
Ethernet	10/100	none	10/100	10/100
Wireless	802.11n / Bluetooth 4.0	none	none	none
Video Output	HDMI / Composite	HDMI / Composite	HDMI / Composite	HDMI / Composite
Audio Output	HDMI / Headphone	HDMI	HDMI / Headphone	HDMI / Headphone
GPIO	40	40	40	40
Price	\$35	\$5	\$35	\$35

Figure (3.6): Raspberry pi Technical Characteristics

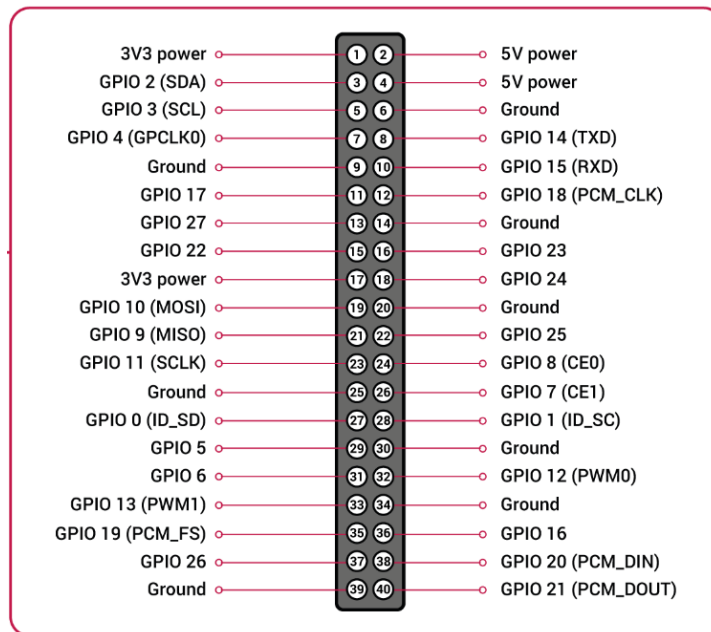


Figure (3.7): Raspberry Pi 3 GPIO pin Layout

3.6.4 Motor Driver IC L293D

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC. which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller. There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch. 500 RPM 12V DC Geared Motor is high-quality low-cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside. Although motor

gives 500 RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque. 500RPM 12V DC geared motors for robotics applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel as shown in figure (3.8) IC driver L293D.[35]

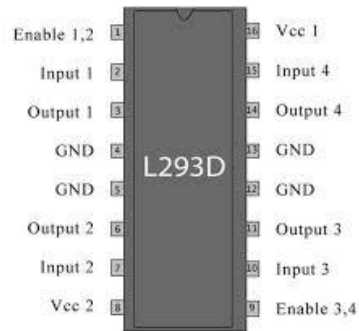


Figure (3.8): IC Driver L293

3.6.5 Dc Motor

500 RPM 12V DC Geared Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside. Although motor gives 500 RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque. 500RPM 12V DC geared motors for robotics applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel as shown in figure (3.9) motor DC.[35]



Figure (3.9): Motor DC

3.6.6 Stepper Motor

Stepper motors are DC motors that move in discrete steps. They have multiple coils that are organized in groups called "phases". By energizing each phase in sequence, the motor will rotate, one step at a time. With a computer controlled stepping you can achieve very precise positioning and/or speed control. For this reason, stepper motors are the motor of choice for

many precision motion control applications. Stepper motors come in many different sizes and styles and electrical characteristics. This guide details. We used unipolar coil and five wire, the number of steps per revolution ranges from 4 to 400. Commonly available step counts are 24, 48 and 200. Resolution is often expressed as degrees per step. A 1.8° motor is the same as a 200 step/revolution motor. The trade-off for high resolution is speed and torque. High step count motors top-out at lower RPMs than similar size. And the higher step-rates needed to turn these motors results in lower torque than a similar size low-step-count motor at similar speeds as shown in figure (3.10) stepper motor.[38]

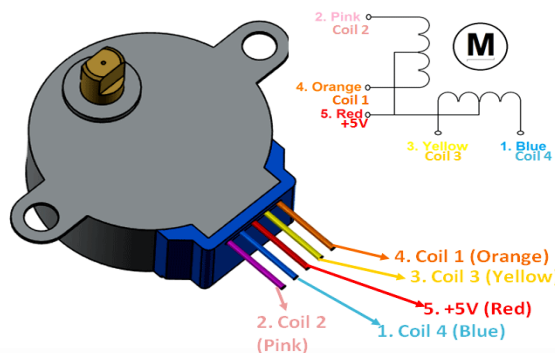


Figure (3.10): Stepper Motor

3.6.7 IC Driver - ULN2003

The ULN2003A is an array of seven NPN Darlington transistors capable of 500 mA, 50 V output. It features common-cathode flyback diodes for switching inductive loads. It can come in PDIP, SOIC, SOP or TSSOP packaging. In the same family are ULN2002A, ULN2004A, as well as ULQ2003A and ULQ2004A, designed for different logic input levels. It has 16 pins, 7 input pins (pin 1 to pin 7), 7 output pins (pin 10 to pin 16), and 2 pin for power supply figure (3.11) show IC driver ULN2003.[39]

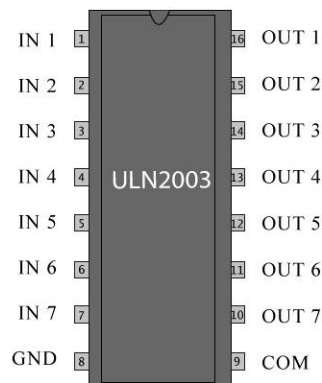


Figure (3.11): IC Driver ULN2003

3.6.8 Logitech HD Pro Webcam

The camera module will be mounted on the robot and will move turning turret of the turret and robot's turning directions. This is so that the camera can have sight of the targets at all times during the competition. The camera utilizes a USB cord which will be connected to the Raspberry Pi with pre-installed drivers to support it as shown in figure (3.11) webcam.[37]



Figure (3.11): Webcam

Chapter Four

Results and Discussion

Chapter Four

Results and Discussion

4.1 Overview

This chapter provides the stages and steps by which the proposed system can be implemented and turned into being a practical model.

The first part of this project is an electric robot, controller it by the computer, and it sending video living to network on IP address " 192.168.43.60" by any device in network.

The project contain main three device, first a computer is a device for controlling the robot and displaying the video, an electric robot, and cell phone is connect between electric robot and computer, The robot contains four DC motors, two stepper motors, web camera, and laser gun, a DC motors moves it to the four way (in front of, back, right and left), a mobile robot tower contains camera and laser gun, a stepper motors moves the mobile robot tower (up, down, right and left).

4.2 Configure Raspberry Pi (just first time)

4.2.1 Step 1: Downloading Required Soft Wares

(Raspberry pi imager, Win32diskImager and VNC viewer), as shown in figure (4.1) a download page for Raspberry Pi imager (OS).

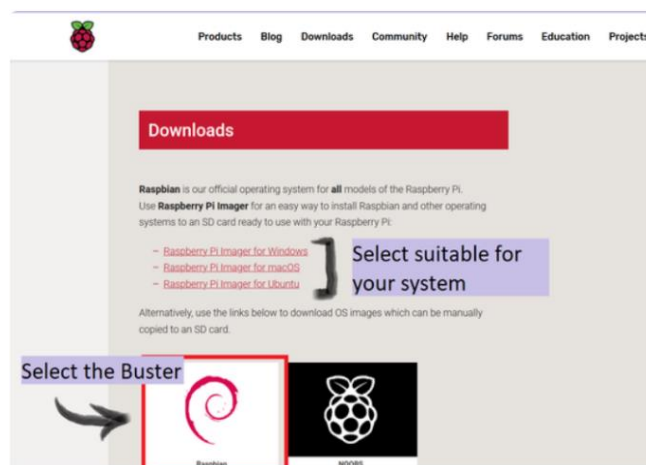


Figure (4.1): Download Page for Raspberry Pi Imager (OS).

Step 2: Write raspberry OS to SD card

First time we must format SD card Fat32 file system and write raspberry OS to SD card by win32diskImage. As shown in figure (4.2) the method of writing the program in the SD card.

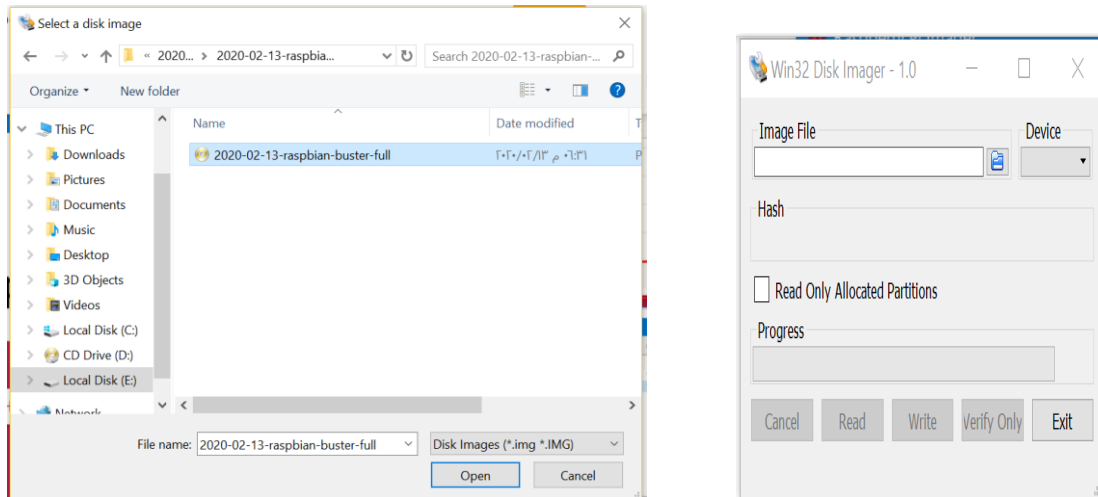


Figure (4.2): The Method of Writing the Program in the SD Card.

4.2.2 Step 3: Creating "SSH" File in SD Card

After done, open the boot folder, create a new document named "SSH" without any extensions, save and then unmount the drive. As shown in figure (4.3) how to create "SSH" file and peace it.

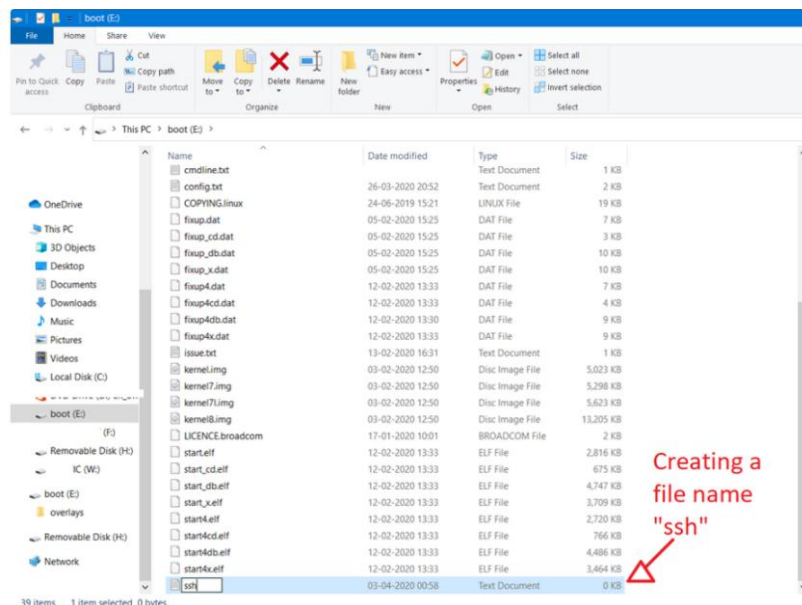


Figure (4.3): How to Create "SSH" File and Peace it.

4.2.3 Step 4: Power Up Pi

Now connect the SD card, Ethernet and power to raspberry, connect the Ethernet cable to your laptop. As shown in figure (4.4) how to insert the SD card, connect pc and plug in power supply.

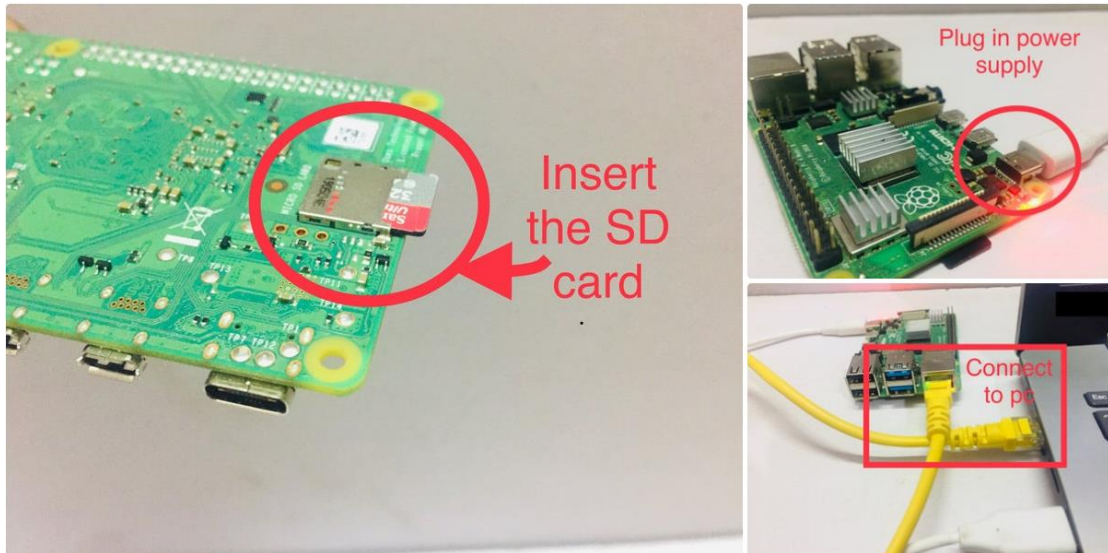


Figure (4.4): How to Insert the SD Card, Connect Pc and Plug in Power Supply

4.2.4 Step 5: Sharing Network

Go to Control Panel--> Network and Internet --> Network Connections, right-click on Wi-Fi select properties, go to sharing section and check on “Allow other network users to connect through this computer’s Internet connection”. Make sure that Home network connection is Ethernet. Save and close the window. As shown in figure (4.5) how to set network.

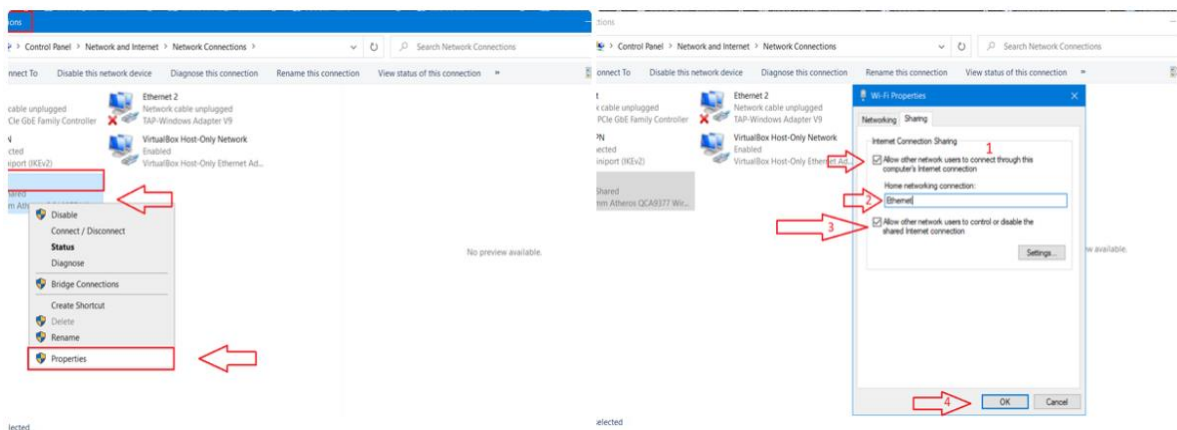


Figure (4.5): How to Set Network

4.2.5 Step 6: Entering Pi Terminal Through SSH

To access the terminal window of raspberry pi use PuTTY program, In order to do that open the Bitwise SSH Client, enter raspberrypi.local or the IP address (use Advanced IP scanner to get the IP address) as host and leave 22 as default port in the server section. As shown in figure (4.6) how to inter raspberry pi by PuTTY program.

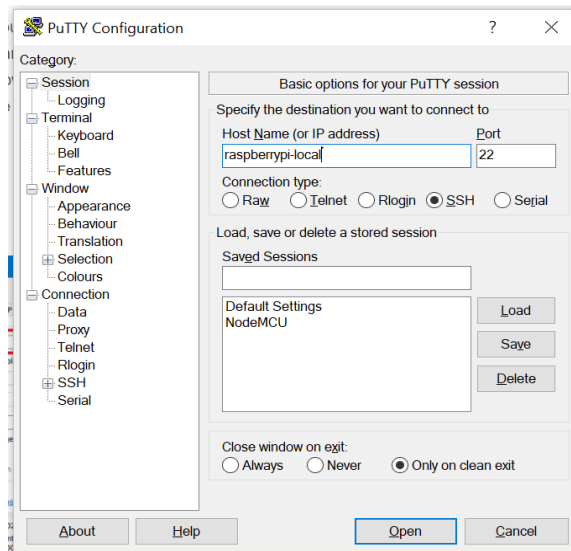


Figure (4.6): How to Inter Raspberry Pi By PuTTY Program.

4.2.6 Step 7: Raspberry pi Setting

A) Enable VNC viewer:

Enter to setting page for Raspberry pi by command "sudo raspi-config", and change enable interfaces 'VNC viewer'. As shown in figure (4.7) how enabled VNC server.

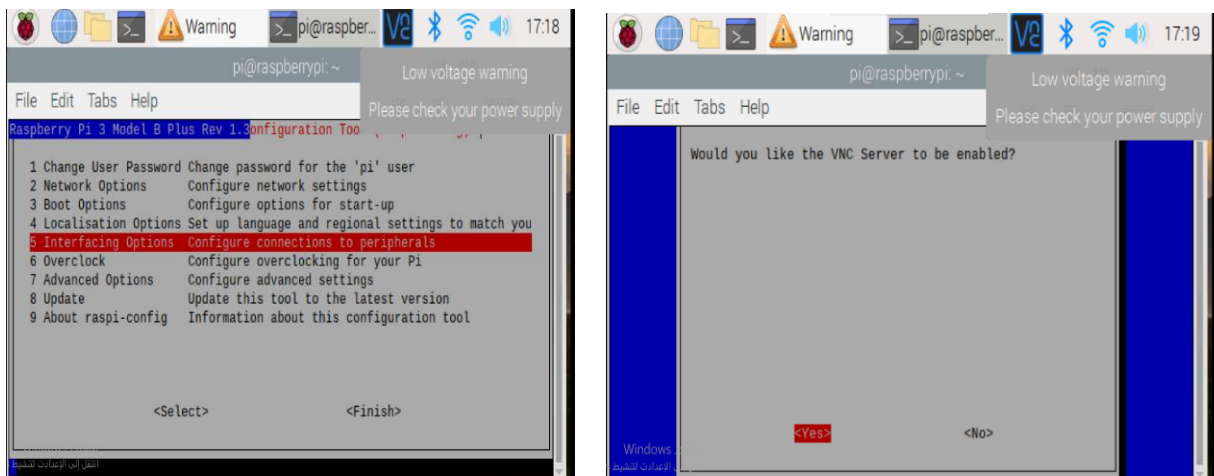


Figure (4.7): How Enabled VNC Server.

B) Connect Wi-Fi auto:

In command line write `"/etc/wpa_supplicant/wpa_supplicant.conf"` and edit program. As shown in figure (4.8) Automatic link program.

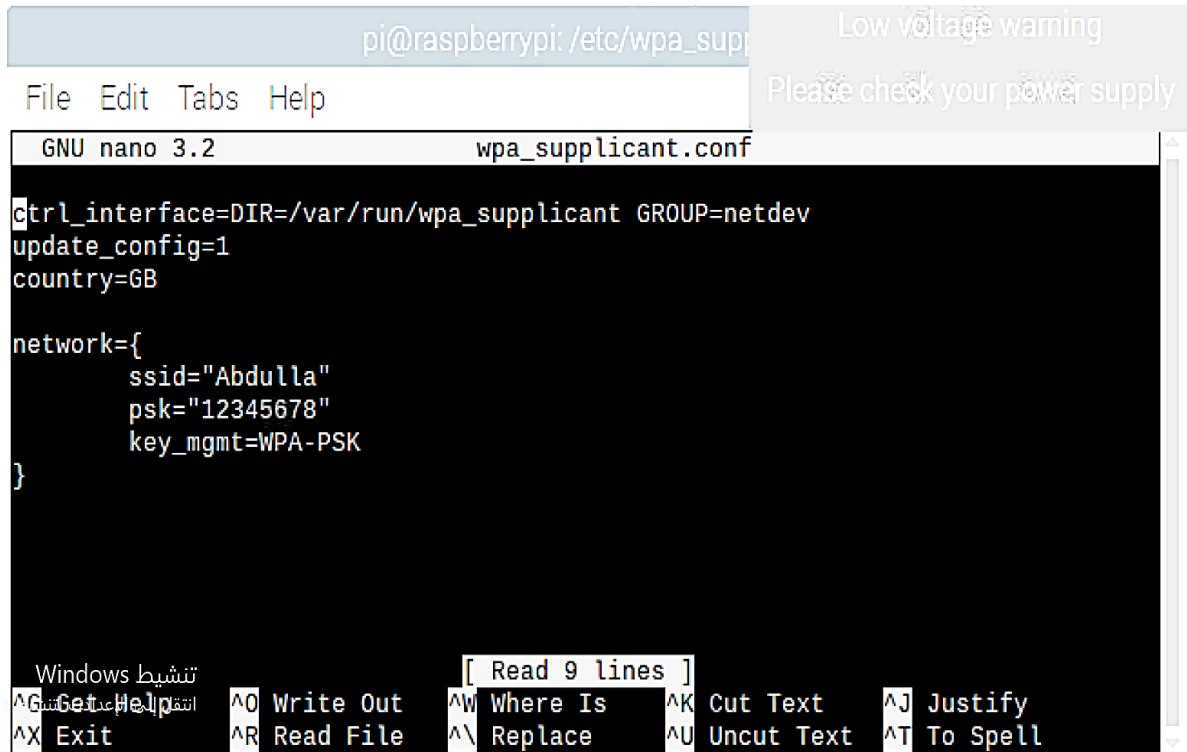


Figure (4.8): Automatic Link Program.

C) Update raspberry pi and install GPIO library

In command line write this `"sudo apt-get update"` to update raspberry pi library and write `"sudo apt-get install python-rpi.gpio python3-rpi.gpio"`. As shown in figure (4.9) how to install GPIO library.

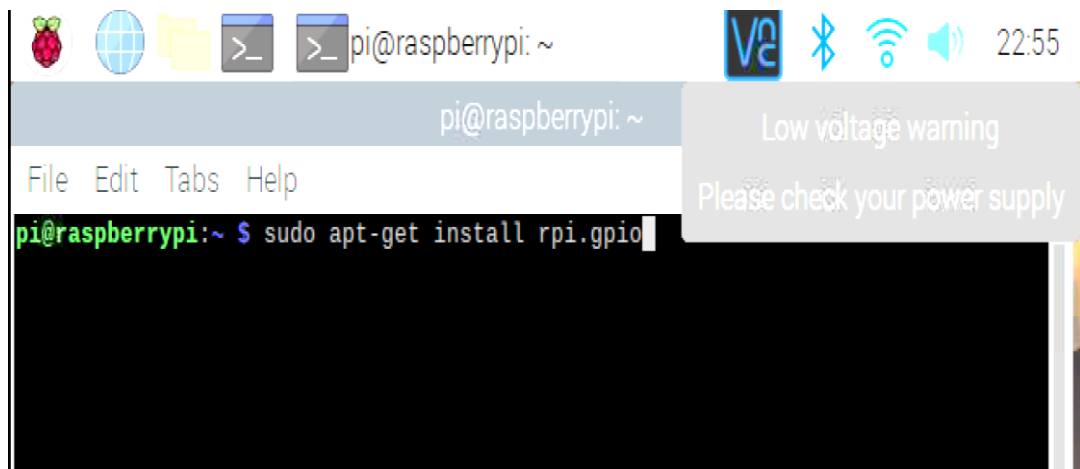


Figure (4.9): How to Install GPIO Library.

D) Installing and turn-on a raspberry pi server

In command line write "sudo apt-get install apache2 -y" to install server , To find ip address write "ifconfig" and write "sudo start server" to turn on server. As shown in figure (4.10) how start server and IP Address for it.

```
pi@raspberrypi:~$ ifconfig
eth0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether b8:27:eb:32:6a:2d txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 17 bytes 1004 (1004.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 17 bytes 1004 (1004.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.43.60 netmask 255.255.255.0 broadcast 192.168.43.255
    inet6 fe80::293c:7710:e28f:dcf0 prefixlen 64 scopeid 0x20<link>
    ether b8:27:eb:67:3f:78 txqueuelen 1000 (Ethernet)
    RX packets 3104 bytes 231225 (225.8 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 3397 bytes 1589412 (1.5 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

pi@raspberrypi:~$ sudo start server
```

Figure (4.10): How Start Server and IP Address for it.

E) Installing and configuration a motion:

In command line write "sudo apt-get install motion" and edit "sudo nano /etc/motion/ motion.conf" and look up this and change it

```
daemon on
stream_localhost off
output_pictures off
ffmpeg_output_movies off
stream_maxrate 100
framerate 100
width 640
height 480
```

4.2.7 Step 8: Design the Tkinter and Make the program (user interface program)

The tkinter package ("Tk interface") is the standard python interface to the Tk GUI toolkit. Both Tk and tkinter are available on most Unix platforms, as well as windows system. (Tk itself is not part of python; it is maintained), The user interface program is the place where the user could interact with the robot. It provides the user a graphic user interface to control the robot. The GUI is programmed using python language. The user could control the robot from the GUI by clicking the buttons and check the robot status through the consoles on the GUI. By using

g this GUI, the user could teleoperate to drive the robot and control the robot arm. On the console, the user could see the moving direction of the robot, angle of the robot arms. As shown in figure (4.11) control interface

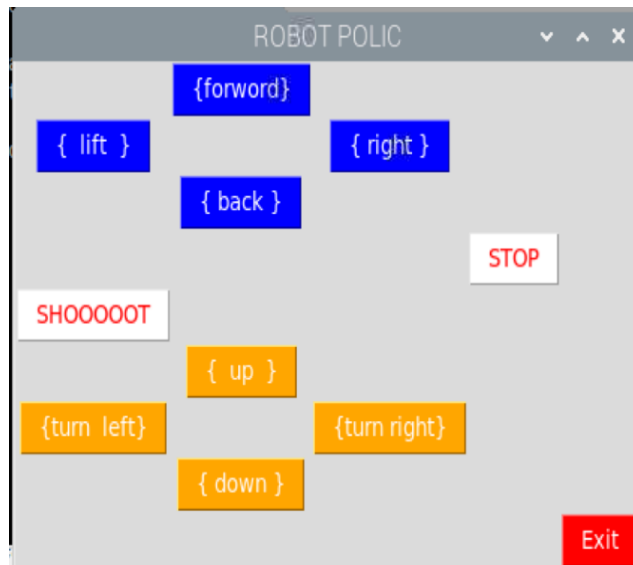
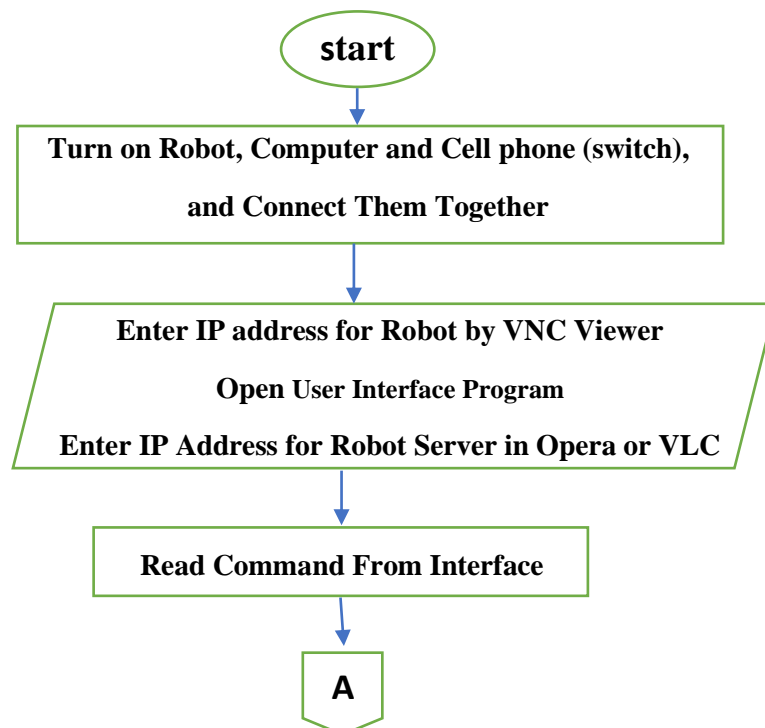


Figure (4.11): Control Interface

4.3 System Flow Char

At this stage, the project was modelled in a flowchart format to facilitate the idea of project work, as shown in the figure (4.12) to follow the method of operating the system, and we will discuss the detailed explanation in the following heading



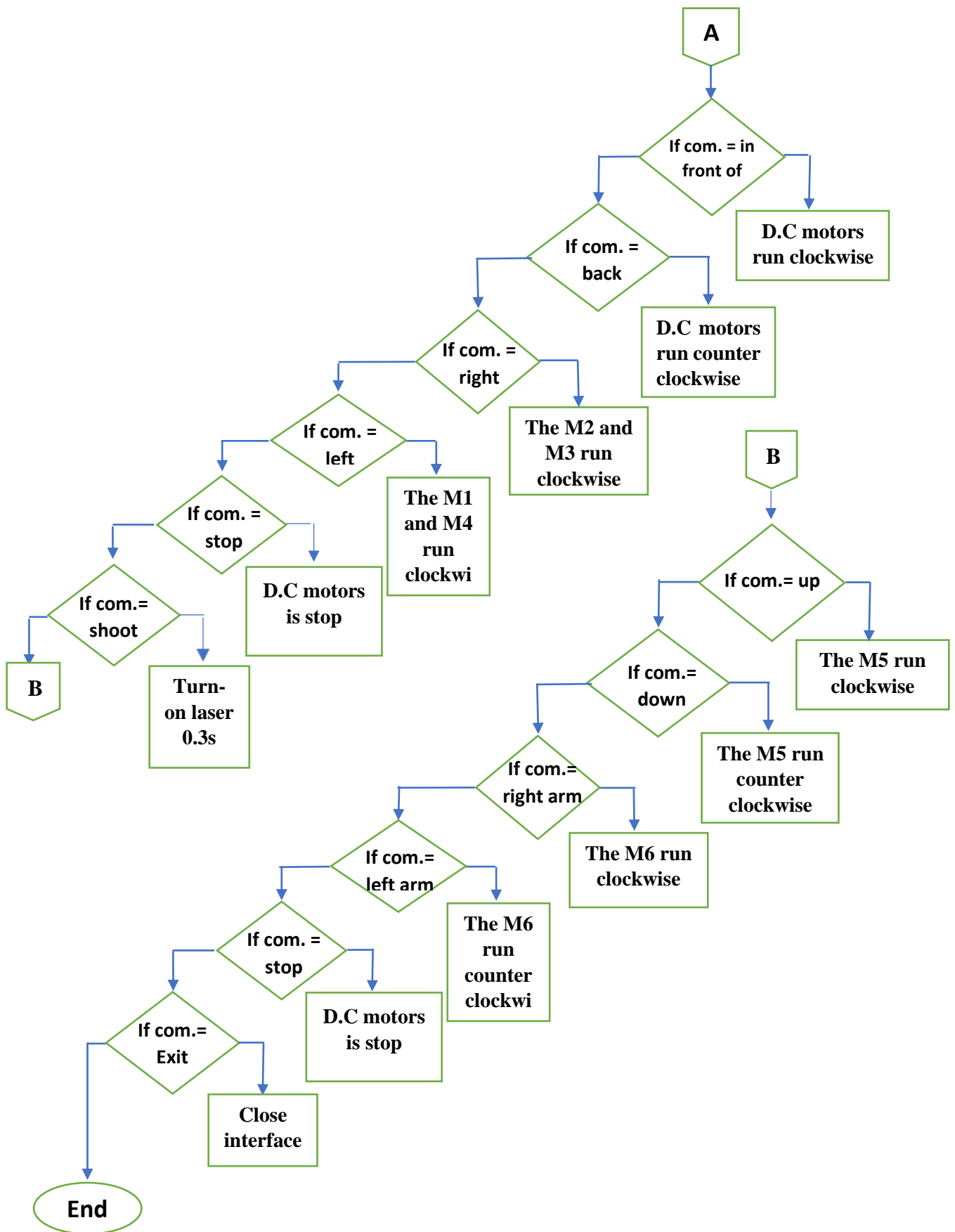


Figure (4.12): System Flow Char

4.4 System Operation

4.4.1 Step 1: Turn-on Devices and Connect Them Together

First time turn-on devices with Wi-Fi and create network from cell-phone with a name "Abdulla" and password "12345678". As shown in figure (4.13) setting up the network point.

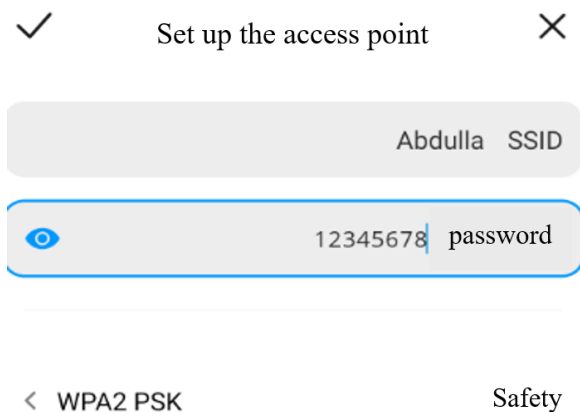


Figure (4.13): Setting Up The Network Point.

4.4.2 Step 2: Raspberry pi Viewer in Computer

In computer open the VNC viewer program and enter IP address for electric robot "192.168.43.60" to show the desktop for raspberry. As shown in figure (4.14) how to entering to raspberry pi by VNC viewer.

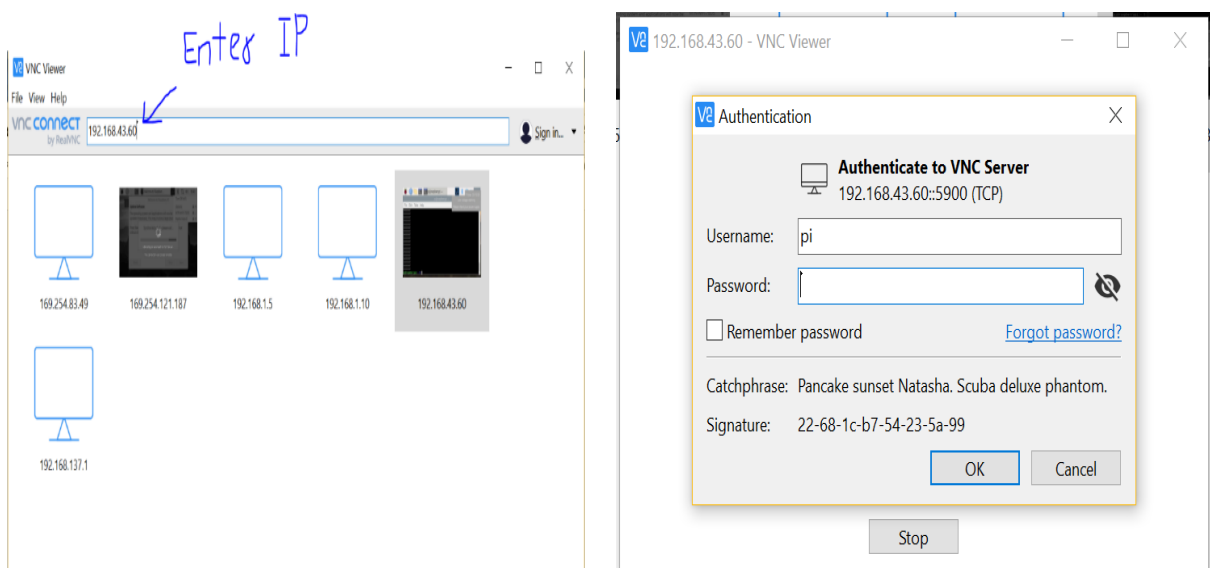


Figure (4.14): How to Entering to Raspberry Pi By VNC Viewer.

4.4.3 Step 3: Open User Interface Program

After enter to raspberry turn-on file "user interface". As shown in figure (4.15) how to open interface control and it.



Figure (4.15): How to Open Interface Control and it.

4.4.4 Step 4: Open Video Living:

Enter IP address for Robot server in opera or VLC player. As shown in figure (4.16) Live broadcast transmission in VLC player and as shown in figure (4.17) Live broadcast transmission in opera.

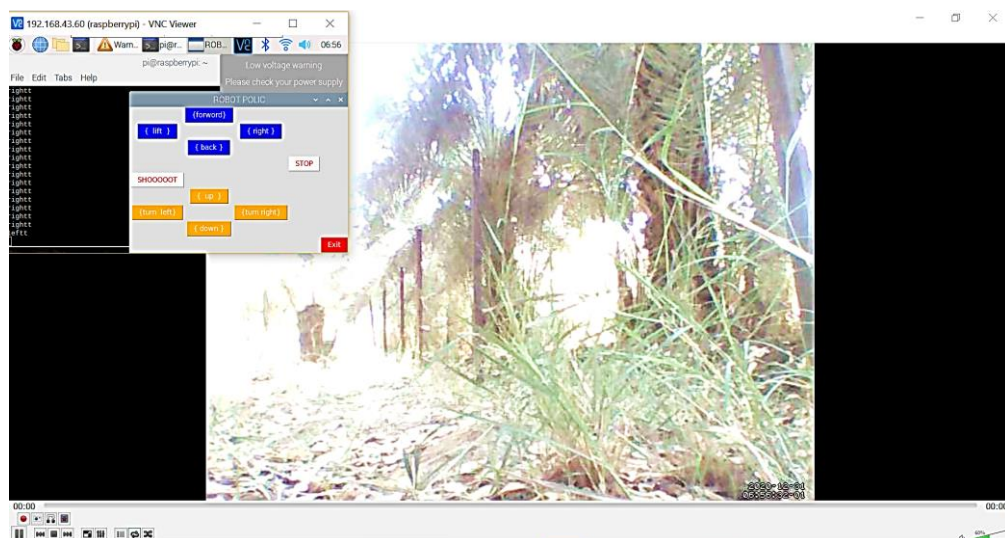


Figure (4.16): Live Broadcast Transmission in VLC Player.

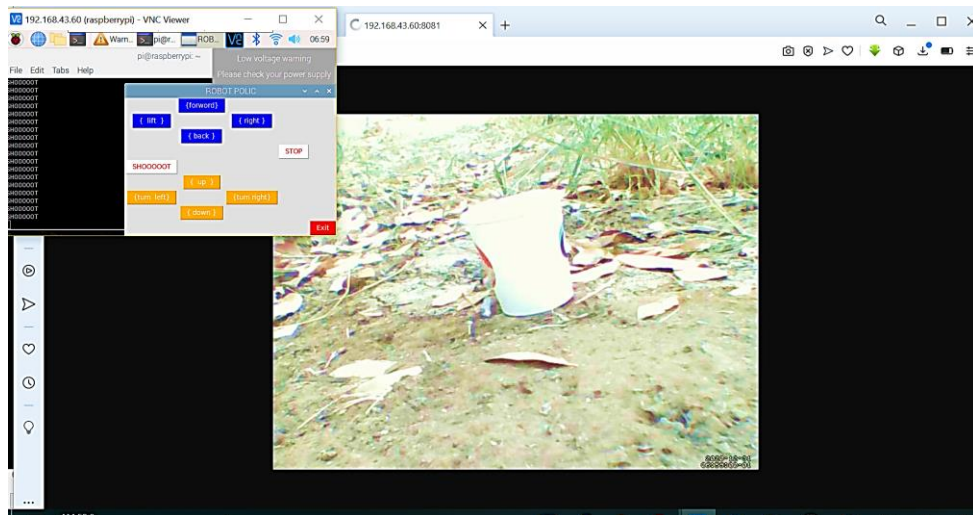


Figure (4.17): Live Broadcast Transmission in Opera.

4.4.5 Step 5: Read Command

When you press a button in the user interface, it send a command to GPIO-raspberry pi.

- a) "In front of" button send to (GPIO (18,16,24,22,26,32,38 and 40)) to start a D.C motors clockwise. It moves the electric robot forward.
- b) "Back" button send to (GPIO (18,16,24,22,26,32,38 and 40)) to start a D.C motors counter clockwise, it moves electric robot back.
- c) "Right" button send to (GPIO (18,16,24,22,26,32,38 and 40)) to operate the two DC motors m1 and m4, and stop M2 and M3. It turns to the right.
- d) "Lift" button send to (GPIO (18,16,24,22,26,32,38 and 40))to operate the two DC motors m2 and m3, and stop M1 and M4. It turns to the left.
- e) "Stop1" button send to (GPIO (18,16,24,22,26,32,38 and 40))to stop M1,M2,M3 and M4, it stop electric robot.
- f) "Up" button send to (GPIO (3,5,7 and 11)) to start a 4-step stepper motor (M5), it moves the robot arm up by one degree.
- g) "Down" button send to (GPIO (3,5,7 and 11)) to start a 4-step stepper motor (M5), it moves the robot arm down by one degree.
- h) "Turn right" button send to (GPIO (15,19,21 and 23)) to start a 4-step stepper motor (M6), it moves the robot arm right by one degree.
- i) "Turn lift" button send to (GPIO (15,19,21 and 23)) to start a 4-step stepper motor (M6), it moves the robot arm lift by one degree.
- j) "Shoooot" button send to (GPIO 29) to shoot by laser.

k) "Exit" button close the control window.

As table (4.1) show relation between a command and state electric robot:

table (4.1): relation between a command and state electric robot

Nu.	Button	Action
1	In front of	An electric robot forward
2	Back	An electric robot go back
3	Right	An electric robot turns-right
4	Lift	An electric robot turns-lift
5	Stop	An electric robot stop
6	Up	An arm robot moves up
7	Down	An arm robot moves down
8	Turn right	An arm robot turns right
9	Turn lift	An arm robot turns left
10	Exit	Close the control window (Tkinter)

4.5 Result

4.5.1 Robot Movement

The robot can move strong in all four directions without any bump. When moving forward the DC motors are turn-on clockwise, and when moving backward, the DC motors are turn-on counterclockwise. When moving turn-right the DC motors (1 and 2) are turn-on clockwise and the DC motors (3 and 4) are turn-off, When moving turn-lift the DC motors (3 and 4) are turn-on clockwise and the DC motors (1 and 2) are turn-off, as shown in figure (4.18)



Figure (4.18): Robot Movement.

4.5.2 Robot Arm Movement

The robot arm can move up and down by 0.9 degrees for each step, and the arm can move in the vertical direction at an angle of (270) degrees. The robot arm can move left and right by 0.9 degrees for each step, and the arm can move in the horizontal direction at an angle of (360) degrees, as shown in figure (4.19)



Figure (4.19): Robot Arm Movement.

4.5.3 The Scope of Work of the Robot

The robot works within the range of the wireless network, and the robot works on automatic communication with the network that has a point in the name of "Abdulla" and a password "12345678". As show in figure (4.20).



Figure (4.20): The Scope of Work of the Robot

4.5.4 Live Broadcast Transmission

The robot works on imaging and live broadcasting under the heading "192.168.43.60:8081" within the network, but the imaging quality is small due to the poor resolution of the camera, the transmission speed is very slow due to the speed of the image processor in the Raspberry. As show in figure (4.21)

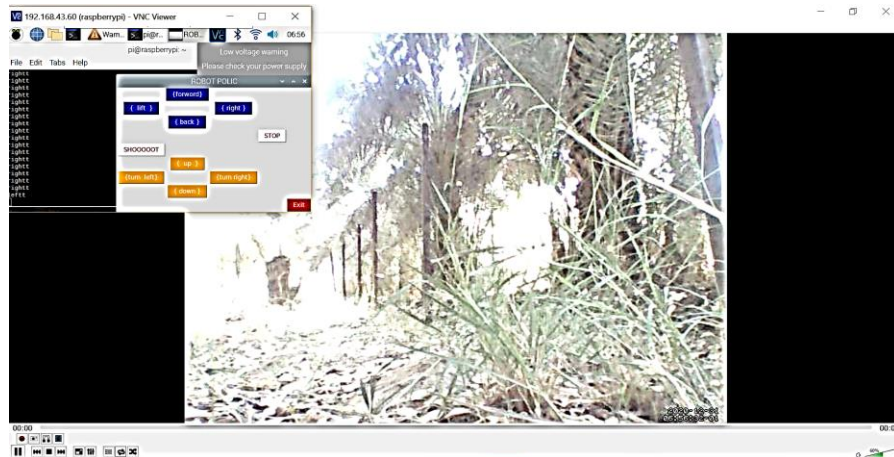


Figure (4.21): Live Broadcast Transmission

4.5.5 Site to Shoot

The laser can be directed in the middle of the display screen if the target is at a distance of (1.5) meters from the robot, and the laser launch position changes slightly while moving the target away from or near the robot. This is because the camera and the laser are installed in the same tower and are controlled together. As show in figure (4.22).



Figure (4.22): Site to Shoot

4.5.6 Control Interface

A control interface for the robot was designed in the Python language and contains (11) keys to control the movement of the entire robot, the keys (forward, backward, right, left and stop), control the movement of the robot model on the ground, the keys (up, down, turn-right and turn-left) control the movement of the robot tower, the key (shoot) control firing the laser beam and the key Exit to close the control window. As show in figure (4.23).

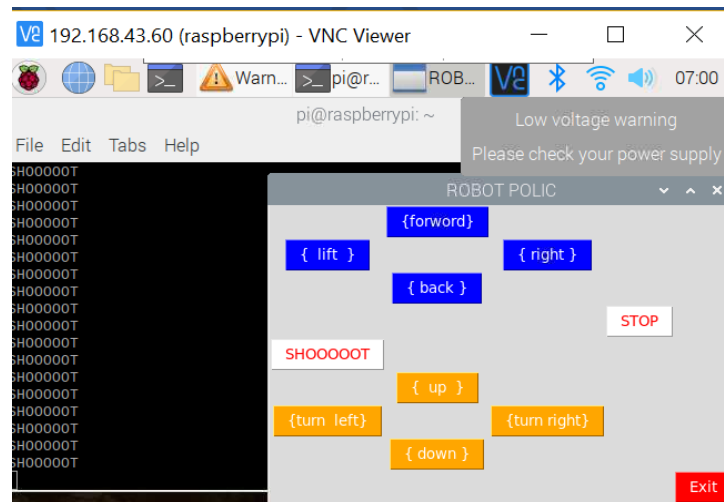


Figure (4.23): Control Interface

4.5.7 Design the Robot

The robot model was designed with pressed wood, the component slices were computer drawn and the wood was laser cut. Figure No. (099) shows the final shape of the robot. As shown in figure (4.24).



Figure (4.24): Design the Robot

4.5.8 The Link for The Recorder Video

<https://youtu.be/NfWB9LW0q38.com>. As shown in figure (4.25).

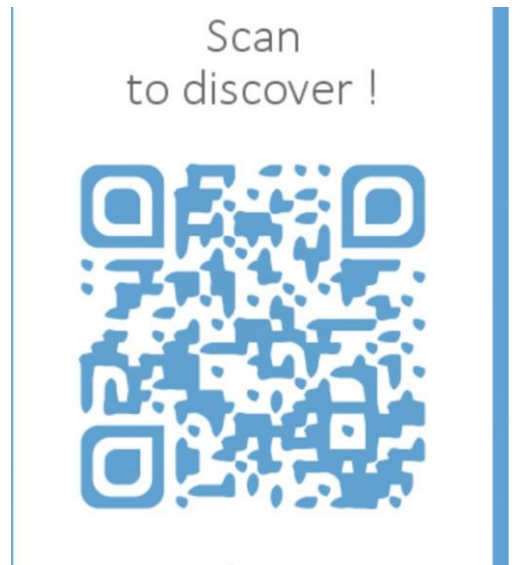


Figure (4.25): QR for Link The Recorder Video

4.5.9 The Success Rate of the Robot

Table No. (4.2) shows the Success Rate of the Robot

Table (4.2)

No.	Activity	Success rate
1	Robot movement	100%
2	Robot arm movement	90%
3	The scope of work of the robot	75%
4	Live broadcast transmission	65%
5	Site to shoot	75%
6	Control interface	88%
7	Design the robot	88%
Project success rate		94%

Chapter Five
Conclusion and
Recommendations

Chapter Five

Conclusion and Recommendations

5.1 Conclusion

Our idea is mainly for army use. The army is doing researches on this type of ideas and doing their lab works to build a capable working robot. It will replace the humans and will save many lives in critical situations, In this project we used raspberry pi working on Raspbian OS. As the communication is done with the help of internet so limitation of range of operation does not arise and thus, we can monitor any remote areas. One can easily monitor as well as control the activity of the robotic unit. We are very hopeful with our idea that it will bring a significant change in our technical field and our minds.

5.2 Recommendations

In order to get a better performance for the robot, the following recommendations should be taken Provide the robot with

1. Add a raster image processor, Interface design for the inclusion of wanted photos and design an Android application for control the robot.

REFERENCES

REFERENCES

- [1] R.Hema, M.Sundararajan, S.Balaji, International Journal of Innovative Technology and Exploring Engineering (IJITEE), "Smartphone Control Robot with Automatic Firing Gun, July 2019.
- [2] Husnain Ahmad, Syed Mohsin Ali, Usman Ayub Sheikh, Zain Murtaza, Muhammad Rizwan, "Design and Manufacturing of a Low-Cost 2-DOF Autonomous Sentry Gun" (IEEE Conference, pp.196-201, 2016).
- [3] Pieter Simoens , Mauro Dragone ,and Alessandro Saffiotti;"The Internet of Robotic Things"; A review of concept, added value and applications; International Journal of Advanced Robotic Systems; January-February 2018.
- [4] Siddharth Mandgi, Shubham Ghatge, Mangesh Khairnar, Kunal, Siddharth Mandgi nt; Journal of Engineering Research and Application; "Object Detection And Tracking Using Image Processing"; February 2018.
- [5] Li, C. R., Lin, Y. C., Hung, M. W., Yang, C. C., Tsai, H. Y., Chang, Y. J., ... & Hsiao, W. T. Integrating temperature, humidity, and optical aerosol sensors for a wireless module for three-dimensional space monitoring. In Sensors Applications Symposium (SAS), 2018 IEEE (pp. 1-4). IEEE.
- [6] Bae, S. D., Kim, G. S., Chu, S. J., & Mok, Y. K. U.S. Patent No. 9,868,591. Washington, DC: U.S. Patent and Trademark Office. (2018).
- [7] Pinter, M., Wright, T. C., Reynolds, H. N., Lai, F., & Wang, Y. U.S. Patent No. 9,974,612. Washington, DC: U.S. Patent and Trademark Office. (2018).
- [8] Ankush Sharma¹, Aakanksha; International Journal of Science and Research (IJSR); Introduction to HTML (Hyper Text Markup Language) (2017).
- [9] FHA. Shibly; "Android Operating System: Architecture, Security Challenges and Solutions";2016.
- [10] Tianci Zhao (RBE) Peng Ren (CS), Intelligent Vision-Driven Robot For Sample Detection And Return
- [11] 1G. Anandravisekar, 2A. Anto Clinton, 3T. Mukesh Raj, 4L. Naveen, 1,2,3,4 UG Students,, International Journal of Engineering Research & Technology (IJERT), "IOT Based Surveillance Robot" March- 2018,
- [12] Mr.T.Saravanakumar¹, D.Keerthana², D.Santhiya³, J.Sneka⁴, D.Sowmiya⁵ ¹Dept of ECE, Assistant professor, Pollachi Institute of Engineering and Technology, International Journal of Electronics, Electrical and Computational System IJEECS, "Surveillance Robot Using Raspberry Pi-IoT" March 2018,

- [13] Muhammad Kashif¹, Muhammad Arslan², Rocky Chakma³, Farhad Banoori⁴, Abdullah Al Mamun⁵, Ganantu Lal Chakma "Design and Implementation of Image Capture Sentry Gun Robot" 2018,
- [14] Prof. I. Y. Sheikh¹, Ms. Jaya S. Vyawahare², Ms. Sampada B. Mahajan³, Ms. Prachi R. Bal⁴, Ms. Seema U. Sakhare⁵ ¹Assistant Professor, E&TC Department, Pankaj Laddhad Institute of Technology and Management Studies, Buldana "CONVERGENCE 2016" International Journal of Research in Advent Technology (IJRAT) National Conference, "Review Paper on Wi-Fi Surveillance Robot using Raspberry pi"; 06th-07th April 2016
- [15] ¹Prof.S.G.Galande, ² Pawar Yogesh, ³Korade Amit, ⁴Chavan Jalindar. IJEDR International Journal of Engineering Development and Research (www.ijedr.org) "War field spying robot with wireless camera and firing system"
- [16] Prof. Pokharkar Sagar B., Ashutosh V. Deoghare, Bhushan V. Khurge. International Journal of Engineering and Technical Research (IJETR), "Automatic robot gun" March 2015.
- [17] Prof. S. A Joshi, Aparna Tondarkar, Krishna Solanke, Rohit Jagtap Marathwada Mitra Mandal's International Journal Of Engineering And Computer "Surveillance Robot for Military Application" May 2018,
- [18] Peng Jian-sheng, ¹National Key Laboratory of Communication, UEST of China Chengdu 610054, China ²Department of Physics and Mechanical & Electronic Engineering, Hechi University, Yizhou 546300, China The Open Electrical & Electronic Engineering Journal, "An Intelligent Robot System for Spraying Pesticides" 2014.
- [19] Hazarika, S. M., & Dixit, U. S. (2018). Robotics: History, Trends, and Future Directions. *Introduction to Mechanical Engineering*, 213-239.
- [20] Wronka, C. M., & Dunnigan, M. W. Internet remote control interface for a multipurpose robotic arm". *International Journal of Advanced Robotic Systems*, (2006).
- [21] Minamide, A., Takemata, K., Naoe, N., Yamada, H., & Hoon, P. S. Fifth IEEE International Conference on (pp. 179-181), "Development of a long-distance-controlled robot system for engineering education. In *Wireless, Mobile, and Ubiquitous Technology in Education*". IEEE. (2008, March).
- [22] Pacchierotti, C., Meli, L., Chinello, F., Malvezzi, M., & Prattichizzo, The International Journal of Robotics Research, "D. Cutaneous haptic feedback to ensure the stability of robotic teleoperation systems". (2015).

- [23] Fang, B., Guo, D., Sun, F., Liu, H., & Wu, Y. A In Robotics and Biomimetics (ROBIO), IEEE International Conference "robotic hand-arm teleoperation system using human arm/hand with a novel data glove". (2015, December).
- [24] Chatel, S., & Pradalier, C. Mesh (Doctoral dissertation, UMI 2958 GeorgiaTech-CNRS). Networks for robotic teleoperation-State of the Art and Implementation for Robotics (2016).
- [25] Hiyama, A., Kosugi, A., Fukuda, K., Kobayashi, M., & Hirose, M. In International Conference on Human Aspects of IT for the Aged Population Facilitating Remote Communication between Senior Communities with Telepresence Robots. (2017, July).
- [26] Williams, L. J. U.S. Patent No. 9,722,640. Washington, DC: U.S. Patent and Trademark Office .(2017).
- [27] Javed, O., Rasheed, Z., Alatas, O., & Shah, M. KNIGHT/spl trade. ". In Multimedia and Expo, 2003. ICME'03. Proceedings. 2003 International Conference on (Vol.1, pp. I-649). "a real time surveillance system for multiple and non-overlapping camerasIEEE. (2003, July).
- [28] Javed, O., & Shah, M. algorithms and practice (Vol. 10). Springer Science & Business Media. "Automated multi-camera surveillance" (2008).
- [29] Altahir, A. A., Asirvadam, V. S., Hamid, N. H. B., Sebastian, P., Saad, N. B., Ibrahim, R. B., & Dass, S. C. IEEE Sensors Journal. "Surveillance Systems". (2018).
- [30] Verma, G., Gautam, S., Agarwal, R., Saxena, S., & Verma, D. "Implementation of Smart Video Surveillance System Using Motion Detection Technique". In Sensors and Image Processing (pp. 65-72). Springer, Singapore. (2018).
- [31] International federation of robotics (IFR), "World Robotics", Switzerland: United Nation, 2005.
- [32] H. Durrant-Whyte and T. Bailey, "Simultaneous Localization and Mapping". IEEE Robot. Automat. Mag. Jun. 2006.
- [33] F. Chaumette and S. Hutchinson, IEEE Robot. Automat." Visual Servo Control Part 1: Basic Approaches," Dec. 2006.
- [34] Dr M Senthamil Selvi, M.Faesa Fathima, S.Dhivyuaa, S.Mouriya. Sri Ramakrishna Engineering College. "SURVEILLANCE ROBOT USING RASPBERRY PI FOR DEFENSE" (2019)
- [35] Mayank Dharaskar, Vatan Gupta, Priyanka Kale, Reeta Chopade, Aayush Jaiswal, Prof. Sharadkumar Ghadale, International Research Journal of Engineering and Technology (IRJET), " IOT Based Surveillance Robotic Car Using Raspberry PI", Mar-2018

- [36] Aaron Hoyt, Daniel Agudelo, Rafael Ramirez, Rachel Gremillion, Nerf-Enabled Battlebot with Automated Target Detection using Multiple Sensing, Department of Electrical Engineering and Computer Science University of Central [Florida](#), [Fall](#) 2016.
- [37] <https://cdn-learn.adafruit.com/downloads/pdf/all-about-stepper-motors.pdf?timestamp=1586708830>
- [38] <https://www.theengineeringprojects.com/2017/06/introduction-to-uln2003.html>
- [39] Germany's Federal Ministry of Education and Research. (2003, Nov. 11). MORPHA, [Online]. Available: http://www.morpha.de/php_e/morpha_projekt.php.3.
- [40] Video link for the final result <https://youtu.be/NfWB9LW0q38.com>.

Program Tkinter

Program Tkinter

```
from Tkinter import *
import time
import RPi.GPIO as GPIO
GPIO.setmode(GPIO.BOARD)
GPIO.setup(3,GPIO.OUT)
GPIO.setup(5,GPIO.OUT)
GPIO.setup(7,GPIO.OUT)
GPIO.setup(11,GPIO.OUT)
GPIO.setup(15,GPIO.OUT)
GPIO.setup(19,GPIO.OUT)
GPIO.setup(21,GPIO.OUT)
GPIO.setup(23,GPIO.OUT)
GPIO.setup(29,GPIO.OUT)
GPIO.setup(16,GPIO.OUT)
GPIO.setup(18,GPIO.OUT)
GPIO.setup(20,GPIO.OUT)
GPIO.setup(22,GPIO.OUT)
GPIO.setup(38,GPIO.OUT)
GPIO.setup(40,GPIO.OUT)
GPIO.setup(26,GPIO.OUT)
GPIO.setup(32,GPIO.OUT)
root = Tk()
root.title("ROBOT POLIC")
selected = IntVar()
def forward(): #defining function led1ON
    print("forward") #to be printed on terminal
    GPIO.output(18,1)
    GPIO.output(16,0)
    #GPIO.output(20,1)
    GPIO.output(22,0)
    GPIO.output(26,1)
    GPIO.output(32,0)
```

```
GPIO.output(38,1)
GPIO.output(40,0)
def lift(): #defining function led1ON
    print("lift") #to be printed on terminal
    GPIO.output(18,1)
    GPIO.output(16,0)
    GPIO.output(20,1)
    GPIO.output(22,0)
    GPIO.output(26,0)
    GPIO.output(32,0)
    GPIO.output(38,0)
    GPIO.output(40,0)
def right(): #defining function led1ON
    print("right") #to be printed on terminal
    GPIO.output(18,0)
    GPIO.output(16,0)
    GPIO.output(20,0)
    GPIO.output(22,0)
    GPIO.output(26,1)
    GPIO.output(32,0)
    GPIO.output(38,1)
    GPIO.output(40,0)
def down(): #defining function led1ON
    print("back") #to be printed on terminal
    GPIO.output(18,0)
    GPIO.output(16,1)
    GPIO.output(20,0)
    GPIO.output(22,1)
    GPIO.output(26,0)
    GPIO.output(32,1)
    GPIO.output(38,0)
    GPIO.output(40,1)
def STOP1(): #defining function led1ON
    print("STOP1") #to be printed on terminal
```

```

def SHOOOOOT(): #defining function led1ON
    print("SHOOOOOT") #to be printed on terminal
def up(): #defining function led1ON
    print("up") #to be printed on terminal
def leftt(): #defining function led1ON
    print("leftt") #to be printed on terminal
def rightt(): #defining function led1ON
    print("rightt") #to be printed on terminal
def down(): #defining function led1ON
    print("down") #to be printed on terminal
def STOP2(): #defining function led1ON
    print("STOP2") #to be printed on terminal
def btnExit():
    root.destroy()
btu1Button = Button(root, text="{ forword }", bg="blue", fg="white", command = forword)#,
value=10,
btu2Button = Button(root, text="{ lift }", bg="blue", fg="white", command = lift)#, value=10,
btu3Button = Button(root, text="{ right }", bg="blue", fg="white", command = right)#,
value=10,
btu4Button = Button(root, text="{ back }", bg="blue", fg="white", command = back)#,
value=10,
btu11Button = Button(root, text="STOP", bg="white", fg="red", command = STOP1)#,
value=10,
btu10Button = Button(root, text="SHOOOOOT", bg="white", fg="red", command =
SHOOOOOT)#, value=10,
btu5Button = Button(root, text="{ up }", bg="orange", fg="white", command = up)#,
value=10,
btu6Button = Button(root, text="{turn left}", bg="orange", fg="white", command = leftt)#,
value=10,
btu7Button = Button(root, text="{turn right}", bg="orange", fg="white", command = rightt)#,
value=10,
btu8Button = Button(root, text="{ down }", bg="orange", fg="white", command = down)#,
value=10,

```

```
btu12Button = Button(root, text="STOP", bg="white", fg="red", command = STOP2)#,
value=10,
btu9Button = Button(root, text="Exit", bg="red", fg="white", command = btnExit)#, value=10,
btu1Button.grid(column=1, row=0)
btu2Button.grid(column=0, row=1)
btu3Button.grid(column=2, row=1)
btu4Button.grid(column=1, row=2)
btu11Button.grid(column=3, row=4)
btu10Button.grid(column=0, row=5)
btu5Button.grid(column=1, row=6)
btu6Button.grid(column=0, row=7)
btu7Button.grid(column=2, row=7)
btu8Button.grid(column=1, row=8)
btu12Button.grid(column=3, row=9)
btu9Button.grid(column=5, row=10)
root.mainloop()
```