

WIRELESS NETWORK BASED GESTURE CONTROLLED ROBOT

Submitted in partial fulfillment of the requirements for
the award of
Bachelor of Engineering Degree in Computer Science and Engineering

by

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SCHOOL OF COMPUTING**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

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CHENNAI – 600119.**

APRIL 2020



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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **Shubham Gupta (38110529)** who carried out the project entitled “**Wireless Network based gesture controlled robot**” under our supervision from Nov 2020 to April 2021.

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DECLARATION

I, of **Shubham Gupta (38110529)** hereby declare that the Project Report entitled "**WIRELESS NETWORK BASED GESTURE CONTROLLED ROBOT**" done by me under the guidance of **Dr.MATHIVANNAN M.E., Ph.D.**, is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

DATE: APRIL 2020

PLACE:

SIGNATURE OF THE CANDIDATE

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ABSTRACT

Much after more than many years of information gadgets advancement, numerous individuals despite everything discover the association with the PCs and robots an awkward encounter. Endeavors ought to be made to adjust PCs and robots to our regular methods for correspondence: discourse and non- verbal communication. The point of this work is to actualize an ongoing order framework through hand movement affirmation, using all around helpful gear and low costing sensor like a direct raspberry-pie and a USB webcam, so any customer can use it in organizations or at home. The reason of our philosophy is a fast division method to procure the hand movement from the whole picture which can oversee immense number of hand shapes against different establishments and lightning conditions, and an affirmation method that recognizes the hand pose for various control application. Administration robots legitimately associate with individuals, so finding an increasingly common and simple UI is of crucial significance. While prior works have concentrated principally on issues, for example, control and route in the earth, scarcely any automated frameworks are utilized with straightforward interfaces that can control the robot by trademark techniques. This energize response need. In this method, customer will handle the robot by using movements with palm. Here request indications were delivered for the movements using picture getting ready, where gaussian blur algorithm is used to reduce noise in the image, Cannyedge algorithm is used to detect fire outlayers and masking algorithm is used for Ro extraction .

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Machine Learning is the field of study that gives computers the capability to learn without being explicitly programmed. ML is one of the most exciting technologies that one would have ever come across. As it is evident from the name, it gives the computer that makes it more similar to humans: The ability to learn. Machine learning is actively being used today, perhaps in many more places than one would expect.

Machine learning, as a powerful approach to achieve Artificial Intelligence, has been widely used in pattern recognition, a very basic skill for humans but a challenge for machines. Nowadays, with the development of computer technology, pattern recognition has become an essential and important technique in the field of Artificial Intelligence. The pattern recognition can identify letters, images, voice or other objects and also can identify status, extent or other abstractions.

Since the computer was invented, it has begun to affect our daily life. It improves the quality of our lives; it makes our life more convenient and more efficient. A fascinating idea is to let a computer think and learn as a human. Basically, machine learning is to let a computer develop learning skills by itself with given knowledge. Pattern recognition can be treated like computer being able to recognize different species of objects. Therefore, machine learning has close connection with pattern recognition.

Machine Learning is a scientific research field at the intersection of machine learning and robotics. It studies techniques allowing a robot to acquire novel skills or adapt to its environment through learning algorithms. The embodiment of the robot, situated in a physical embedding, provides at the same time specific difficulties. While machine learning is frequently used by computer vision algorithms employed in the context of robotics, these applications are usually not referred to as “robot learning”.

1.2 PURPOSE OF THE MACHINE LEARNING

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves.

Nowadays, with the development of computer technology, pattern recognition has become an essential and important technique in the field of Artificial Intelligence. The pattern recognition can identify letters, images, voice or other objects and also can identify status, extent or other abstractions.

The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly.

1.3 PROBLEM STATEMENT

The traditional wired buttons controlled robot becomes very bulgy and it also limits the distance the robot goes. The wired based hand gesture robot have allot its space to a limited distance where long run of robot cannot possible and the complications with wired connections and also we have wireless based hand gesture controlling robot using Arduino and micro-controllers. The setup will be handled by input and output sources handled by accelerometer and electro-mechanical sensors but many complications occurred in terms of range and performace. So our proposed idea is develop a wireless hand gesture robot using machine learning and python, Where we developed a prototype to solve the real time applications using the setup.

1.4 OBJECTIVE

The main objective of this project is to develop a prototype, where it will be used to handle or solve the real time applications using the machine learning and python. In this we are going to take fire-case scenario and object detection as the real time applications and solve this by using machine learning algorithms i.e. Guassian blur algorithm, Canny-edge algorithm and Masking Techniques.

More researches have proposed the wireless based hand gesture robot using various techniques. The existing systems have less accuracy. The proposed system uses different machine learning algorithms and python techniques to solve the real time applications. The proposed system increases its accuracy with less time and cost compared with existing systems.

CHAPTER 2

LITERATURE SURVEY

Ronny mardiyanto, heri suryoatmojo [1] "Development of hand gesture recognition sensor based on accelerator and gyroscope for controlling arm of underwater remotely operated robots". At the present time movement sensor relies on accelerometer and whirligig. Spinner is the sensor which is utilized to get the position the manager hand when he is working in submerged worked vehicle and it is related with a hand. The pro supervisor may utilize the joystick for land and water proficient regulate system viably what's more, it is bit complex for the beginning customers. The structure contain two guidelines part, ground station and sea remotely worked robot arm.in this paper the hand development seeing sensor utilized by the client and the floor station and he can arranged to control the arms of robot at the submerged. In this animating operator or spinner are fitted in arm joint, arms. The gadget evaluate the 3-Dimensional spot of each part for making three-dimensional spot of hand. Here we utilized the CAD programming. gadget is worked with no readiness. Submerged file is successfully completed using contraption. Anala pandit, Dhairya Dand [2] hand movement contraption with foundation for clinical present day looks at. Associating with frameworks is finished with the assistance contact display, wired or wireless connection for reassurance. At the present time machine granting device, most regular passing on gadget, for coordinates and device for different mechanical assembly. conferring with orders are realized usage for movement. Here transmitter will move with turn 3-Dimensional article. Accelerometer changed to remote correspondence 3-Dimensional outlines should be conceivable no issue by any stretch of the imagination. Incredible collaboration Christian manery [3]"hugging a robot odd? Exploring the impact of robot appearance on client's view of embracing". machine can interface with individuals using physical joint effort like grasping. Here association must be a masterminded circumspectly as userfriendly structure where coordinate consistently or breaking point repulsiveness. The assessments includes physical joint effort between the people and the humanoid robot ARMAR – IIIb. It gives the best outcome following to testing among the unmistakable factor. userfriendly, Easy to work. Akitoshi harada

[4] Robot finger plan for myoelectric hand and assertion of finger development by methods for surface Electromyography. At this moment, hand group obliging to the thing to a ME prosthetic hand and activity of finger development through ground Electromyography are point by point. The robots incorporates forefingers or thumb fingers, is made to apply essential exercises required logically, weight can be lifted. Jianhua Ren, Huichao Wang, [5] "A portable artificial robotic hand controlled by EMG signal using ANN classifier." In this paper, making a transportable robots for the truly provoked people to do essential activities. Electromyography information and yield are accumulated mass of individual arm to get the intensions of activities, where four kinds of Gestures are choosen to trade thoughts . An ANN is talented in adventures with the segment took up from the ME signal. The robots hand is mad with 7 period of chance and gear with sign acquirement power control and little scope processor are arranged. remotely associated with the PC. Easy to utilize. Have no requirement. Effective and exact execution. Vinayak kamanth, Sandeep Bhat [6] "Kinetic sensor based real- time robot path planning using gesture and clap sound." At present an extensive part of the indoor works like cleaning, object notoriety, etc. Are done by utilizing the automated. For the inside works we should deal with the robots and utilization on motions and applaud sounds. Now, predominant methodology is utilized on changing the applaud sound signal orders from dynamic sensor identified with the PC and cell phone is snared through RF connect. The equipment is anticipated on arduino code to avoid unnecessary movement of the robots. The applaud for impel motion following mode to move the robot and deactivate the development checking mode after last ending the robot.

S.N O	Titles	Author	Content
1	Hand Gesture Controlled Robot	<u>Narsingoju Adithya, Sridevi Chitti</u>	The critical reason of this corporation is to increase a passage system to control a robot by using the use of misuse MEMS in particular based totally absolutely assessing form. MEMS might be a hint Electro Mechanical discoverer that is a touchy and healthful for police paintings the tilt. This locator unearths the lean and makes use of the accelerometer to transport the orientation of the robot looking on tilt
2	Hand Gesture Based Wireless Controlled Robot	<u>Dushyant Singh, Riturvanjali Singh, Neelam Sharma, Sagar Shrivastav , and Ashutosh Mittal</u>	This paper presents a Gesture Controlled robot which can be controlled by your hand gestures based on 3 axis accelerometer and robot move in four direction forward, backward, left and right. Including wireless camera (night vision) which is use to send audio video signal up to 30 meter, and human motion sensor working on the principle of infrared it detect 790 nanometer wavelength from human body. Mostly in military application, industrial robotic, construction vehicles in civil side.
S.N O	Titles	Author	Content
3	Robot Control by Accelerometer Based Hand Gesture using Arduino Microcontroller	<u>Pankaj Kumar Gautam, Sudhasnhu Pandey, Vishwajeet Kumar Nanda</u>	Most of robots are controlled by wireless connection (like remote or cell phones) or by direct (wired) connection. In this project work we have designed a robot which is to be controlled by hand gesture of human and an accelerometer is used to move robot according to hand movement. In this work the hardware requirements and complexity has been removed because of not using remote control.
4	Hand Gesture Controlled Robot Using Arduino	<u>Ms.Asmita Jadhav , Ms. Deepika Pawar , Ms.Kashmira Pathare, Ms.Prachi Sale, Prof.R.Thakare.</u>	This paper presents a Hand Gesture Controlled Robot using Arduino, which can be controlled by simple hand gesture. According to the movement of the person hand, the accelerometer start moves. It is based on 3axis of accelerometer and robot move in four direction forward, backward, left and right. For sensing Human motion, we use infrared sensor, it's range is 790nm wavelength from human body. This type of robot widely used in military application, industrial robotic, construction field

Table 2.1 Literature Survey

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Gestures are used universally to express emotions and thoughts. Using these gestures it is possible to control the wheelchair in an efficient way which is natural and convenient unlike controlling it by a computer, which can be an arduous task. This model involves the use of micro-electromechanical sensors, micro-controllers, and transmitter-receiver pair for wireless transmission of data and the wheelchair for the prototype. Based on the data from either the accelerometer or the touchpad, the movements of the wheelchair is controlled. This paper presents a new gesture controlled wheelchair with many advantages such as reduced complexity, easy controlling, low cost and great reliability compared to other conventional wheelchairs. The working and assembly of this system will be explained in the paper.

Drawbacks:

- The major advantage of this system over other systems is that it provides real time palm gesture recognition, leading to an effective and natural way of controlling robots
- Many existing systems have used Bluetooth wireless control which is replaced by RF modules in this paper, and due to which the range has been enhanced.
- The flux sensor is used for easy operation of robotic hand movement.

3.2 PROPOSED SYSTEM

In our framework we proposed a hand signal controlling robot by utilizing python with picture handling. In our framework we can utilize Raspberry Pi as the principle controller and USB camera is utilized for observation monitoring. If any fire is distinguished and naturally it will turn on the water sprinkler and furthermore this framework is proposed to if any snag or article is identified by ultrasonic and it will pick by the gripper, and furthermore we can control the online conveyance of our robot by utilizing the versatile or PC. At last we are likewise control

the robot by utilizing the finger or hand signal like one finger to push ahead, two fingers to go in reverse and three fingers to left side And four fingers to right side.

Advantages:

- Low cost remote gadget is utilized.
- This framework used to fire identified, measure the separation and pic the article is simple.

3.3 SYSTEM REQUIREMENTS

Requirement analysis determines the requirements of a new system. This project analyses on product and resource requirement, which is required for this successful system. The product requirement includes input and output requirements it gives the wants in term of input to produce the required output. The resource requirements give in brief about the software and hardware that are needed to achieve the required functionality.

3.3.1 HARDWARE REQUIREMENTS

The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete and consistent specification of the whole system. They are used by software engineers as the starting point for the system design. It shows what the systems do and not how it should be implemented.

- ✓ Raspberry pi
- ✓ USB camera
- ✓ Ultrasonic sensor
- ✓ Water sprinkler
- ✓ Motor driver
- ✓ Motors
- ✓ Gripper

3.3.2 SOFTWARE REQUIREMENTS

The software requirements are the specification of the system. It is a set of what the system should do rather than how it should do it. The software requirements provide a basis for creating the software requirements specification. It is useful in estimating cost, planning team activities, performing tasks and tracking the team's and tracking the team's progress throughout the development activity.

- ✓ Raspbian OS
- ✓ Python
- ✓ VNC Viewer

CHAPTER 4

SYSTEM DESIGN

4.1 PROPOSED WORK

In our system we proposed a hand gesture controlling robot by using python with image processing .In our system we can used raspberry pi is the main controller and usb camera is used to surveillance monitoring.If any fire detected and automatically it will turn on the water sprinkler and also this system proposed to if any obstacle or object detected by ultrasonic and it will pick by the gripper, and also we can control the online communicate the our robot by using the mobile or laptop. Finally we are also control the robot by using the finger or hand gesture like one finger to move forward, two fingers to move backward and three fingers to left side And four fingers to right side.

Advantages:

- Low cost wireless device is used.
- This system used to fire detected, measure the distance and pic the object is very easy.
- And also online communication.

4.2 ARCHITECTURE DIAGRAM

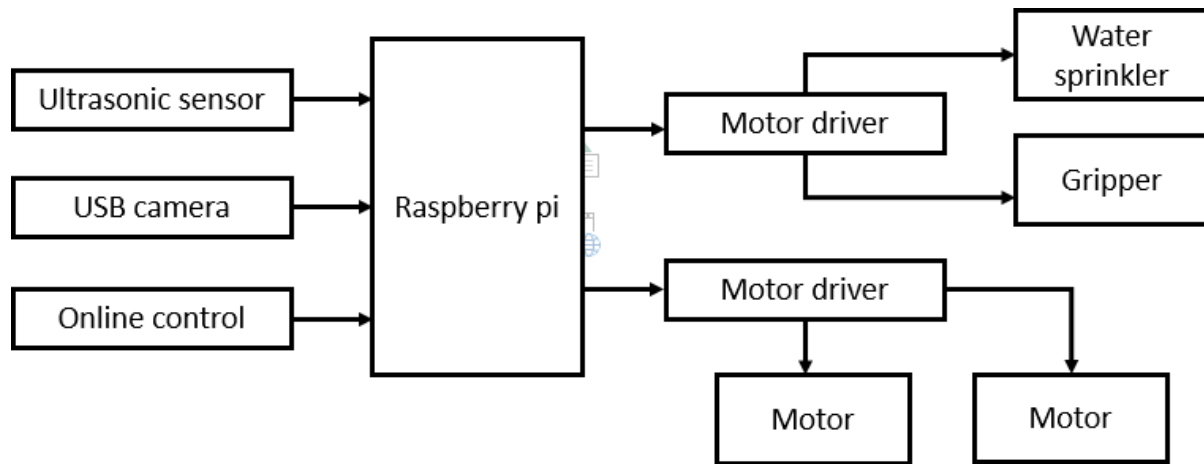


Fig 4.1 Implementation model

4.2.1 Raspberry Pi

Raspberry Pi seems to be new in the world and many people really don't know what the Raspberry Pi is. Raspberry Pi can be defined as a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you would expect a desktop computer to do, from browsing the internet and playing highdefinition video, to making spreadsheets, word-processing, and playing games. It is great bonding with Arduino and can do a lot with Arduino.

Exploring the Raspberry Pi Board

There are two models of Raspberry Pi, model A and model B. These two are bit similar with few advance features on model B compared to model A. Model B has 512 MB RAM, two USB port where as Model A has 256 MB RAM and just a USB port. Besides, Model B has Ethernet port while Model A does not.

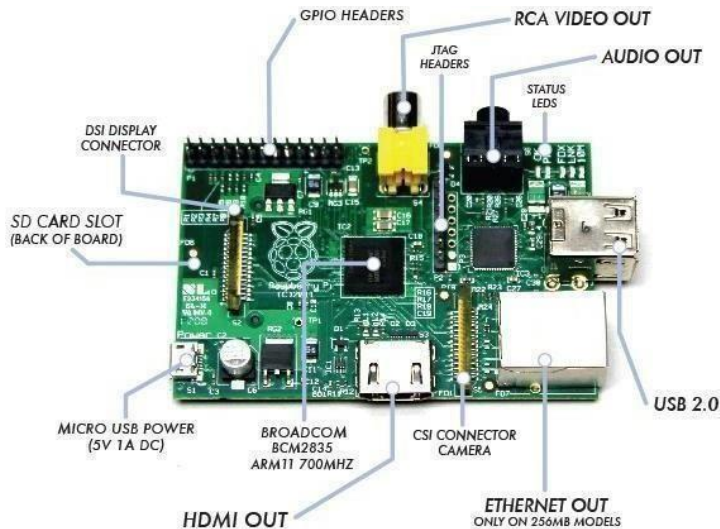


Fig 4.2 Raspberry Pi Model B(Sanders, 2013)

Different components of the Pi are named in the Figure 5-1 and brief description on each component is given in following sections.

SD Card Slot

Raspberry Pi doesn't have the real hard drive as in laptop and computer, SD card is taken as solid state drive (SSD) which is used to install operating system and all others software and store everything. This card is needed to insert into the slot for using the Raspberry Pi.

SD card may be 2GB, 4GB or 16GB.

Micro USB Power

The power port is a 5V micro-USB input and supply should be exactly 5v as it doesn't have onboard power regulator. So, power supply shouldn't exceed than 5V.

HDMI Out

This output port is used to connect the Raspberry Pi with a monitor via HDMI (High Definition Multimedia Interface). Hence, any screen or TV can be connected to it which consists of HDMI port.

Ethernet and USB port

Both the Ethernet port and USB port on Model B are supplied via the onboard LAN9512 chip. It is a high-speed USB 2.0 hub with a 10/100 Ethernet controller (Donat, 2014). USB ports are used to connect the inputs (keyboard, mouse). Almost everything that can connect to computer via USB also can connect with Raspberry Pi.

RCA Video Out and Audio Out

Audio and RCA video jacks are present on the board for audio and video out. The Raspberry Pi does support sound over its HDMI output, but there is a standard 3.5-mm audio jack to plug in headphones but USM mikes may work or not.

For video, the RCA jack sends video to any connected RCA video device.

GPIO Headers(Pins)

GPIO pins stands for general purpose of input output pins. These pins are used to connect any number of physical extensions with the Raspberry Pi. Raspberry Pi has pre-installed libraries that allow us to access the pins using programming languages like C, C++ or python.

ChIPs (Broadcom)

The most important component in a Raspberry Pi is chip that is Broadcom which is placed at the middle of the board. The chip consists of ARM11 processor running at 700 MHz and a Videocore4 GPU and can be over clocked to at least 800 MHz without a problem.

Raspberry Pi 2 Model B

Recently, Raspberry Pi 2 Model B has been launched recently which Broadcom BCM2836 ARM Cortex-A7 Quad Core Processor has powered Single Board Computer running at 900MHz, 1GB RAM and 4 Quad USB ports. It is the advanced version of Model B and is 6 times faster than Model B Raspberry Pi. In addition, it has combined 4-

pole jack for connecting your stereo audio out and composite video out and advanced power management. Figure 5-2 shows the top view of the board with labels of some important components (raspberrypi.org, 2015a).

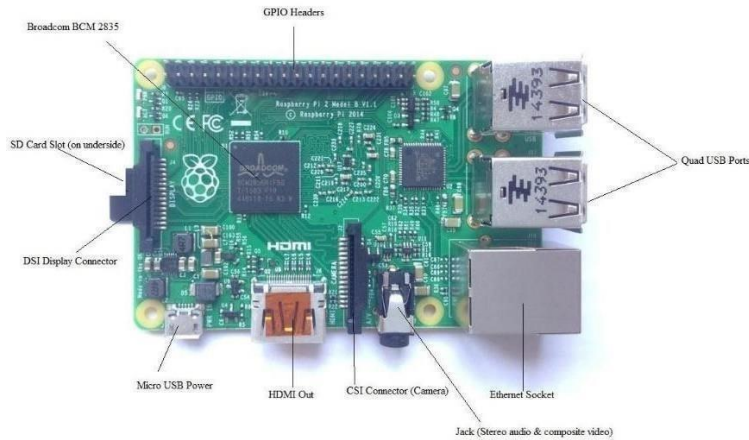


Fig 4.3 Raspberry Pi 2 Model B

Hardware Required for Raspberry Pi

Raspberry Pi can't start alone, it needs many other peripherals (hardware). There is a brief description of the hardware requirements in the following section (Bates, 2014).

Power Supply

As mentioned already in the above theory portion, Raspberry Pi needs 5V power supply. If the supply exceeds 5V, then it can't be guaranteed to work properly. The power supply also needs to supply at least 500 milliamps (mA), and preferably more like 1 amp (A). If the supply is 500 mA or less, it is likely to have the malfunction of keyboard and mouse. It is not a good idea to power the Raspberry Pi from the USB port of a computer and hub as they mostly provide current less than required. Hence, the Raspberry Pi requires a Micro-USB connection which is capable of supplying at least 700 mA (or 0.7 A) at 5V.

Storage

A separate hardware is required for the storage purpose in Raspberry Pi. For this, SD card is used, mostly 4 GB and 8 GB if needed. The operating system and all files are stored in the card. We can buy blank SD card and install operating system or buy a pre-installed one.

Input

External keyboard and mouse are required to provide input to the Raspberry Pi. No any additional software is needed to use the keyboard and mouse.

Monitor

We can use monitor or TV with HDMI port or DVI inputs as the screen for the Raspberry Pi. For DVI inputs, HDMI-to-DVI converters are required which can be finding easily in a market. Monitor is most important for the Raspberry Pi as it is the only way to see what we have done on it.

Network

As in laptop or computer, we can access to internet and network in Raspberry Pi as well. For that, we can use wired Ethernet connection which is easier option or Wi-Fi module to access Wi-Fi in the Raspberry Pi.

4,2,2 Python (programming language)

Python is a widely used high-level programming language for general-purpose programming, created by Guido van Rossum and first released in 1991. An interpreted language, Python has a design philosophy which emphasizes code readability (notably using whitespace indentation to delimit code blocks rather than curly brackets or keywords), and a syntax which allows programmers to express concepts in fewer lines of code than possible in languages such as C++ or Java. The language provides constructs intended to enable writing clear programs on both a small and large scale. Python features a dynamic type system and automatic memory management and supports multiple programming paradigms,

including object-oriented, imperative, functional programming, and procedural styles. It has a large and comprehensive standard library. Python interpreters are available for many operating systems, allowing Python code to run on a wide variety of systems. CPython, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of its variant implementations. CPython is managed by the non-profit Python Software Foundation

4.2.3 ULTRASONIC SENSOR:

- The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone).
- The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object.



Fig 4.4 Ultrasonic Sensor

4.2.4 Usb camera:

- A webcam is a video camera that feeds or streams its image in real time to or through a computer to a computer network.
- When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and emailed as an attachment.
- When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware.



Fig 4.5 Web Camera

4.2.5 WATER SPRINKLER:

An Irrigation sprinkler is a device used to irrigate agricultural crops, lawns, landscapes, golf courses, and other areas. They are also used for cooling and for the control of airborne dust. Sprinkler irrigation is a method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground. The pump, valves, distribution pipes, and sprinklers are generally designed to apply water as uniformly as possible. Sprinklers that spray in a fixed pattern are generally called sprays or spray heads. Sprays are not usually designed to operate at pressures, due to misting problems that may develop.

Higher pressure sprinklers that themselves move in a circle are driven by a ball drive, gear drive, or impact mechanism (impact sprinklers). These can be designed to rotate in a full or partial circle.



Fig 4.6 Water Sprinkler

4.2.6 Motor driver:

The L293D is a popular 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single L293D IC is capable of running two DC motors at the same time; also the direction of these two motors can be controlled independently. So if you have motors which has operating voltage less than 36V and operating current less than 600mA, which are to be controlled by digital circuits like Op-Amp, 555 timers, digital gates or even Micro controllers like Arduino, PIC, ARM etc.. This IC will be the right choice for you.

Using this L293D motor driver IC is very simple. The IC works on the principle of Half H-Bridge, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a setup which is used to run motors both in clock wise and anti-clockwise direction. As said earlier this IC is capable of running two motors at the any direction at the same time, the circuit to achieve the same is shown below.

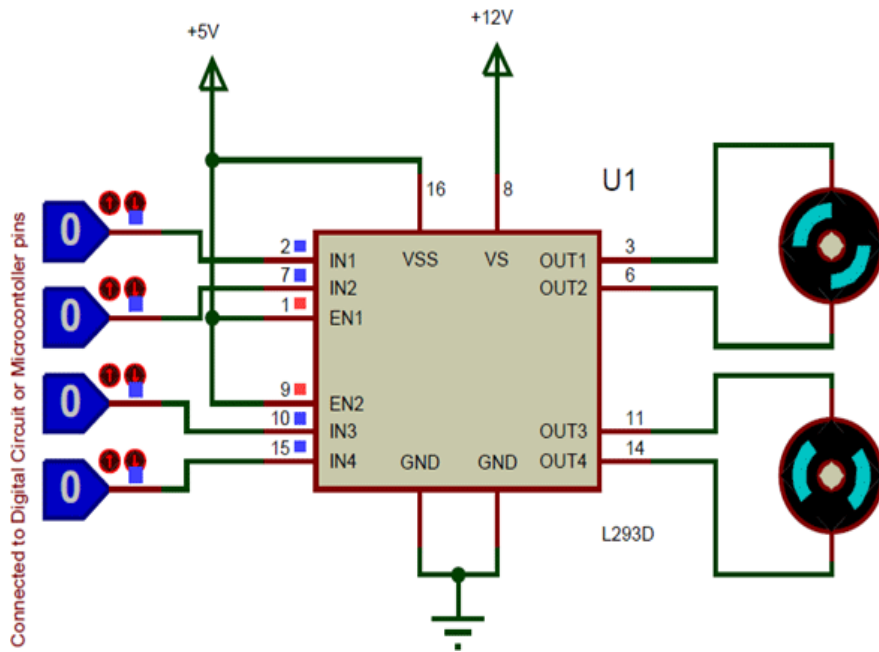


Fig 4.7 Motor Driver

All the Ground pins should be grounded. There are two power pins for this IC, one is the Vss(Vcc1) which provides the voltage for the IC to work, this must be connected to +5V. The other is Vs(Vcc2) which provides voltage for the motors to run, based on the specification of your motor you can connect this pin to anywhere between 4.5V to 36V, here I have connected to +12V.

The Enable pins (Enable 1,2 and Enable 3,4) are used to Enable Input pins for Motor 1 and Motor 2 respectively. Since in most cases we will be using both the motors both the pins are held high by default by connecting to +5V supply. The input pins Input 1,2 are used to control the motor 1 and Input pins 3,4 are used to control the Motor 2. The input pins are connected to the any Digital circuit or microcontroller to control the speed and direction of the motor. You can toggle the input pins based on the following table to control your motor.

Applications

- Used to drive high current Motors using Digital Circuits
- Can be used to drive Stepper motors
- High current LED's can be driven

4.3 ALGORITHMS AND METHODS

4.3.1 GUASSIAN BLUR ALGORITHM

In image processing, a **Gaussian blur** (also known as **Gaussian smoothing**) is the result of blurring an image by a Gaussian function (named after mathematician and scientist Carl Friedrich Gauss). It is a widely used effect in graphics software, typically to reduce image noise and reduce detail. The visual effect of this blurring technique is a smooth blur resembling that of viewing the image through a translucent screen, distinctly different from the bokeh effect produced by an out-of-focus lens or the shadow of an object under usual illumination. Gaussian smoothing is also used as a pre-processing stage in computer vision algorithms in order to enhance image structures at different scales—see scale space representation and scale space implementation.

Mathematically, applying a Gaussian blur to an image is the same as convolving the image with a Gaussian. This is also known as a two-dimensional Weierstrass transform. By contrast, convolving by a circle (i.e., a circular box blur) would more accurately reproduce the bokeh effect. Since the Fourier transform of a Gaussian is another Gaussian, applying a Gaussian blur has the effect of reducing the image's high-frequency components; a Gaussian blur is thus a low pass filter.

Gaussian smoothing is commonly used with edge detection. Most edge-detection algorithms are sensitive to noise; the 2-D Laplacian filter, built from a discretization of the Laplace operator, is highly sensitive to noisy environments. Using a Gaussian Blur filter before edge detection aims to reduce the level of noise in the image, which improves the result of the following edge-detection algorithm. This approach is commonly referred to as Laplacian of Gaussian, or LoG filtering.

A Gaussian blur effect is typically generated by convolving an image with an FIR kernel of Gaussian values. In practice, it is best to take advantage of the Gaussian blur's separable property by dividing the process into two passes. In the first pass, a one-dimensional kernel is used to blur the image in only the horizontal or vertical direction. In the second pass, the same one-dimensional kernel is used to blur in the remaining direction. The resulting effect is the same as convolving with a two-dimensional kernel in a single pass, but requires fewer calculations.

Discretization is typically achieved by sampling the Gaussian filter kernel at discrete points, normally at positions corresponding to the midpoints of each pixel. This reduces the computational cost but, for very small filter kernels, point sampling the Gaussian function with very few samples leads to a large error. In these cases, accuracy is maintained (at a slight computational cost) by integration of the Gaussian function over each pixel's area.

When converting the Gaussian's continuous values into the discrete values needed for a kernel, the sum of the values will be different from 1. This will cause a darkening or brightening of the image. To remedy this, the values can be normalized by dividing each term in the kernel by the sum of all terms in the kernel.

The efficiency of FIR breaks down for high sigmas. Alternatives to the FIR filter exist. These include the very fast three box blurs, the fast and accurate IIR Deriche edge detector, a "stack blur" based on the box blur

4.3.2 CANNY EDGE ALGORITHM

The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. It was developed by John F. Canny in 1986. Canny also produced a *computational theory of edge detection explaining why the technique works*.

Canny edge detection is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. It has been widely applied in various computer vision systems. Canny has found that the requirements for the application of edge detection on diverse vision systems are relatively similar. Thus, an

edge detection solution to address these requirements can be implemented in a wide range of situations. The general criteria for edge detection include:

1. Detection of edge with low error rate, which means that the detection should accurately catch as many edges shown in the image as possible
2. The edge point detected from the operator should accurately localize on the center of the edge.
3. A given edge in the image should only be marked once, and where possible, image noise should not create false edges.

To satisfy these requirements Canny used the calculus of variations – a technique which finds the function which optimizes a given functional. The optimal function in Canny's detector is described by the sum of four exponential terms, but it can be approximated by the first derivative of a Gaussian.

Among the edge detection methods developed so far, Canny edge detection algorithm is one of the most strictly defined methods that provides good and reliable detection. Owing to its optimality to meet with the three criteria for edge detection and the simplicity of process for implementation, it became one of the most popular algorithms for edge detection.

The Canny edge detection algorithm is composed of 5 steps:

1. Noise reduction;
2. Gradient calculation;
3. Non-maximum suppression;
4. Double threshold;
5. Edge Tracking by Hysteresis.

4.3.3 MASKING TECHNIQUE

In image processing, a **kernel**, **convolution matrix**, or **mask** is a small matrix. It is used for blurring, sharpening, embossing, edge detection, and more. This is accomplished by doing a convolution between a kernel and an image.

Edge Handling

Kernel convolution usually requires values from pixels outside of the image boundaries. There are a variety of methods for handling image edges.

Extend

The nearest border pixels are conceptually extended as far as necessary to provide values for the convolution. Corner pixels are extended in 90° wedges. Other edge pixels are extended in lines.

Wrap

The image is conceptually wrapped (or tiled) and values are taken from the opposite edge or corner.

Mirror

The image is conceptually mirrored at the edges. For example, attempting to read a pixel 3 units outside an edge reads one 3 units inside the edge instead.

Crop

Any pixel in the output image which would require values from beyond the edge is skipped. This method can result in the output image being slightly smaller, with the edges having been cropped.

Kernel Crop

Any pixel in the kernel that extends past the input image isn't used and the normalizing is adjusted to compensate.

Normalization

Normalization is defined as the division of each element in the kernel by the sum of all kernel elements, so that the sum of the elements of a normalized kernel is unity. This will

ensure the average pixel in the modified image is as bright as the average pixel in the original image.

4..3.4 MOTION RECOGNITION ALGORITHM

The point of hand identification is to gadget a program that can distinguish the hands, track them continuously and play out some motion acknowledgment. It was finished with straightforward sign handling performed on pictures got from a Raspberry Pi camera. It identified the human hand from the picture and identify it as a correct hand or left hand. It incorporated the accompanying strides to get the outcomes.



Fig 4.1 Motion recognition diagram

Detecting Background :

From the feed from the camera, we evacuate the foundation. We utilize running normal over an arrangement of pictures to get the normal picture which will be the foundation as well. Condition to recognize foundation by averaging.

$$C[i][j] = \alpha \text{ Cur BG}[i][j] + (1-\alpha)\text{CurFrame}[i][j]$$

Equation to detect background by averaging.

This equation works because of the assumption that the background is mostly static. Hence for those stationary item, those pixels aren't affected by this weighted averaging and $\alpha + (1-\alpha) = 1$. Hence those pixels that are constantly changing isn't a part

of the background, hence those pixels will get weighed down. Hence the stationary pixels or the background gets more and more prominent with every iteration while those moving gets weighed out. Thus after a few iterations, we get the above average which contains only the background. In this case, even face is a person is a part of the background as it needs to detect only my hands.

Background Subtraction:

A simple method to start background subtraction is we can subtract the pixel values. However this will result in negative values and values greater than 255, which is the maximum value used to store an integer, but if we have a black background then nothing gets subtracted in that case. Instead we use an inbuilt background subtractor based on a Gaussian Mixture based Background/Foreground Segmentation Algorithm. Background subtraction involves calculating a reference image, subtracting each new frame from this image and thresholding the result which results in a binary segmentation of the image which highlights regions of non-stationary objects. We then use erosion and dilation to enhance the changes to make it more prominent.



Fig.4.2 Output of background subtraction

CHAPTER 5

SYSTEM IMPLEMENTATION

5.1 MODULES

5.1.1 ROBOTIC MOVEMENT

The robotic movement is happened based on the point of hand identification is to gadget a program that can distinguish the hands, track them continuously and play out some motion acknowledgment. It was finished with straightforward sign handling performed on pictures got from a Raspberry Pi camera. It identified the human hand from the picture and identify it as a correct hand or left hand. It incorporated the accompanying strides to get the outcomes.

From the feed from the camera, we evacuate the foundation. We utilize running normal over an arrangement of pictures to get the normal picture which will be the foundation as well. Condition to recognize foundation by averaging. This equation works because of the assumption that the background is mostly static. Hence for those stationary item, those pixels aren't affected by this weighted averaging and $a \cdot + (1-a) =$. Hence those pixels that are constantly changing isn't a part of the background, hence those pixels will get weighed down. Hence the stationary pixels or the background gets more and more prominent with every iteration while those moving gets weighed out. Thus after a few iterations, we get the above average which contains only the background. In this case, even face is a person is a part of the background as it needs to detect only my hands.

This hand gesture recognition robot can be constructed using low cost arm processor boards such as beagle board and raspberry pi. To achieve this we need to do image processing the images we can control the robot using hand gestures. This project mainly focuses on Raspberry Pi ARM-11 based processor utilization, image processing. The Raspberry Pi consists of USB ports through which external devices are interfaced with the board. Here the webcam is interfaced to it using the USB ports available on board. Images captured by the webcam are sent to the Raspberry pi board where the processing of the

image will be done. After this, the code gets executed and the dc motors are rotated in accordance to the written code i.e., forward, backward, right, left. Here the dc motors are not directly connected to the Raspberry Pi two motor driver circuits (L298) are used which can drive four dc motors combined.

The final bot model is shown in Fig 4. The bot consists of Raspberry PI with Ubuntu running on it. The Logitech USB camera is fixed to the front to capture hand gestured images. Based on defects, the bot moves forward, backward, spins clockwise and anticlockwise

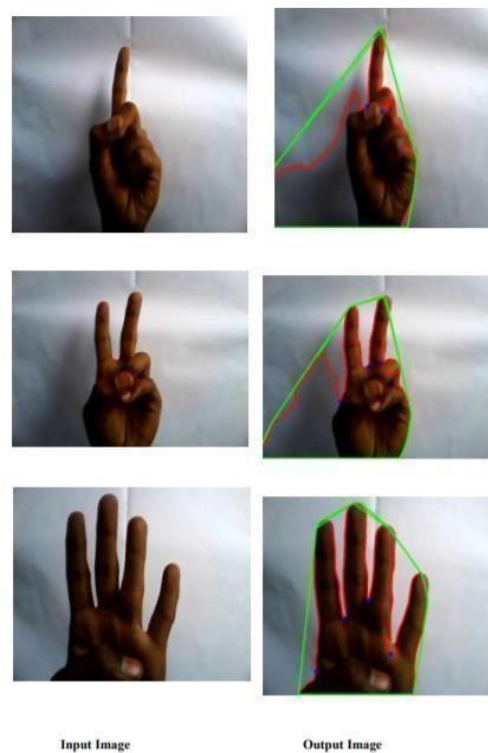


Fig 5.1 Hand gestures

5.1.2 DETECTION OF FIRE

This project mainly concerned with the implementation of the fire detection recognition technology (using Image processing) using a Raspberry Pi board and a webcam interfaced to it. First of all the OS is installed into the Raspberry Pi board via Micro SD card and appropriate code is written in python language using the open CV libraries and is dumped in the board. Now two motor driver circuits and a webcam are interfaced to the board. The webcam will capture the images and send to the board, where the image processing will be done and a pulse will be sent to the L298 motor driver circuit which will enable or disable the dc motors i.e., logical 1 for rotation and logic 0 for hold. The main keywords used here are Wheezy Raspbian, Raspberry Pi, usb camera, Image Processing, Open CV, python.

This project is mainly intended in implementing a technology of hand gesture recognition (using Image Processing) and made it available to the common man for the most affordable price. We can implement this project in both Military and Social applications. The social applications include the movement of wheel chair of a handicapped person and the military application includes the hostage saving missions where there is risk to the life. As of now, a wheel chair can be controlled using voice control and remote control technologies which is not only expensive but also involves expertise of the user in terms of using the device. There are also techniques which involves image processing like control of wheel chair using eye movements[11], but this method proved to be ineffective because the physically challenged need to carry a laptop/ notebook pc at all times increasing inefficiency in terms of size. So we were self-motivated to perform this project to reduce all the inefficiencies involved in the former techniques which will be a successful implementation of hand gesture technology.

If any fire detected and automatically it will turn on the water sprinkler and also this system proposed to if any obstacle or object detected by ultrasonic and it will pick by the gripper, and also we can control the online communicate the our robot by using the mobile or laptop. Finally we are also control the robot by using the finger or hand gesture like one finger to move forward, two fingers to move backward and three fingers to left side And four fingers to right side.

5.1.3 IMAGE PROCESSING

Image processing is a form of signal processing for which the input is an image and the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques treat the image as a two-dimensional signal. Image processing is computer imaging where application involves a human being in the visual loop. In other words the image are to be examined and are acted upon by people. The major topics within the field of image processing include: Image restoration, Image enhancement, Image compression etc.

Picture handling is any type of sign preparing for which the info is a picture, for example, a photo or video outline; the yield might be a picture or a lot of attributes or parameters identified with the picture. Prior to going to handling a picture, it is changed over into an advanced structure. Digitization incorporates inspecting of picture and quantization of tested qualities. In the wake of changing over the picture into bit data, handling is performed. The essential preparing method might be Image improvement, Image reclamation, and Image pressure.

TYPES OF IMAGE PROCESSING

There are two methods available in Image Processing i.e. analog image processing and digital image processing.

A. Analog Image Processing

Analog image processing is any image processing task conducted on two-dimensional analog signals by analog means i.e. the alteration of image through electrical means. The most common example is the television image. Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. When creating images using analog photography, the image is burned into a film using a chemical reaction triggered by controlled exposure to light. It is processed in a darkroom, using special chemicals to create the actual image. This process is decreasing in popularity due to the advent of digital photography, which requires less effort.

B. Digital Image Processing

Digital image processing is the use of computer algorithms to perform image processing on digital images. There are three major benefits to digital image processing: a consistently high quality of the image, a low cost of processing, and the ability to manipulate all aspects of the process. In digital photography, the image is stored as a computer file. This file is translated using photographic software to generate an actual image. The colors, shading, and nuances are all captured at the time the photograph is taken, and the software translates this information into an image.

5.1.4 OBJECT DETECTION

Object Detection takes place using Ultrasonic sensors. The Ultrasonic Sensor conveys a high-recurrence sound heartbeat and afterward times to what extent it takes for the reverberation of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (similar to a little speaker), the different gets them, (similar to a modest microphone). The speed of sound is around 341 meters (1100 feet) every second in air. The ultrasonic sensor utilizes this data alongside the time contrast among sending and getting the sound heartbeat to decide the separation to an article.

Ultrasonic sensors are devices that use electrical–mechanical energy transformation, the mechanical energy being in the form of ultrasonic waves, to measure distance from the sensor to the target object. Ultrasonic waves are longitudinal mechanical waves which travel as a succession of compressions and rarefactions along the direction of wave propagation through the medium. Any sound wave above the human auditory range of 20,000 Hz is called ultrasound. If any object is detected, the object is picked through the robotic arm.

5.1.5 ONLINE CONTROLLER OF ROBOT

We can control our robotic movement in our mobile or laptop by installing an application in our device i.e., VNC Viewer. In computing, **Virtual Network Computing (VNC)** is a graphical desktop-sharing system that uses the Remote Frame Buffer protocol (RFB) to remotely control another computer. It transmits the keyboard and mouse events from one computer to another, relaying the graphical-screen updates back in the other direction, over a network. VNC is platform-independent – there are clients and servers for many GUI-based operating systems and for Java. Multiple clients may connect to a VNC server at the same time. Popular uses for this technology include remote technical support and accessing files on one's work computer from one's home computer, or vice versa. There are a number of variants of VNC which offer their own particular functionality; e.g., some optimised for Microsoft Windows, or offering file transfer (not part of VNC proper), etc. Many are compatible (without their added features) with VNC proper in the sense that a viewer of one flavour can connect with a server of another; others are based on VNC code but not compatible with standard VNC. In this, we have provided controls of left, right, forward and backward movements. By using these controls, we can be able to perform movements to our robot. It is very much suitable for forest application, when forest catches fire, we can be able to control our robot by using online controller.

The robotic movement is happened based on the point of directions to which we give to gadget a program that can distinguish the hands, track them continuously and play out some motion acknowledgment. It was finished with straightforward sign handling performed on pictures got from a Raspberry Pi camera. It identified the human hand from the picture and identify it as a correct hand or left hand. It incorporated the accompanying strides to get the outcomes.

5.2 RESULTS AND DISSCUSION

5.2.1 Results

- When the Hand Gestures is Detected through the camera, the robot keeps moving based on the indication given i.e, right,left, forward and reverse.
- If any object is detected, the object is picked through the robotic arm.
- Fire is been detected by camera and can be stopped by using water sprinkler.
- It is used in Military applications by online access through phone or laptop.



CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 CONCLUSION

The idea is to build a robot which can be controlled using fingers and manoeuvre it wirelessly. With this project two goals are achieved and are now able to control it through fingers control robot is a stepping stone of success for the implementation of this algorithm to a fire detection Compact size of Raspberry Pi, more reliability, usage of image processing and avoiding the usage of laptop/notebook pc is an added advantage to this technique. Using this technique it is possible to control the robot using frames taken as input and manoeuvre it accordingly. This work can be further extended by taking the input as a sequence of frames i.e., by capturing video and manoeuvre it respectively. In summary, this technique can replace the existing remote controlled and voice controlled technologies in an economical way.

6.2 FUTURE ENHANCEMENT

This work can be further extended by taking the input as a sequence of frames i.e., by capturing video and manoeuvre it respectively. In summary, this technique can replace the existing remote controlled and voice controlled technologies in an economical way.

The extension of this work will focus on developing the advanced algorithms for fast and accurate. There can be future works done based on other real time applications to get more the accurate results.

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Wireless network based gesture controlled robot

ABSTRACT:

Much after more than many years of information gadgets advancement, numerous individuals despite everything discover the association with the PCs and robots an awkward encounter. Endeavors ought to be made to adjust PCs and robots to our regular methods for correspondence: discourse and non-verbal communication. The point of this work is to actualize an ongoing order framework through hand movement affirmation, using all around helpful gear and low costing sensor like a direct raspberry-pie and a USB webcam, so any customer can use it in organizations or at home. The reason of our philosophy is a fast division method to procure the hand movement from the whole picture which can oversee immense number of hand shapes against different establishments and lightning conditions, and an affirmation method that recognizes the hand pose for various control application. Administration robots legitimately associate with individuals, so finding an increasingly common and simple UI is of crucial significance. While prior works have concentrated principally on issues, for example, control and route in the earth, scarcely any automated frameworks are utilized with straightforward interfaces that can control the robot by trademark techniques. This energize response need. In this method, customer will handle the robot by using movements with palm. Here request indications were delivered for the movements using picture getting ready, where gaussian blur algorithm is used to reduce noise in the image, Cannyedge algorithm is used to detect fire outlayers and masking algorithm is used for Ro extraction .

Keywords: Raspberry Pi, usb camera, water sprinkler, Open CV, Python.

I INTRODUCTION : In the present age, the automated business has been creating numerous new patterns to expand the proficiency, openness and precision of the frameworks. Fundamental errands could be employments that are hurtful to

they in spite of everything ought to be obliged by individuals itself. Robots can be wired or remote, both having a controller device. Both have upsides and drawbacks related with them. Past controlling on mechanical framework through physical gadgets, ongoing strategy for signal control has gotten well known. The principle to utilize motions and provides a progressively normal method for controlling and gives a rich and instinctive type of collaboration with the automated framework. This for the most part includes Image Processing and Machine Learning for the framework or application advancement. Past this, it likewise requires an equipment for interfacing with the framework for signal control. There are a few frameworks that have been created in a similar field utilizing different procedures. Developments can begin from any real improvement or state at any rate when in doubt start from the face or hand. Different methods of reasoning have been made utilizing cameras and PC vision estimations to decode signal based correspondence. In any case, the distinctive verification and affirmation of position, step, proxemics, and human practices is likewise the subject of sign assertion structures. Development certification can be viewed as a course for PCs to start to get a handle on human non-verbal correspondence, thusly there's a need of building a more lavish extension among machines and people than harsh substance UIs or even GUIs (graphical UI), which despite everything limit a huge bit of pledge to help a mouse. This may make ordinary data contraption, for example, mouse, consoles and even touch-screens dreary. The undertaking is an application for live movement signal acknowledgment utilizing Raspi camera module and plays out the activity relating to it. In our case we have controlled. This work focuses on to execute gesture recognition technology i.e., by Image recognition using raspberry pi board and control the dc motors according to the data obtained from the images which are captured using a webcam. Fundamental highlights of raspberry pi are Broadcom BCM2835 Arm-11 processor (700 MHz), 512MB RAM, on board USB

the human, monotonous occupations that are exhausting, upsetting and so on. In spite of the fact that robots can be a substitution to individuals,

2.0 ports. Giving a wide scope of processors dependent on a typical design that conveys superior and cost proficiency. These processor boards are capable to execute complex working frameworks, for example, Linux and can support complex graphic user interfaces.

The Raspberry pi processor board is the best decision for a person keen on minimal effort Arm processor. It has been outfitted with a base game plan of features to allow the customer to experience the power of the processor. It might be viably interfaced with various outside contraptions like webcams, raspcam, comfort, etc. The L298 motor driver circuit is ideal for mechanized applications and fitting for relationship with a microcontroller requiring just a few control lines for every motor. It can similarly be interfaced with essential manual switches, TTL method of reasoning gateways, moves, etc. Signals are utilized generally to communicate feelings and considerations. Utilizing these motions it is conceivable to control the wheelchair in a proficient manner which is common and advantageous not at all like controlling it by a PC, which can be a challenging assignment. This model includes the utilization of miniaturized scale electromechanical sensors, smaller scale controllers, transmitter-beneficiary pair for remote transmission of information and the wheelchair for the model. In light of the information from either the accelerometer or the touchpad, the developments of the wheelchair is controlled. This paper presents another signal controlled wheelchair with numerous points of interest, for example, decreased multifaceted nature, simple controlling, minimal effort and extraordinary unwavering quality contrasted with other ordinary wheelchairs. The working and get together of this framework will be clarified in the paper.

The critical ideal situation of this system over various structures is that it gives continuous palm movement affirmation, inciting a fruitful and ordinary strategy for controlling robots. Many existing systems have used Bluetooth remote control which is superseded by RF modules right now, because of which the range has been improved. The flux sensor is used for easy operation of robotic hand movement.

II Related work:

Ronny mardiyanto, heri suryoatmojo [1] "Development of hand gesture recognition sensor based on accelerator and gyroscope for controlling arm of underwater remotely operated robots". At the present time movement sensor relies on accelerometer and whirligig. Spinner is the sensor which is utilized to get the position the manager hand when he is working in submerged worked vehicle and it is related with a hand. The pro supervisor may utilize the joystick for land and water proficient regulate system viably what's more, it is bit complex for the beginning customers. The structure contain two guidelines part, ground station and sea remotely worked robot arm. In this paper the hand development seeing sensor utilized by the client and the floor station and he can arranged to control the arms of robot the submerged. In this animating operator or spinner are fitted in arm joint, arms. The gadget evaluate the 3-Dimensional spot of each part for making three-dimensional spot of hand. Here we utilized the CAD programming. gadget is worked with no readiness. Submerged file is successfully completed using contraption. Anala pandit, Dhairya Dand [2] hand movement contraption with foundation for clinical present day looks at. Associating with frameworks is finished with the assistance contact display, wired or wireless connection for reassurance. At the present time machine granting device, most regular passing on gadget, for coordinates and device for different mechanical assembly. conferring with orders are realized usage for movement. Here transmitter will move with turn 3-Dimensional article. Accelerometer changed to remote correspondence 3-Dimensional outlines should be conceivable no issue by any stretch of the imagination. Incredible collaboration Christian manery [3] "hugging a robot odd? Exploring the impact of robot appearance on client's view of embracing". machine can interface with individuals using physical joint effort like grasping. Here association must be a masterminded circumspectly as userfriendly structure where coordinate consistently or breaking point repulsive mess. The assessments includes physical joint effort between the people and the humanoid robot ARMAR – IIIb. It gives the best outcome following to testing among the unmistakable factor. userfriendly, Easy to work. Akitoshi harada [4] Robot finger plan for myoelectric hand and assertion of finger development by methods for surface Electromyography. At this moment, hand group obliging to the thing to a ME prosthetic hand and activity of finger development through ground Electromyography are point by point. The robots incorporates forefingers or thumb fingers, is made to apply essential exercises required logically.

Holding or snatching. A decided work to the framework to follow the human's fragment. For controlling each finger of the made myoelectric prosthetic hand transparently, Manpower is lessened incase of lifting objects. High weight can be lifted. Jianhua Ren, Huichao Wang, [5] "A portable artificial robotic hand controlled by EMG signal using ANN classifier." In this paper, making a transportable robots for the truly provoked people to do essential activities.

Electromyography information and yield are accumulated mass of individual arm to get the intensions of activities, where four kinds of Gestures are choosen to trade thoughts. An ANN is talented in adventures with the segment took up from the ME signal. The robots hand is made with 7 period of chance and gear with sign acquirement power control and little scope processor are arranged. remotely associated with the PC. Easy to utilize. Have no requirement. Effective and exact execution. Vinayak kamanth, Sandeep Bhat [6] "Kinetic sensor based real-time robot path planning using gesture and clap sound." At present an extensive part of the indoor works like cleaning, object notoriety, etc. Are done by utilizing the automated. For the inside works we should deal with the robots and utilization on motions and applaud sounds. Now, predominant methodology is utilized on changing the applaud sound signal orders from dynamic sensor identified with the PC and cell phone is snared through RF connect. The equipment is anticipated on arduino code to avoid unnecessary movement of the robots. The applaud for impel motion following mode to move the robot and deactivate the development checking mode after last ending the robot.

III Proposed work:

In our system we proposed a hand gesture controlling robot by using python with image processing. In our system we can use raspberry pi is the main controller and usb camera is used to surveillance monitoring. If any fire detected and automatically it will turn on the water sprinkler and also this system proposed to if any obstacle or object detected by ultrasonic and it will pick by the gripper, and also we can control the online communicate the our robot by using the mobile or laptop. Finally we are also control the robot by using the finger or hand gesture like one finger to move forward, two fingers to move backward and three fingers to left side And four fingers to right side.

3.1 Advantages:

- Low cost wireless device is used.
- This system used to fire detected, measure the distance and pic the object is very easy.
- And also online communication.

IV.PROJECT DESCRIPTION:

This work mainly focusses on usage of the fire discovery acknowledgment innovation (utilizing Image preparing) utilizing a Raspberry Pi board and a webcam interfaced to it. As a matter of first importance the OS is introduced into the Raspberry Pi board by means of Micro SD card and suitable code is written in python language utilizing the open CV libraries and is dumped in the board. Now two motor driver circuits and a webcam are interfaced to the board. The webcam will catch the pictures and send to the board, where the picture handling will be finished and a pulse will be sent to the L298 motor driver circuit which will enable or disable the dc motors i.e., logical for rotation and logic 0 for hold. The main keywords used here are Wheezy Raspbian, Raspberry Pi, usb camera, Image Processing, Open CV, python. The block diagram is shown as below,

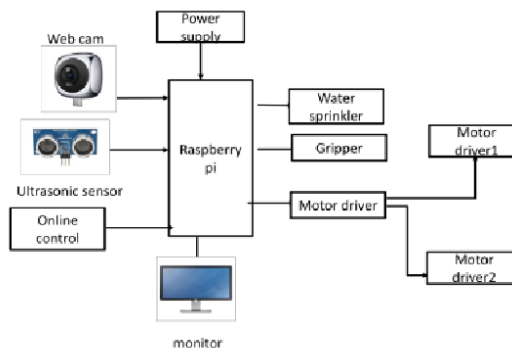


fig.1 block diagram

The Raspberry Pi incorporates USB ports through which outside contraptions are interfaced with the board. Here the webcam is interfaced to utilizing the USB ports open arranged. Pictures got by the webcam are sent to the Raspberry pi board where the arranging of that picture will be finished. After this, the code gets executed and the dc engines are pivoted in understanding for composed codes i.e., one finger, two fingers, three fingers, four fingers. This project is mainly intended in implementing a technology of hand gesture recognition (using Image Processing) and made it available to the common man for the most affordable price. We can implement this project in

both Military and Social applications. The social applications include the movement of wheel chair of a handicapped person and the military application includes the hostage saving missions where there is risk to the life. As of now, a wheel chair can be controlled using voice control and remote control technologies which is not only expensive but also involves expertise of the user in terms of using the device. There are also techniques which involves image processing like control of wheel chair using eye movements[11], but this method proved to be ineffective because the physically challenged need to carry a laptop/ notebook pc at all times increasing inefficiency in terms of size. So we were self- motivated to perform this project to reduce all the inefficiencies involved in the former techniques which will be a successful implementation of hand gesture technology.

4.1 Wheezy Raspbin :

The expression "Ubuntu" is a conventional African idea cap began from the bantu dialects of southern Africa. The Ubuntu guarantees incorporates Ubuntu will consistently be for nothing out of pocket, close by its standard undertaking releases and security invigorates. Ubuntu goes with full business support from definitive and numerous associations from wherever all through the world. Ubuntu gives the best interpretations and availability joins that the free programming framework brings to the table. Ubuntu's inside applications are commonly free and open source. We need you to utilize free and open source programming, improve it and pass it on.

4.2 Raspberry PI :

The Raspberry Pi is a Visa evaluated single-board PC made in the UK by the Raspberry Pi establishment. The Raspberry Pi has a Broadcom BCM2835 structure on a chip (SoC), which joins an ARM1176JZF-S 700MHz processor, video center LV GPU, and was from the start dispatched with 256 MB of RAM, later moved to 512 MB. It rejects a natural hard circle or strong state drive, at any rate utilizes a SD card for booting and innovative amassing. Raspberry Pi bolsters OS like Linux, Android, Arch Linux ARM, and Unix.

4.3 Image Processing :

Picture handling is any sort of sign getting ready for which the data is an image, for instance, a photograph or video layout; the yield may be an image or a ton of characteristics or parameters related to the image. Preceding going to taking care of an image, it is changed over into an automated structure. Digitization consolidates looking at of picture and quantization of tried characteristics. In the wake of changing over the image into bit information, taking care of is performed. The fundamental getting ready framework may be Image redesign, Image recovery, and Image pressure.

4.4 Open CV :

The Open CV library programming bundle underpins numerous capacities whose exhibition can be essentially improved on the Intel building, particularly the Open CV library is a grouping of low-overhead, predominant errands performed on pictures.

V. Software components:

- a. Raspbian OS
- b. Python

Hardware components:

- Raspberry pi
- USB camera
- Ultrasonic sensor
- Water sprinkler
- Gripper
- Motor driver.

5.1 Raspberry pi:



The Raspberry Pi is a development of negligible single-board PCs made in the United Kingdom by the Raspberry Pi Foundation to move the preparation of focal programming working in schools and in making nations. The chief model ended up being undeniably more prominent than anticipated, selling outside of its objective feature for utilizes, for example, apply self-rule and web of things.

5.2 USB camera:



2

A webcam is a camcorder that feeds or streams its picture 2gitimately to or through a PC to a PC form. When "got" by the PC, the video stream might be spared, seen or sent on to different systems by strategies for structures, for example, the web, and educated as an attachment. When sent to a remote domain, the video stream might be spared, seen or on sent there. Instead of an IP camera (which interfaces utilizing Ethernet or Wi-Fi), a webcam is commonly related by a USB association, or close to association, or got together with PC gear.

10

5.3 Ultrasonic sensor:



The ultrasonic sensor passes on 3 high-repeat sound heartbeat . while later occasions to what degree it takes for the resounding of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (similar to a little speaker), the different gets them, (similar to an inconspicuous microphone).The speed of sound is around 341 meters (1100 feet) reliably in air. The ultrasonic sensor utilizes this data nearby the time qualification among sending and getting the sound heartbeat and choose for partition to a thing.

VI. GESTURE RECOGNITION ALGORITHM :

The point of hand identification is to gadget a program that can distinguish the hands, track them continuously and play out some motion acknowledgment. It was finished with straightforward sign handling performed on pictures got from a Raspberry Pi camera. It recognized the human hand from the picture and identify it as a correct hand or left hand. It incorporated the accompanying strides to get the outcomes.

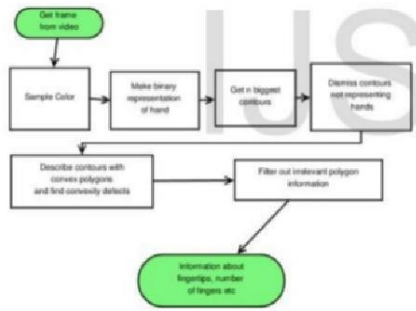


Fig.2.

6.1 Detect Background:

From the feed from the camera, we evacuate the foundation. We utilize running normal over a grouping of pictures to get the normal picture which will be the foundation as well.

$$C[i][j] = \alpha \text{Cur BG}[i][j] + (1-\alpha)\text{CurFrame}[i][j]$$

Equation to detect background by averaging.

This condition works in view of the supposition that the foundation is for the most part static. Henceforth for those stationary thing, those pixels aren't influenced by this weighted averaging and $\alpha x + (1-\alpha)x = x$. Thus those pixels that are continually changing isn't a piece of the foundation, henceforth those pixels will get burdened. Thus the stationary pixels or the foundation gets increasingly more conspicuous with each emphasis while those moving gets weighed out. In this manner after a couple of emphasess, we get the better than expected which contains just the foundation. Right now, face is an individual is a piece of the foundation as it needs to identify just my hands.

6.2 Background Subtraction:

A basic strategy to begin foundation subtraction is we can subtract the pixel esteems. Anyway this will bring about negative qualities and qualities more noteworthy than 255, which is the most extreme worth used to store a whole number, however on the off chance that we have a dark foundation, at that point nothing gets subtracted all things considered. Rather we utilize an inbuilt foundation subtraction dependent on a Gaussian Mixture based Background/Foreground Segmentation Algorithm. Foundation subtraction includes ascertaining a reference picture, subtracting each new edge from this picture and thresholding the outcome



Fig.3 Output of background subtraction

which brings about a parallel division of the picture which features districts of non-stationary articles. We at that point use disintegration and widening to improve the progressions to make it progressively conspicuous.

IV. Results and Discussion:

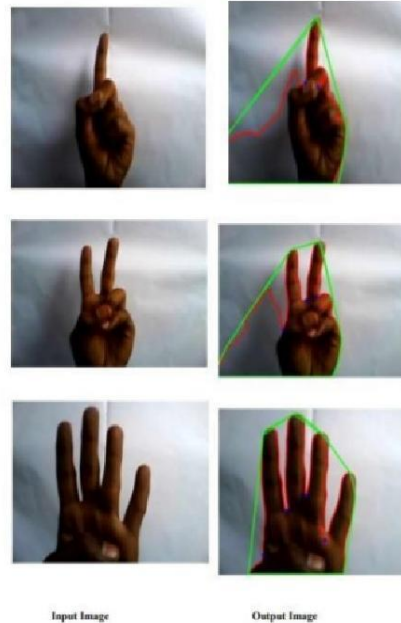


Fig.4. result images

The final bot model is shown in Fig 4. The bot consists of Raspberry PI with Windows running on it. The Logitech USB camera is fixed to the front to capture hand gestured images. Based on defects, the bot moves forward, backward, spins clockwise and anticlockwise.

VII. CONCLUSION:

The idea is to build a robot which can be controlled using fingers and manoeuvre it wirelessly. With this project two goals are achieved and are now able to control it through fingers control robot is a stepping stone of success for the implementation of this algorithm to a fire detection Compact size of Raspberry Pi, more reliability, usage of image processing and avoiding the usage of laptop/notebook pc is an added advantage to this technique. Using this technique it is possible to control the robot using frames taken as input and manoeuvre it accordingly. This work can be further extended by taking the input as a sequence of frames i.e., by capturing video and manoeuvre it respectively. In summary, this technique

can replace the existing remote controlled and voice controlled technologies in an economical way.

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