“IOT Based Robotic Arm Control Using Raspberry Pi”

DISSERTATION-I

Submitted in partial full filament of the requirement for the award of the

Degree of

MASTER OF TECHNOLOGY
IN

(EMBEDDED SYSTEM)
By

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Under the Guidance of

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(APRIL-2018)

CERTIFICATE

This is to certify that the Dissertation titled **"IOT Based Robotic Arm Control Using Raspberry Pi "** that is being submitted by **ASHOOTOSH SHARMA** is in partial fullfilment of the requirements for the award of **MASTER OF TECHNOLOGY DEGREE**, is a record of bonafide work done under my /our guidance. The contents of this , in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma and the same is certified.

Mr Swapnil Bagwari,
Project Supervisor,
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DECLARATION

I**, Ashootosh Sharma**, student of **Master of Technology in Embedded System** under Department of **Electronics and communication engineering** of Lovely Professional University, Punjab, hereby declare that all the information furnished in this Dissertation report is based on my own intensive research and is genuine.

This thesis does not, to the best of my knowledge, contain part of my work which has been submitted for the award of my degree either of this university or any other university without proper citation.

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ABSTRACT

Robotics has useful features and scope in our day to day life. It can make our life easy and fast. But in real life interaction between man and robot like household or workplace creates a new question about the controlling the robot. It is quite impossible to command a robot through a keyboard or interfaces like this. The problem can be solved by using operating system like raspberry pi and also by using IOT. Raspberry pi has the fastest processor (CPU: quad core 64-bit arm cortex A53 clocked at 1.2GHz) than other processors IOT makes robotic vehicle able to control through internet from any where. IOT based vehicle has a web camera and a robotic arm mounted on it which can pick and place. Python is used as programming language to control the robotic vehicle movement as the input is send to the robotic vehicle i.e. key is pressed, robotic vehicle moves accordingly and we get the video feedback on our pc.

LIST OF ABBREVIATION

DOS disk operating system
SoC system on chip
CHI computer human interface
HMI human machine interface
USB universal serial bus
RIA Robotics Institute of America
DTMF dual tone multiple frequency

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1. INTRODUCTION

A robot is a machine guided automatically capable of operating by itself. Other common feature is that with their presence or movements a robot often expresses an intended emotion or agency the Robotics Institute of America (RIA) defines a robot as “reprogrammable multifunctional manipulator”, which allows materials, parts, tools or special tools designs to move.

“RIA”subdivides the robots into four classes: tools that use objects with manual control, automated devices that use objects with pre-established cycles, programmable and controlled by all robots with constant path from point to point, and the last type that receives information of the environment. In industry robotics is a step beyond mechanization. The robot plays an important role in world economy and progress. Engineers try to combine robots with mathematical and organizational tools by using various applications to builds complex systems for rapidly growing range of activities. Many of these roles are currently outside the framework of the general automation robot. The man machine interface (HMI) or the human computer interface (CHI), which was known previously as a man machine interface, generally to communicate with the computer. They are employed to control temperature and pressure in automatic systems. But complex work patterns such reorganization, restructuring of speech require human experience. The robotic arm is an automatic manipulator which is easily programmable and controlled by the original voice command or through keypad/mouse.

In the purposed system raspberry pi is used as controller and to get the information of real world camera and ultrasonic sensors are used to detect obstacle. This vehicle control system is used will help in reducing accidents that happens on the road. Ultrasonic sensors are used to detect the obstacle in the path of vehicle and camera is used give information about the red signal and speed limit sign board etc so if the driver makes the mistake there will be no accidents because system will reduce automatically the speed of vehicle or forcibly stop the vehicle.

2. LITERATURE SURVEY

M. Meena 1, P. Thilagavathi (2013)

The surveillance robot is widely used in mostly applications like industrial application (automation), home automation, hospitals, space exploration; military (defence) etc for this purpose continuous surveillance is required. In this study automatic docking system (ADS) is purposed with recharging and battery replacement process. The robot can return ADS whenever battery is low. The charging duration is important regarding this to overcome this difficulty battery replacement is a better solution. The robot can come to ADS when battery is low and get replaced with new battery within 30 seconds, so that the robots need not to be turned off whenever replacement is there. System design can work in three modes: (1) patrolling mode (2) first response modes (3) remote control mode whenever voltage level of ion battery is below the threshold level a message is sent to docking station. After receiving message robot automatically moves to the docking station. There are two units to check whether the robot enters to docking station, one is I sensor and other is electrode unit on the oscillating bar. With this design it only takes 30 seconds to accomplish the battery exchanging process. [1]

K.Aruna, A.Sri Ramsagar, G.Venkateswarlu(2013)

Robot is controlled by a mobile phone that makes a call to the mobile phone attached to the robot. In this call if any key is pressed corresponding tone is heard at the other end of the call by using dual tone multiple frequency (DTMF). The robot perceives the DTMF tone with the help of phone stacked in it. The received tone is processed by the atmega32 microcontroller with the help of DTMF decoder MT8870. Decoder decodes the DTMF tone into its equivalent binary digit and this binary digit is send to micro controller. The microcontroller is pre-programmed to take decision for any input or output to motor drivers for forward, backward motion or return. The primary function of the mobile operated robot with DTMF decoder is to move that places where man can't move. The robot perceives the DTMF tone with the help of phone stack in the robot. [2]

Mayank Dharaskar, Vatan Gupta, Priyanka Kale, Reeta Chopade, Aayush Jaiswal, Prof. Sharadkumar Ghadale (2016)

This study is base on IOT based robotic car which uses raspberry pi, USB camera, two dc motors and robotic chassis to built this robotic car setup. It has a web camera mounted over it, through which we can get live video feedback and interesting part is one can control it from the web browser using internet. A page is built in HTML which has left, right; backward, forward links by clicking the links one can move it in any direction. Two terms are used one motion and other flask motion for getting live video signal from USB camera and flask for sending commands to raspberry pi using python to move the robotic vehicle. The web cam will capture the live data and then send to desired device through internet and the user will be observing this data on the monitor at the users end.
L298N motor driver can control two dc motors at a time so it is easy to use it. SSH is secured shell without it raspberry pi wouldn't be detected by windows. With the help o raspberry pi the range of operation of robotic car is not limited it can remote large areas. One can easily control as well as monitor the activity of the robotic unit. [3]

Dr. Shantanu K. Dixit, Mr. S. B. Dhayagonde (2014)

This study helps us to detect living bodies with the help of PIR sensor and to control the robot with the help of internet. The camera mounted robot is able to move horizontally and vertically around its vertical axis. Camera movement is controlled through the webpage by the user and providing with enhanced view of the surroundings. PIC 16F877 is used for controlling dc motors which is used for collecting data from PIR sensor for detecting living being. This technology gives helping hand to our security forces for detecting intruders. Also, used in finding the injured persons during disasters such as earthquakes, collapsing of buildings, in mining fields and can be used as a spy robot. [4]

Aaruni Jha, Apoorva Singh, Ravinder Turna, Sakshi Chauhan (2015)

This is RF based spying robot attached to wireless camera that can reduce human victim. This robot sends signal to the base station using wireless camera. Android phone is used to control the movement of the robot. The robot sends the signal to RF receiver mounted on the robot via RF transmitter at the base station, with this feature robot can transmit real time videos with night vision capabilities and can't be identified by the enemies. It uses 8051 microcontroller which controls the motor and wireless camera as well as receiver and transmitter unit. The aim of the paper is to view things accurately that are happening in the surrounding area, to all this control is needed where controls RF signals are used. By using this signal encoding is done and signal is sent to the transmitter which gives input to drive the motor it is used as short distance spy robot. [5]

Md Norozzaman Jiko, Mahmudul Hasan Shayket, Ashraful Ghani Bhuiyan, and Golam Rabby (2016)

This paper represents rescue robot which can run on any rough surface including staircase. It can also floats on water as well as dive under water. IOT based rescue robot uses new technology which makes it unique. As it is IOT based so it can be easily monitored by android or computer. For sensing environment various sensors are installed in it. Its flexible structure provides it to be modified and updated for expanding it to be used in various applications. There are six wheels in total, using V-belt as tank tracks, made from ebonite sheet (wheels).three servo motors and six dc motors are used. Arduino controller is used to control the motors. A Bluetooth module HC-05 is connected with Arduino controller to communicate with the smart phone. Temperature sensor, pressure sensor, humidity sensor and gas sensor are connected with Arduino controller to sense the environment. Two Li-Po batteries are used one for driving motor and other for powering the Arduino controller. Two android phones are used one placed at the front and other inside the robot. In this amphibious robot smart technologies are used for communication via internet. It can run on the rough surface, staircase, underwater and on water. [6]

Kena Patel and Bhavna K. Pancholi (2017)

This project is designed to develop a fire fighting robotic vehicle using android application. Robotic vehicle is loaded with water tanker and a pump which is controlled by wireless communication to sprinkle water to extinguish fire. An AVR Atmega-32 is used for desired operation. Remote operation is achieved by any smart phone/tablet etc with android OS, upon a GUI based touch screen operation. Android is using XML and functioning is defined in JAVA . It has mainly two modules (1) navigating module (2) fire extinguisher module. Navigating module (transmitter) is used to navigate robotic vehicle, it consists of android phone with android application. Fire extinguisher module is a whole fire fighting robotic vehicle (receiver) which has water sprinkler to extinguish fire. Next part of fire extinguishing module is to detect flame which

detects flame near to robotic vehicle. Feature of obstacle detection is added which is use to protect the robotic vehicle from obstacle. Upon both of above inconvenience alert is given the form of buzzer. The developed system decreases risk factor involved in job of fire fighting. [7]

Satish Kumar Ojha, Vishal Singh, Priyank Sharma, Swaraj Dash (2017)

This is a system for unmanned mission which will help in exploration of viable planetary options that can support human life. The project has two robotic systems: base station and rover the base station is already docked on the planet and rover is unmanned mission sent to planet. It involves wireless communication between two systems. This automated technology helps in reducing risk of human lives but also reduces cost of space mission. Base station is coded with embedded c upon Arduino IDE when base station boots up it connects to the wifi network under MQTT broker hosted by raspberry pi. An input supply of 5V and 2A is provided to raspberry pi from 6000 mAh powerbank operating for two hours. Camera on pi draws a power of 1250 mw. [8]

Supantha Mandal, Suraj Kumar Saw, Shilpi Maji,Vivek Das , Sravanth kumar Ramakuri, Sanjay kumar (2016)

This paper focus on path following two wheeled compact portable robot using Arduino as central driving functional unit with wifi control and Bluetooth module with collision detection avoidance and control features which provides unique ability of danger avoidance , falling from a height with improved stability and precision control. The design is integrated with infrared sensors, bluetooth module, and wifi module control with dc gear motors which controls the speed of vehicle and avoid collision in the path of the robot. A low cost robust portable design using GUI control has been implemented with advanced features which makes it very unique and attractive for commercial productions. [9]

Kevin I-Kai Wang, Opender Singh, Eu-Lee Teh, Kean Aw (2016)

This study seeks to address the issues by developing an untethered unmanned ground vehicle with a multitude of sensors to map its 3D path coupled with GUI to fascillate two way communications with raspberry pi micro controller. In this paper wireless communication is achieved by TCP over a wifi connection. Dead reckoning has been used as a technique to process proprioceptive sensor data. The raspberry pi is an OTS (open testing data) was chosen as microcomputer for this study because of its superiority. Motor controls are done with the help of python script which uses motor controller and sensors onboard vehicle. In the following research a prototype of 3D terrain mapping vehicle that can make its own path was successfully developed using off the shell components. A sensible 3D path of vehicle was successfully constructed by combining multiple sensor data including odometry, pitch angle and heading of the vehicle. [10]

Mohammad Salah Uddin and Mario Gianni (2017)

This study introduces a long range internet connected robot teleoperation system based on internet of things (IOT). The aim of study is to support operators during remote teleoperation of robotic systems in situations where operators loose connections due to damaged caused to that particular vehicle. IOT allows connecting remote and mobile things or machines. It also assets through the use of wireless communication and low cost sensors, computing and storage devices. System architecture consists of a pioneer 3AT mobile robot endowed with a notebook computer. It is connected to computer via USB serial port. The notebook is connected to internet via 4G modem. Internet connection is also mandatory since we are interesting in controlling robot via

IOT. On top of ROS architecture an application that receives command from IOT cloud and convert them to velocity commands for robot. It reduces the cost of deployment currently it moves blindly to some extent. [11]

Mr. Lokesh Mehta, Mr. Pawan Sharma (2014)

This paper reveals it as a spy robot which is controlled by keyboard of the computer. It can give live telecast of audio and video signals from surroundings and can be sent to remote station by RF signal and also able to give signal whenever there is darkness in the surroundings because it has extra circuitry which detects darkness and automatic flash light is on. Its maximum range is 200 meters. When a key is pressed from the keyboard of monitor it firstly converts the signal into machine language by Arduino board through USB port represents it as cmos logic. Now signal from Arduino board is converted into RF signal by RF module. At the remote section signal is received from RF module in the form of radio frequency which is converted into binary. From RF module, signal is transmitted to microcontroller, which makes the decision according to command described in programming. Ultrasonic sensor detects the distance and data sent to microcontroller output is generated as per decision of the microcontroller and display on LCD(16x2) and also displays on LCD monitor and LDR detects the light using microcontroller makes a decision either flash light is off or on. Following favourable results are based on robot as live telecast, night vision, obstacle detector and distance measurement. [12]

Mohammed Rubaiyat Tanvir Hossain,Md. Asif shahjalal, Nowroz Farhan Noor(2017)

In this paper web controlled partial robotic vehicle system is purposed. The idea is to control a robotic vehicle from any where through Internet over a secured web server. The main purpose is to minimise the risk of human life and ensure high safety during drive. The car can be remotely control through Internet using web server, in case of no connectivity it can act autonomously depending on good weather condition. Purposed study consists of complex computer vision algorithms and live transmission of video with the internet. Raspberry Pi and Arduino are used to built this prototype. Raspberry Pi streams the video to internet. A user can access the streaming video through internet. Although Raspberry-Pi is a powerful tool yet we need more powerful tool to implement this idea on a real car. [13]

3. HARDWARE COMPONENTS

3.1 Raspberry Pi

Raspberry pi OS is used for making robot wireless and web based. Web cam is interfaced with Raspberry Pi and then videos are transmitted wirelessly from the robotic vehicle to the user's monitor, from where the user can conveniently control the robotic arm movement and also the robotic vehicle movement. Raspberry pi is connected with the wi-fi which enables raspberry pi to transmit signal over the web network .Raspberry pi uses SD card for memory and booting because it doesn't have inbuilt storage. It is powered through USB cable and requires 5V power supply and 700-1000 mA current. It operates at 1.2 GHz. Python is used as a programming language to write code into Raspberry pi.

3.1.1 INTRODUCTION TO RASPBERRY PI

Raspberry Pi is low cost credit card sized single board computer. It packs enough power to run games, word processor like open office, image editor like Gimp and any program of similar magnitude. Pi is based on a Broadcom SoC (System of Chip) with an ARM processor, a GPU and 256 to 512 MB RAM. It uses SD card for booting because it has no hard disk for storage, SD card reader is used to image the OS system. 5V power supply is needed through USB cable, displays information on TV/monitor with DVI /HDMI port, HDMI cable or HDMI to DVI converter cable is used as display connector, USB mouse/keyboard is used as input, Ethernet cable is used as network connector.

3.1.1 Raspberry Pi-3

Raspberry Pi-3 is third generation of Raspberry Pi. It replaced the Pi2 model of raspberry pi. It has following inbuilt features:
*802.11n wireless LAN
* 1.2 GHz ARMv8 CPU
*Bluetooth
* 1 GB RAM
*40GPIO PINS
*Ethernet port
*Full HDMI port
*Camera and Display interface
The raspberry pi 3 has indistinguishable frame variable to the past pi2 (pi1model b+) and has finish similarity with pi1 and pi2. We prescribe the pi3 module b for use in schools or for any broad utilize those who wish to install their pi in a venture may incline towards pi zero or model A+ which are more useful in inserted activities and tasks which requires low power.

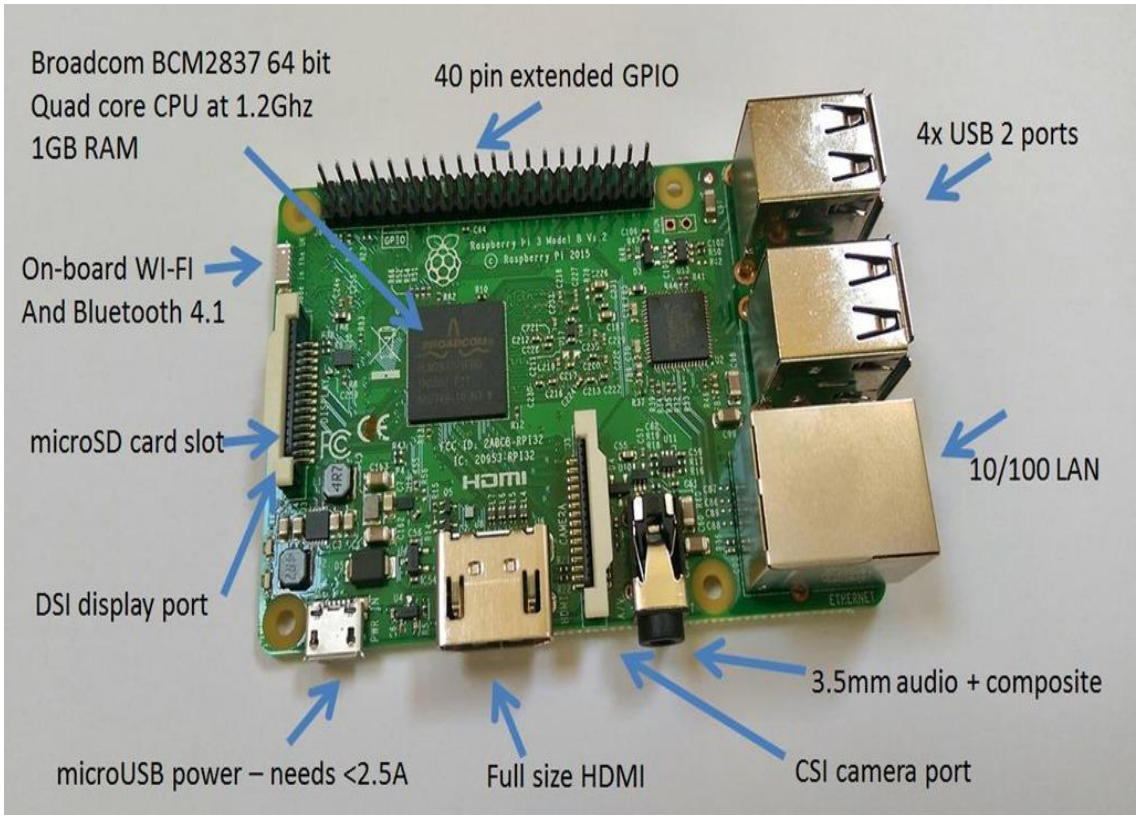

Fig. 1 Raspberry Pi-3

The Raspberry Pi 3 GPIO Header

Pin#	NAME	Connection		Connection	NAME	Pin#
01	3.3V			**5V** (Powerboost)	5V	02
03	GPIO 2			**5V** (Cupcade)	5V	04
05	GPIO 3			**GND** (Powerboost)	Ground	06
07	GPIO 4	**START**			GPIO 14	08
09	Ground	**GND** (Cupcade)			GPIO 16	10
11	GPIO 17	**UP**		**SELECT**	GPIO 18	12
13	GPIO 27	**DOWN**		**GND** (Select/Start)	Ground	14
15	GPIO 22	**LEFT**		**RIGHT**	GPIO 23	16
17	3.3V			**A**	GPIO 24	18
19	GPIO 10	**B**		**GND** (ABXYR)	Ground	20
21	GPIO 09	**X**		**Y**	GPIO 25	22
23	GPIO 11	**L Shoulder**		**R Shoulder**	GPIO 08	24
25	Ground	**GND** (L)			GPIO 07	26
27	ID_SD				ID_SC	28
29	GPIO 05				Ground	30
31	GPIO 06				GPIO 12	32
33	GPIO 13				Ground	34
35	GPIO 19				GPIO 16	36
37	GPIO 26				GPIO 20	38
39	Ground				GPIO 21	40

FIG. 2. GPIO PINS OF RASPBERRY PI-3

The features of the RASPBERRY PI 3 model b are discussed below:

CPU	QUAD CORE 64-BIT ARM CORTEX A53 Clocked at 1.2GHz
GPU	400MHZ VIDEO CORE IV MULTIMEDIA
MEMORY	1GB LPDDR2-900SDRAM (900MHz)
USB	4
VIDEO OUTPUTS	HDMI COMPOSITE VIDEO(PAL &NTSC)VIA 3.5mm JACK
NETWORKS	10/100MBPS ETHERNET &802.11n wireless LAN
PERIPHERALS	17 GPIO PLUS SPECIFICATION FUNCTION & HAT ID BUS
BLUETOOTH	4.1
POWER SOURCE	5V Via MICRO USB OR GPIO HEADER
SIZE	85.60mmX56.5mm
WEIGHT	45g

TABLE 1 FEATURES OF RASPBERRY PI

3.2 Robotic arm

It should have three DOF along with a gripper. The gripper will pick and place by means of the gear wheels. The base rotates in circular direction and the other two joints for upward, downward and forward, backward motion respectively. There is no limit to the movement each joint can produce since each joint is controlled by a DC motor.

3.3 Web camera

The visual feedback is provided by the Intex IT-306WC web cam. It can have a resolution of up to 30.0MP, Frame rate of 30FPS along with night time vision. It is plugged into the USB port of the Raspberry Pi**.** The camera module is used to take videos as well as it is used to take images or photographs. It is easy to interface with raspberry pi. Since it is USB camera so we can easily interface it with raspberry pi where 4 USB ports are available. There are multiple libraries available for camera interface to make it easy to use. The camera module works with all module of raspberry pi. Camera is basically used in this system to take real world images and helps in determining the red signals and sign board.

3.4 Motor driver circuit

This circuit consists of the motor driver IC l293d used to power the DC motors. These DC motors will be used to control the robotic vehicle. L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state. The pin diagram of l293d is as:

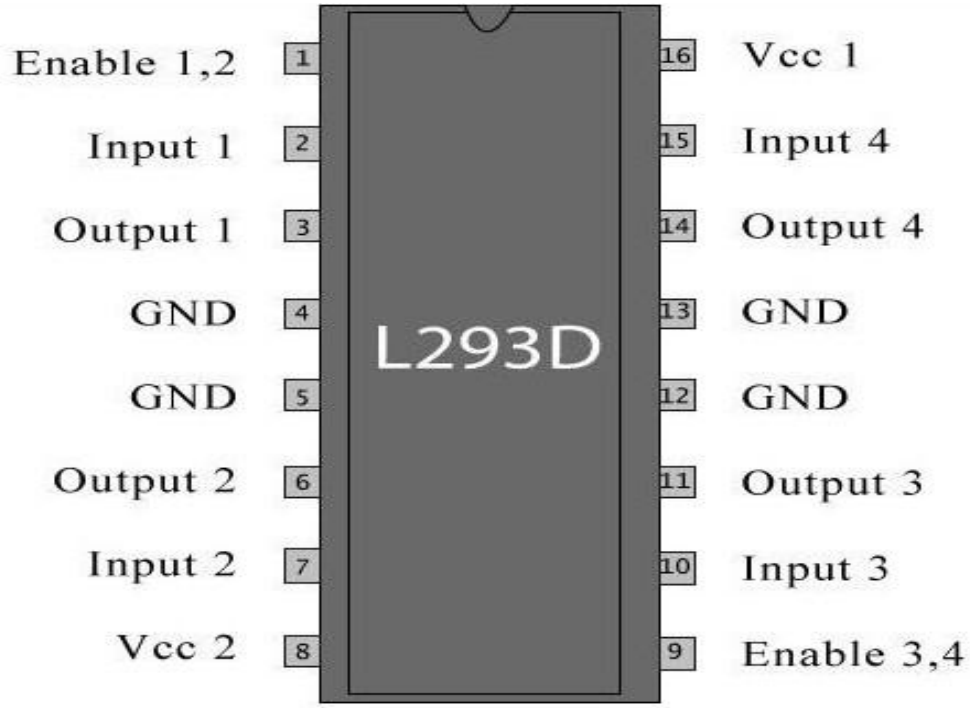

Fig. 3. Pin diagram of motor driver

Pin description of motor driver is as:

Pin No.	**Function**	**Name**
1	Enable pin for Motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 1
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors; 9-12V (up to 36V)	Vcc 2
9	Enable pin for Motor 2; active high	Enable 3,4
10	Input 1 for Motor 1	Input 3
11	Output 1 for Motor 1	Output 3
12	Ground (0V)	Ground
13	Ground (0V)	Ground
14	Output 2 for Motor 1	Output 4
15	Input2 for Motor 1	Input 4
16	Supply voltage; 5V (up to 36V)	Vcc

TABLE 2 PIN DESCRIPTION OF MOTOR DRIVER

3.5 Software design

Python programming is used here. Software design is divided into 4 codes namely:

3.5.1. Web cam Server

Web cam Server is the code run in the Raspberry Pi to capture the images and stream them over the internet. Here the images will be compressed into .jpg format to reduce their size prior to their transmission over the internet. They are sent using byte array over the UDP socket.

3.5.2. Web cam Client

Web cam Client is the run in by the user to receive these images in the form of byte array. They are then displayed on the monitor at a rate closer to 12-20 images per second so that they appear like a continuous video.

3.5.3. Motor Server

Motor Server is run by the user. Monitoring the video, the user maneuvers the robotic vehicle or the robotic arm accordingly. This is done by accepting input either from the keyboard or the webpage. It is done by checking the key press events.

3.5.4. Motor Client

As per the input from the user, either the robotic vehicle or the robotic arm move. This is done by making High or Low the desired GPIO pins of the Raspberry Pi. 4 GPIO pins are connected to the 4servo motors and 4 to the motor driver IC l293d

3.6 Flow chart

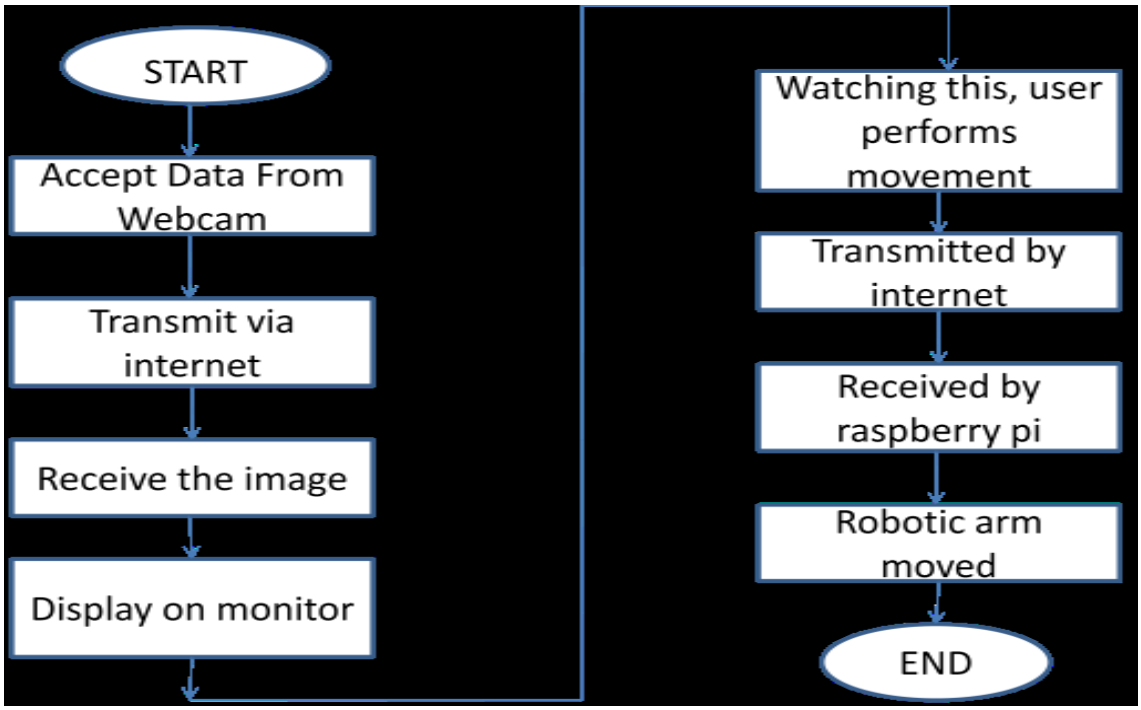

Fig. 4. Flow diagram of the robot controlling program

The flow chart is shown in Fig. 3. It explains how the actions will take place here. Then, the initial stage is to capture the data with the help of a web cam. Then, that data will be transmitted next to the monitor. According to the situation presented, the user will take the necessary measures, such as picking up or placing any object or the movement of the vehicle. But it will be

in terms of signals, which will be transmitted through the Internet. When these signals are received by the raspberry pi placed in the vehicle, the robotic arm and the vehicle will move accordingly. Again, the web cam will capture and send images to the user to take action. This cycle will continue.

3.7 Python

Python is a broadly utilized abnormal state programming dialect for universally useful programming, made by Guido van Rossum and first discharged in 1991. A translated dialect, python has an outline theory which underlines code coherence (quite utilizing white space to delimit code squares as opposed to wavy props or catch phrases), and a sentence structure which enables developers to express ideas in less lines of code than conceivable in dialects, e.g. c++, java. The dialects gives builds planned to empower composing clear projects on both a little and expansive scale.

3.8 OpenCV

OpenCV (open source computer vision) is a library of programming capacities for the most part gone for ongoing pc vision. Originally created by Intel's exploration focus in Nizhniy Novgorod (Russia), it was later upheld by willow garage and is presently kept by Itseez. The library is cross-stage and free for use under the open source BSD permit.

3.9 Hardware Overview

Hardware consists of constructing a robotic vehicle first, then by the help of the program (written on python) an Internet connection was established between the robot vehicle and the user. Then, the robot captures images using web cams and stores them in memory.

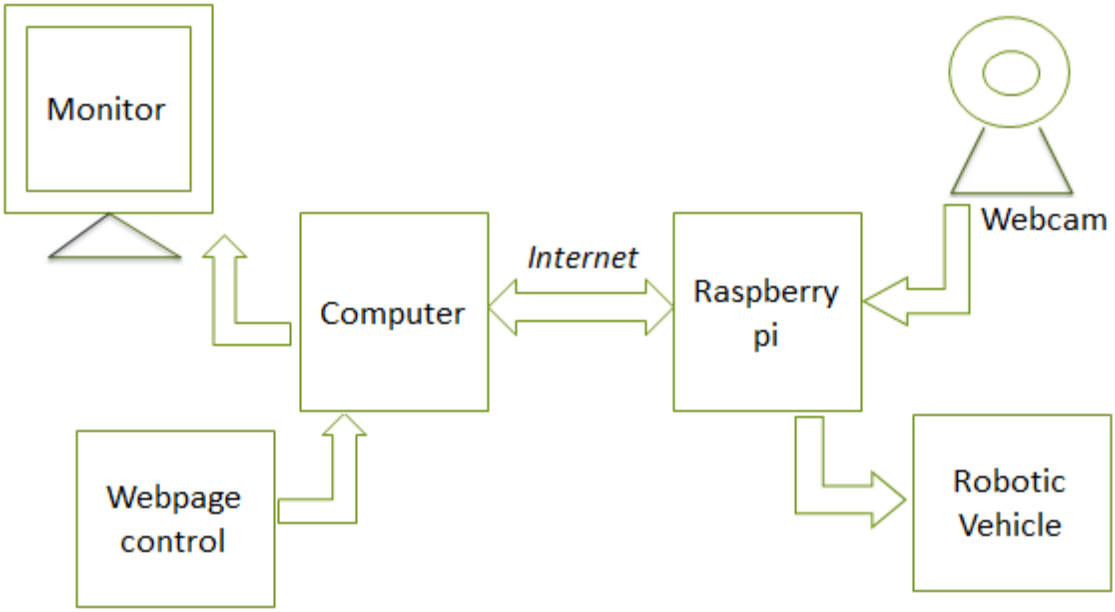

Fig. 5. Block diagram of robotic control vehicle [13]

The other task is to capture and send live images on the Internet so that it has enough rhythm to make it look like a live video for human eyes. Initially, it was implemented using the LAN before going to the Internet. The desired result was achieved by sending low resolution compressed images so that the high loading speed is not available, the transmission is not affected. Then, the program became more dynamic by separating the resolution of the images sent at that particular time according to the available loading speed. For example, in the case of the availability of good loading speeds, images of higher resolution will be sent and vice versa, in case of low loading speed resolution is less.

4. BROAD AREA AND PROBLEM FINDING

Embedded system is a system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today. Modern embedded systems are often based on microcontrollers (i.e. CPUs with integrated memory and/or peripheral interfaces) but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also still common, especially in more complex systems. In either case, the processor(s) used may be types ranging from rather general purpose to very specialised in certain class of computations, or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP).
In this project we use internet to establish communication between the user and a robotic vehicle. This is a reliable connection and a continuous video feedback is available to control the robotic vehicle. Due to the use of internet, there is no limitation on range or distance between the user and the robotic vehicle. There are many surveillance robots which can monitor the particular area having limited range and but by using IOT, increases the area it surveys. Also, by using raspberry pi processing speed becomes high and correspondingly increases its processing time.

Problem finding

Our aim is to control the robotic arm vehicle based on IOT using raspberry pi. Raspberry pi is used to make the robotic arm vehicle wireless and web based. Web-cam is interfaced with raspberry pi and then the videos are transmitted wirelessly to the observer (user's monitor) from where the user can control the robotic arm vehicle movement. Raspberry pi uses 5V power supply through USB and a current of 700-1000 mA clocked at operating frequency 1.2GHz (depending on Pi model). As raspberry pi has no inbuilt storage so we use an SD card for booting purpose. It uses python for writing code to raspberry pi. Also, we use image processing in the robotic arm vehicle which reads the text from the obstacle send it as an image to the user's pc which can take the necessary action.

5. REFERENCES

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[3] Mayank Dharaskar, Vatan Gupta, Priyanka Kale, Reeta Chopade, Aayush Jaiswal, Prof. Sharadkumar Ghadale "IOT Based Surveillance Robotic Car Using Raspberry PI"

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[6] Md Norozzaman Jiko, Mahmudul Hasan Shayket, Ashraful Ghani Bhuiyan, and Golam Rabby "Design and Implementation of Amphibious Smart Rescue Robot"

[7] Kena Patel and **Bhavna K. Pancholi** "A Novel Fire Extinguishing Robotic Vehicle Controlled by Android Application"

[8] Satish Kumar Ojha, Vishal Singh, Priyank Sharma, Swaraj Dash "Navigating a Terrain Using Raspberry-Pi and Node MCU"

[9] Kevin I-Kai Wang, Opender Singh, Eu-Lee Teh, Kean Aw " **3D terrain mapping vehicle for search and rescue"**

[10] **Mohammad Salah Uddin and Mario Gianni** "Long Range Robot Teleoperation System based on Internet of Things"

[11] **Mr. Lokesh Mehta, Mr. Pawan Sharma** "SPY Night Vision Robot with Moving Wireless Video Camera & Ultrasonic Sensor"

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[13] Mohammed Rubaiyat Tanvir Hossain, Md. Asif shahjalal, Nowroz Farhan Noor "design of IoT based autonomous vehicle with the aid of computer vision**"**

[14] Md. Abdullah Al Ahasan, Md. Abdul Awal and Sheikh Shanawaz Mostafa "*Implementation of Speech Recognition Based Robotic System"*

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