Real time Image Processing based Robotic Arm Control Standalone System using Raspberry pi

P.Hemalatha[1], C.K.Hemantha Lakshmi[2], Dr.S.A.K.Jilani[3]
[1]M.Tech student,[2]Assistant Professor, [3]Professor, Department of Electronics & Communication Engineering, MITS, Andhra Pradesh, India.

Abstract

This paper proposes Realtime Image Processing based Robotic Arm Control Standalone System using Raspberry pi. In the present era we made a robot capable of surveillance and also with an alternate application in detecting and following a pre specified object. The detection and recognition has been done using open CV library. The whole code for Object detection written in MATLAB. And this all processing has been done on raspberry pi which works on Raspbian OS based on Debian which is Linux OS.To program the controlling of one arm robot using Raspberrypi for the identification of objects and tracking object operations without any manual control.The total programming model is developed in MATLAB. Simulink support package for raspberrypi hardware. The program includes capturing the object image, processing, identifying the green object and controllingof robot armby using Raspberry Pi.

Keywords - *Raspberry pi, Robot Arm,MATLAB,Simulink.*

I. INTODUCTION

We made a robot capable of surveillance and also with an alternate application in detecting and following a pre specified object. The detection and recognition has been done using open CV library. Raspberry pi has more useful in real time projects. Raspberry pi has small sized pc board The main aim of project is to make a mobile, wireless robot capable of following a pre specified object and also can be used as a surveillance robot Raspberry pi has found its way in major in number of useful and versatile applications in robotic systems Raspberry pi hardware is low cost which does not implement any usual motor control peripherals in raspberry pi hardware. The whole code is written in MATLABthe coordinates of the objects on a platform found with open CV on raspberry piImage is acquired by the camera. Raspberry pi converts the color image to a greyscale image.Computer vision is focused on motion analysis of robot arm revealed that gesture can be characterized based on four different aspects: shape, motion, position and orientation

II. IMPLEMENTATION

Raspberry pi is used as processing hardware with raspbian OS. The whole code for object detection written in MATLAB. Image processing will be taken care by the open CV libraries. By using the raspberry pi the image processing is based on the robotic arm control for pick and place desired object operations.

The implementation process of the proposed work is done in two steps

- Hardware Implementation
- Software Implementation

A. Hardware Implementation

The hardware requires Robot Arm, RPI Camera, Raspberrypi, Relays, and Power Supply. The below figure shows the Proposed System.

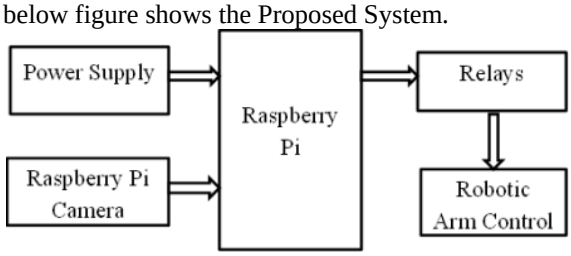


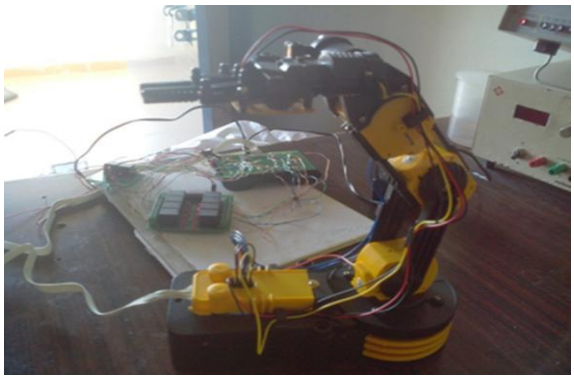
Figure: 1. Proposed System

A. Raspberrypi(Model B+):

Raspberry pi (model B+) is used in our model. Raspberry Pi has small sized pc board with Linux or othersmall operating systems. It was developed by foundation of Raspberry Pi in UK for the use of computer science education. The second version of the Raspberry Pi is used in this project. It consists of an ARM 1176JZF-S processor, which runs at 700MHz clock speed, 512MB SDRAM shared with GPU, a Video Core IV GPU, 2 USB port, 1 100 M bit/s Ethernet port, one video and audio output, one HDMI output. It also has 26 pins including 8 General purpose Input/output (GPIO), one SPI bus, one I2C bus, one UART bus and 3.3V, GND and 5V.The Raspberry Pi needs an external Secure Digital(SD) card to store its operating system and also all the user data.

Hence the Raspberry pi can be used as a really powerful microcontroller which can accomplish almost any functions, and also it can act as a normal use computer with keyboard, mouse and monitor connected.

B. Robotic Arm:



Robotic arm is just like a human arm which is made of five servo motors which will have different configuration of mechanical motion; most of the outer phase is made of plastic parts. The features of robot are functional gripper, base, base rotation, elbow, and wrist motion. The 5 motors operate the grab, release, lower and lift.

Maximum lift: 100g.

Dimensions: 9” L* 6.3”W*15” H

Weight: 658g

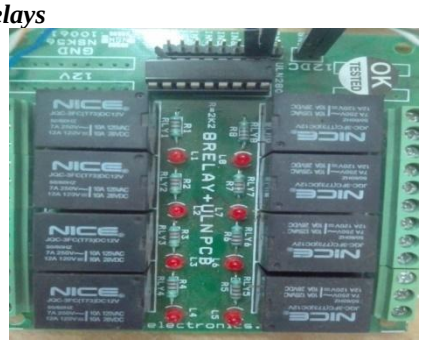
C. Power Supply

The power supply on the raspberrypi is quite simple.It uses a Micro USB connection to power itself. The power source used for the device is a 5200mAh external battery for smart phones and tablets.

D. Raspberrypi NoirCamera:

The Raspberrypi noircamera gives everything the regular camera module. Only one difference (NOIR=No infrared) this means that ability to see in the dark with infrared lighting. Raspberry pi noir camera directly plugs into the Camera Serial Interface (CSI). It’s able to deliver a clear 5 mega pixel resolution image or 1080p HD video recording at 30frames/sec.

E. Relays

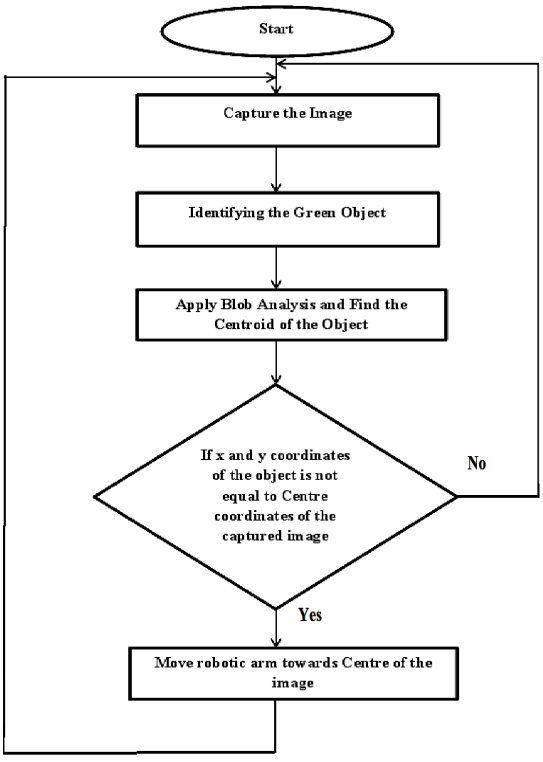


A Relay is acts as a switch. The advantage is that a relay is normally cheaper and easier to replace than switch. Relays control one electrical circuit by closing and opening contacts in another circuit.

B. Software Implementation

To program the controlling of one arm robot using Raspberrypi for the identification of objects and tracking object operations without any manual control.In this project MATLAB software and Raspberrypi is used. Total programming model is developed in MATLAB. Simulink support package for Raspberrypi hardware the program includes the capturing the object image, processing, identifying the color of an object and robotic arm control, relays are used.

FLOW CHART:



III. EXPERIMENTAL RESULTS

Lots of experiments have been conducted to control the robot arm using raspberrypi. This is the processing the image and for the identification of green object and to track the green object programming with respect to time and distance by varying threshold value**.** Tabulated the position of green object by noting the time and distance parameters and drawn the graphical representation.

Below figure shows the snapshots of the Object detection and tracked developed and tested in the real environment.

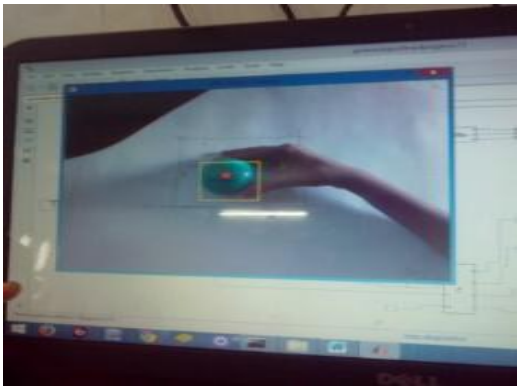
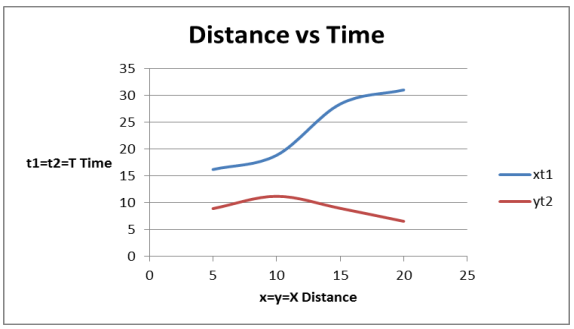


Figure: Detection and tracking of green object

Table:1

Constant Value	x-Distance	Time (t1)	y-Distance	Time (t2)
5	5	16.20	5	8.91
5	10	18.85	10	11.21
5	15	28.40	15	8.96
5	20	31.03	20	6.54

In this graph represents x-distance time(t1)is increasing and y-distance time(t2)is decreasing

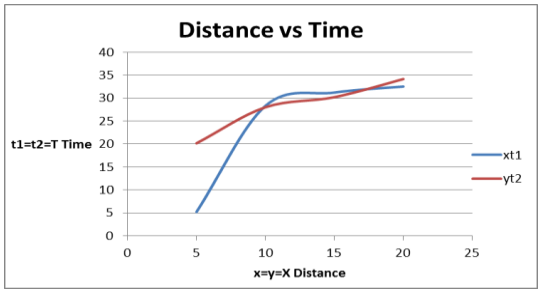


Graph 1: distance vs time at constant value 5

Table:2

Constant value	x-Distance	Time	y-Distance	Time
6	5	11.22	5	24.31
6	10	16.42	10	18.86
6	15	25.53	15	19.22
6	20	31.40	20	35.23

IiIn this graph represents x-distance time (t1)is increasing and y-distance time(t2)is decreasing.

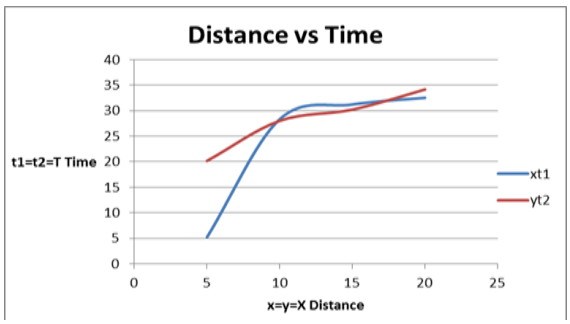


Graph 2: distance vs time at constant value 6

Table:3

Constant value	x-Distance	Time	y-Distance	Time
12	5	32.89	5	8.79
12	10	28.35	10	5.22
12	15	23.96	15	4.40
12	20	22.8	20	3.91

In this graph represents x-distance time(t1)is increasing and y-distance time(t2)is also increasing.

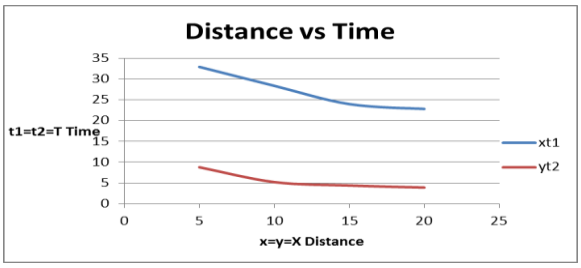


Graph 3: distance vs time at constant value 9

Table:4

Constant value	X-Distance	Time	Y-Distance	Time
9	5	5.20	5	20.15
9	10	28.3	10	28.00
9	15	31.2	15	30.19
9	20	32.51	20	34.14

In this graph represents x-distance time(t1)is decreasing and y-distance time(t2)is decreasing.



Graph 4: distance vs time at constant value 12

IV. CONCLUSION

This proposed solution gives better results while compared with the earlier projects such as efficient image capture. Identification of green object and its motion detection can be done by using this image processing based robotic arm control with the help of raspberrypi.

ACKNOWLEDGEMENT

I extended my sincere thanks to assistant professor C.K.Hemantha Lakshmi and Professor S.A.K.Jilani and also my earnest thanks to Dr.A.R.Reddy, Head of the department of ECE for their support to carry out successful of this research work.

REFERENCES

[1] Dragusu.M,"Practical applications for robotic arm by using image processing" system theory, control and computing (ICSTCC), 2012 16th international conference.

[2] V.Pereira,"Low cost object sorting robotic arm using raspberry pi" Global Humanitarian Technology Conference-South Asia Satellite(GHTC-SAS),2014 IEEE.

[3] C.TheisA.Steinhage andI.Iossifidis ,"Image processing methods for interactive robot control", proceedings 10th IEEE International Workshop on robot and human interactive communication,2001.

[4] Vijayalaxmi,K.Anjali,B.Srujana,P.Rohith Kumar "Object Detection and Tracking using Image Processing" Elecronics and Communications Global Journal of Advanced Engineering Technologies, Special Issue (CTCNSF-2014).

[5] R.Szabo,"Automated colored object sorting applications for robot arms" Electronics andTelecommunications(ISETC),2012 10th International Symposium.

[6] P.Ashish andCharuBhartiya, "Image Processing Based Rose Harvesting System using Raspberry Pi" ElectronicsInternational Journal of Engineering Research & Technology (IJERT)Vol. 4 Issue 04, April-2015.

[7] AartiS.Hajari and SaakshiA.shankarpurkar. "Personal Computer Based Robotic Arm with Vision" International Journal of Image Processing and Vision Sciences(IJIPVS) VOL-1ISS-3,4,2012.

[8] Melwin Abraham C, R.Jegan and Shobhitha Ann JOB "OWI535EDGERoboticArmControlElectroMyoGram(EMG)Signals" International Journal of Innovative Technology and ExploringEngineering(IJITEE)VOL-2,ISS-6,may 2013.