



Image Processing Target tracking Robot using Raspberry pi

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ABSTRACT: The aim of this project is to detect the object and then track it based on the colour or shape of the object. This is a real time visual based project, Images are continuously captured with the help of Pi camera which is located on Robot chassis and is connected to the raspberry pi using RMC connector. It will detect the object of specific colour or shape and then robot tracks that object by moving left or right and forward or backward according to the object movement. It maintains the constant distance between the detected object and robot by using ultrasonic sensor. Image processing is used to capture and calculate the dimensions of frame or moving object image which is captured by Pi camera.

KEYWORDS: Raspberry Pi, Pi camera, Ultrasonic sensor, Color, Image processing, object

I. INTRODUCTION

This Project mainly focuses on the basis to implement the object detection and tracking based on its color and shape. It is a real time visual based project that means input of the project is images or video which is continuously captured with the help of pi camera located on front side of the robot chassis and connected to Raspberry pi with the help of RMC connector. By using this method, we can easily detect and track any object which may be Ball or Book or any instrument, Tools. This project can be used for surveillance purpose in many security applications.

At very first Linux OS is installed into the Raspberry pi board via micro SD card. Micro SD card must be of 8GB because Raspbian OS is of around 4GB. Then the project code is written in Python language for the object detection using Open CV libraries i.e. Open Source Computer Vision is programming functions mainly aimed at real time computer vision. The images captured by pi camera are processed in the Raspberry pi using Image Processing techniques and the center of the object is detected based on the specific colour. Once the object is detected among number of objects, the nearby object is chosen then motor will drive the Robot movement upward-backward or left-right according to the object movement. Robot goes near to the object and maintains the constant distance between robot and object. Ultrasonic sensors are used to avoid obstacles in the way. Three Ultrasonic sensors are used on front, left and right side. When Robot reaches near to the object it beeps the Buzzer and wait for a while then turn to left direction to find next object.

II. RELATED WORK

Previously moving camera was used for object detection and tracking purpose but the result was not accurate and can be used for real time application. Also Arduino along with Image processing technique and Raspberry pi were used for the same purpose but size and weight of object got increased and system became complex.

All the disadvantages of moving camera are overcome in this project using Pi camera and coding also get reduced hence system became flexible. If camera does not provide exact real time output then it became false detection. Image processing Erosion and Dilation techniques were used to detect the specific object.

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

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Vol. 5, Issue 6, June 2017

Table 1 : Literature Survey

Paper	Name of the Paper	Author	Work discussed
IEEE System journal, VOL 9, march 2015	Search, track & kick to the virtual target point of humanoid robot by a neural network based active embedded vision system	Chih-lyan Hwang, Chien-wu Ln	Object tracking using humanoid robot
International journal of trend in research & development, vol 3(3)	Object tracking robot by using raspberry pi with open cv	Department of electrical & electronics engg., avadi, chennai	Raspberry pi kit along with web camera to track colour object effectively
International journal of engineering technology & advanced engineering.	Autonomous ball collecting robot using image processing technique	Sreebudhha college of engg., kerala	Image processing technique using arduino and raspberry pi.

III. SYSTEM DEVELOPMENT

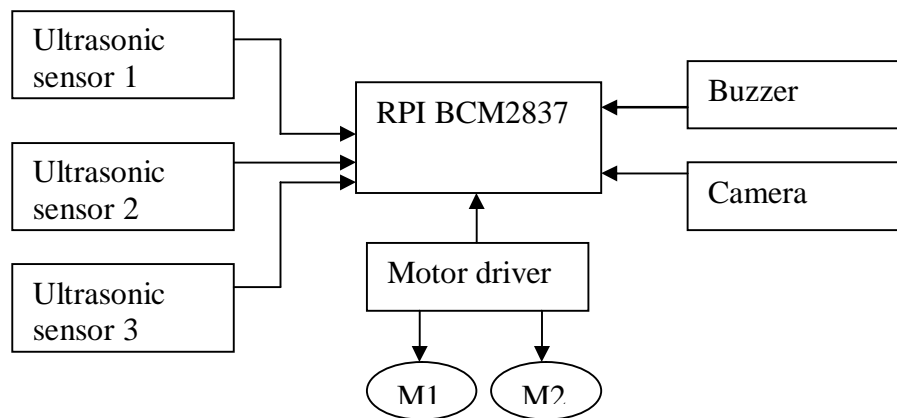


Fig. 1. Block Diagram of the proposed system

Components used-

- Raspberry pi3
- 3 Ultrasonic sensors
- Pi camera
- Buzzer
- Robot chassis
- 2 Motors
- Motor driver ICL293D
- Regulator IC 7805

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Vol. 5, Issue 6, June 2017

Raspberry Pi



Fig. 2. Raspberry Pi

It is single board computer or mini computer consist of BCM2837 64 bit Quad core processor. It operates on 700MHz-1.2GHz. Pi has 1 GB RAM with 4USB ports as CSI(camera serial interface) and DSI (display serial interface).

Ultrasonic sensor



Fig. 3. Ultrasonic sensor

An ultrasonic sensor transmits ultrasonic waves into the air and detects reflected waves from an object. It is used to avoid the obstacles in the way while moving towards object. It works on principle formula

$$\text{Distance} = \text{Time} * \text{Speed}$$

340ms is standard speed. Output of ultrasonic sensor is fed back to Raspberry pi using voltage divider circuitary.

Calculation=

$$V_o = V_{in} * R_2 / R_1 + R_2$$

$$= 5v * 1.5k \text{ ohm} / 1.5 k \text{ ohm} + 1 k \text{ ohm}$$

$$= 3v$$

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Vol. 5, Issue 6, June 2017

Pi camera

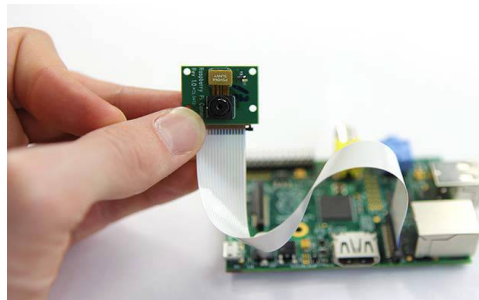


Fig. 4. Pi camera

It is a 5MP Omni vision sensor camera connected to Raspberry pi using RMC connector. It has resolution of 2592*1944 pixel with 30 frames per second. Camera captures the image of object and adjust the center position of object on X-Y plane by moving robot left and right position. It masks the Red colour object and converts RGB to HSV colour format. HSV stands for Hue-colour, Saturation-greyness, Value-brightness.

Power supply

Raspberry pi requires 3.3v. For ultrasonic sensors 5v supply is sufficient using regulator IC 7805, where as motor requires 12v DC supply by external battery.

IV. PERFORMANCE ANALYSIS

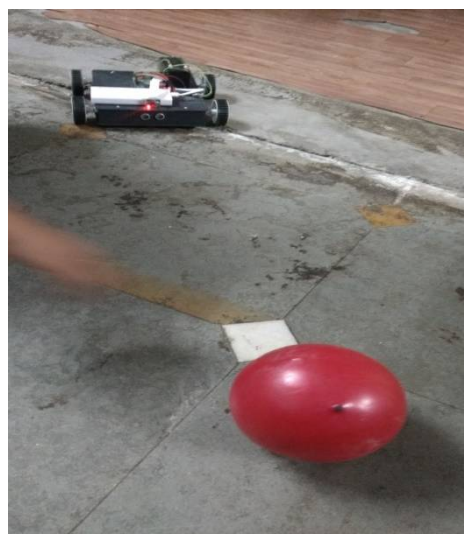


Fig.5. Robot moving towards Red Ball

Image of the object is taken by pi camera which identifies the largest area of colour object. Open CV is used to acquire and analyze the process of digital image and deal with data from realworld to produce numerical information.



ISSN(Online): 2320-9801
ISSN(Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirce.com

Vol. 5, Issue 6, June 2017

According to the object Robot moves forward-backward, left-right position. Buzzer indicates that object is very closed to Pi. When buzzer beeps Robot automatically moves backward and then turn to left direction to find next object.

V. CONCLUSION

The output of the project is tested successfully. The output response of Robot for different object movement was accurate and satisfactory. The objective of the project is to build a system that can detect and track the object of specific colour or shape and that works on the basis of Real time visual data captured by pi camera. The Algorithm is tested and works under all conditions. The Future scope of this work is to develop a robotic arm which can detect, track and pick the object with night vision camera at low cost and which will make a Low cost Real time application.

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