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Autonomous object detection and following robot

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ABSTRACT

The surveillance due to jeopardy has been one of the important aspects in terms of security which is why there have been many solutions designed to encounter it. Surveillance solutions by military services are exquisite and substantial. Battlefield awareness is one of the modern military technique which include various sensors that provide information in terms of pictures of the surroundings. There are many solutions which indicate the presence of enemy. So, the technique of object detection in image processing is used in this project for the purpose of surveillance. The robot is made autonomous so that there would be no need of human intervention. The robot uses raspberry pi camera for image acquisition and raspberry pi board for image processing and laser to shoot if the object is suspicious. Contrary to the traditional methods this autonomous robot has significantly showed a good accuracy in perception of surroundings, decision making and actuation.

Keywords— *Surveillance, image processing, raspberry pi, Object detection*

1. INTRODUCTION

Autonomous robots are very beneficial robots which do not require any human intervention. The function which is done by the robot is the clincher or the cognitive factor that determines how to much extent it can be developed. Autonomous robots that are used for surveillance fall under this category itself. There are many projects that are developed for surveillance in military like 'The Robot Sentry' is one such example which is used for targeting and surveillance purposes in urban areas. Our robot is designed in such a way that it works autonomously, detects objects nearby and processes them, make decisions that are to be followed or actuated by it. So, the main three components of the robot are perception, decision, actuation. Perception is observation of the surroundings, which is achieved through a camera. This acts an eye of the robot. Decision making means processing the images that are acquired through the camera. This is done using raspberry pi and image processing using OpenCV. Raspberry pi acts like the brain of the robot. Actuation is responding to the observations by following the decisions. This is achieved through motors for movement and following, laser to shoot the dubious objects. So, these are like hands and legs of the robot. So, on a whole the robot moves around the place and detects the objects if present and acquires the images of the objects, analyses them and takes the imperative action based upon the analysis of the images.

2. THEORY AND METHODOLOGY



Fig. 1: Raspberry pi board

2.1 Raspberry pi

Raspberry pi is cheap computer which runs Linux and contains GPIO pins which help in connecting electronic devices with it. It is founded and developed by Raspberry foundation in order to achieve complex things using cheaper and easier way than that of

using big computers. It has a microprocessor to process the information it gets through external devices and internal components. It has USB, HDMI ports for connection of hardware devices. A micro-sd slot is available for inserting a memory card containing program files, OS etc. It can be used for various applications like Robotics, IOT, Automation etc. It comes in different memory variants like 1GB, 2 Gb etc.

2.2 Camera

This USB camera is used to acquire images of the surroundings and send them to the raspberry pi board.



Fig. 2: USB camera

2.3 L293D Motor driver and DC motors

L293D motor driver helps in controlling the speed and direction of motors. It can be used to run two dc motors at the same time. Thermal shutdown is done automatically. DC motors are used for the movement of the robot and they come at a different voltage level like 9v, 12v etc. There are motors which run at different rpm. Here 4 dc motors of 100rpm are used.

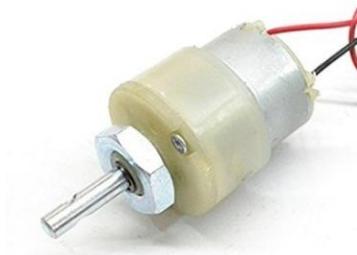


Fig. 3: DC motor 100rpm



Fig. 4: L293D motor driver

2.4 Laser

The laser is project if the object is suspicious. The laser color is determined by the diode which is characterized by the wavelength of the light. It can be blue, green, red etc.



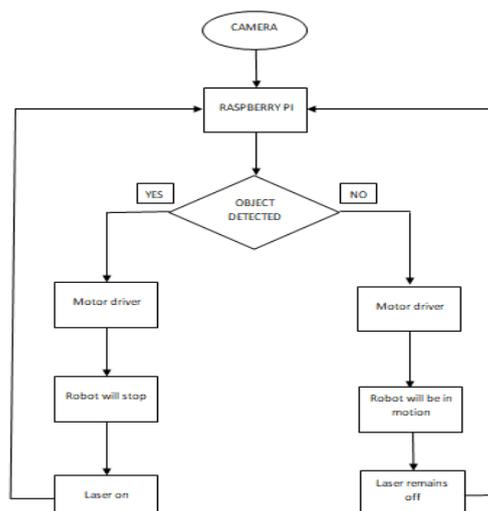
Fig. 5: Laser diode

3. SOFTWARE USED

3.1 OpenCV

Opencv is the tool which is used for the aspect of image processing in the project. It is a library in python which is to be imported in order to perform operations on images or the video acquired by the camera.

4. IMPLEMENTATION AND WORKING



4.1 Robot movement

Robot movement is done using dc motors, L293D motor driver and chassis. The robots moves around and the camera attached to it is used to acquire the images of the surroundings and hence helps in the detecting objects. After this Raspberry pi analyses the objects and their images.

4.2 Object detection and tracking

Object detection is achieved through OpenCV code and libraries in python. Now the analysis of the images is done using image operations and creating a database of object references.

4.3 Object destroying

If the object that is detected is found suspicious, then a laser is projected onto it. This process is done by training the robot using input references.

5. RESULTS

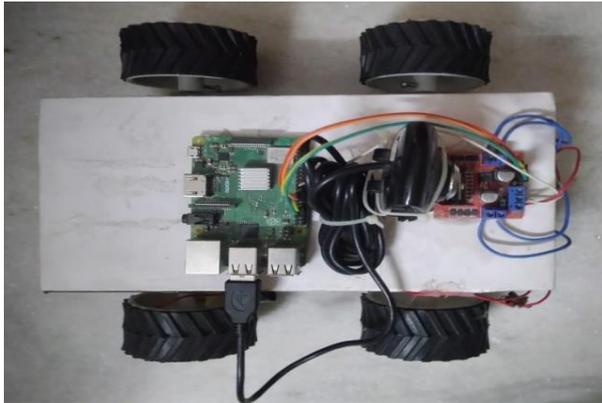


Fig. 6: Prototype of the project

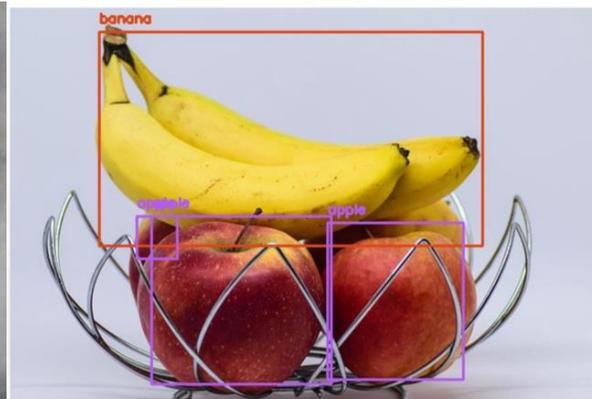


Fig. 7: Object detection of images



Fig. 8: Real time object detection



Fig. 9 Object positioning by robot

6. CONCLUSION

In conclusion, this project can be applied for the use of surveillance and security purposes. Since this project uses the technology of computer vision integrated with robotics it creates a great impact in the aspect of surveillance. This project is transportable and easily be deployed at high risk areas since there would be no requirement of human intervention. So this project can be useful in developing fully automated surveillance robots which can be used for safety purposes. Tracking is not only important for mobile robotic systems but also for a number of applications. Visual surveillance, motion capture and medical imaging all require robust tracking of objects in real time. This project can be further developed by adding the features of detecting objects in the dark by the help of night vision cameras.

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8. REFERENCES

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