

# Edge Detection using Canny Edge Detection technique

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**Abstract**— This paper presents the edge detection and level of pixels to proceed further. Edge Detection is a kind of image- segmentation process and image-segmentation is one of the pre-processing steps in Image Processing. It is used in many places such as the detection of an object lying on the line of sight, the extraction of damaged videos, enhancing the image so it can be recognized well by adjusting the light and dark areas etc. There are variety of image detection algorithms, for example, Canny Edge Detection, Prewitt Edge Detection, Sobel Edge Detection, Roberts Edge Detection, etc. but this research paper will focus on Canny Edge Detection algorithm as it overcomes the shortcomings of other very popular edge detection algorithm called as Sobel Edge Detection algorithm and how we can use the technique for precise detection of obstacles as it is a very important part for our robot system should include.

**Keywords**— robotic arm, sorting, webcam, openCV, Arduino UNO

## I. INTRODUCTION

The guidance we provide to machines, making them intelligent enough to be aware of the surroundings and making them aware of the path to choose to travel comes under an important part in robotic systems called robot navigation and not to mention the ability to move in unknown surroundings and collecting the data so as to make required decisions [1].

The planning of optimum path demands the optimization of specific factors., such as, to choose the least path to the desired location so it doesn't use much of the energy in that purpose, choosing a path which is easier to travel to, or if it's a spying robot, choosing a path where the rate of detection is the least and to see if the path objects will make sound or not. But to gain all of this ability, we have to pack our intelligent machines with different types of sensor to be able to detect as well as some calculations to predict the results [2]-[5].

There is a wide variety of sensors present and it can be daunting at first which one to use, but according to some factors like cost, usage, life and scale, the sensors can be categorized and can be chosen as required [6]-[10]. Some sensors for object detections are: IR (Infra-Red) sensors, RADAR (Radio Detection and Ranging), LIDAR (Light Detecting and Ranging), Ultrasonic sensors, SONAR (Sound Navigation and Ranging), Camera (vision sensor) and such [11]-[13].

So the object detection can be divided in two types:

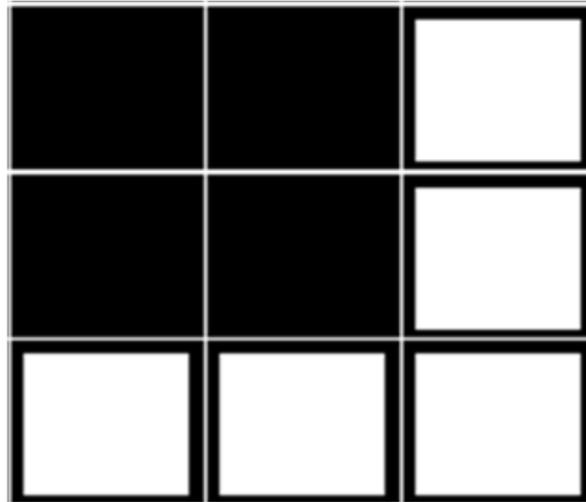
1. Visual-based object detection.
2. Scope-based / Range-based object detection.

In range-based detection, the specimen scans the surroundings and look for any object present and the distance and the position of the object is calculated and reported.

In visual-based object detection, a visual of the object is made which lies in the environment when detected and it is generally done with image processing.

## CANNY EDGE DETECTION METHOD

When we talk about robot's ability to see, it's not just means packing it with a camera and that it is ready to detect anything and interpret or extract data. We need some methods to make it understand the image and there's a lot of computation going on behind this which is usually hidden from the end- user. So, one such computation algorithm going behind is Canny Edge Detection. It is used to detect the features which includes edges, curves, angles and lines, which are really important in order to process the image which is how we are providing our robot a sense of vision[3].



**Fig. 1 shows black and white image**



**Fig. 2 shows Gaussian Smoothing**

So the way this algorithm works for edge detection is that when we scale our image down to pixels, what happens is if some edge is there, there is a sudden change in the pixel intensity. For example, here's an image which shows pixels of a black-and-white image.

Here as we can see are pixels of an image. So how will we teach the computer that it is a part of an edge? As said before, when there's an edge present, there are sudden changes in intensities of colors in the pixel. So that's how we can determine the edges in an image.

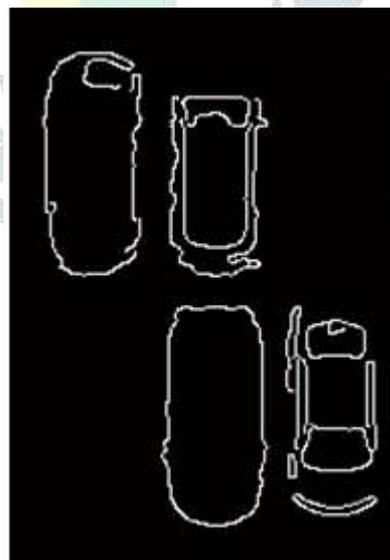
John F. Canny, in 1986, introduced an edge detecting algorithm for detecting a wide variety of edges. He came to a conclusion that the edge detection problem was really a processing optimization problem and so he developed some objective functions which needs to be optimized.

The steps in the Canny Edge Detection method are as follows

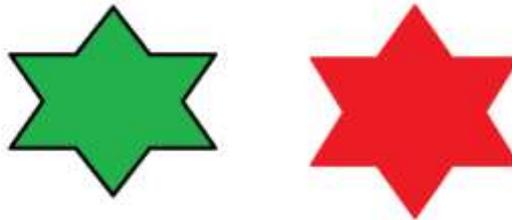
1. Removing the noise in the image by smoothing or blurring the image.
2. The sudden of abrupt changes can be recognized with the help of gradient and when large gradient value is detected, it is marked.
3. Above method is enhanced by applying non- maximum suppression as only local maxima should be marked as the edges.
4. Thresholding is used to determine the edges not determined with the above methods.
5. At last, the finalization is done by removing any edge which is not connected to potent edge.



**Fig. 4 Shows sample image**



**Fig. 5 shows non maximum suppression**



**Fig. 6 shows gradient magnitude**



**Fig. 7 shows hysteresis threshold**

Edge Detection is a kind of image- segmentation process and image-segmentation is one of the pre-processing steps in Image Processing. It is used in many places such as the detection of an object lying on the line of sight, the extraction of damaged videos, enhancing the image so it can be recognized well by adjusting the light and dark areas. In this research Canny Edge Detection algorithm as it overcomes the shortcomings of other very popular edge detection algorithm called as Sobel Edge Detection algorithm and how we can use the technique for precise detection of obstacles as it is a very important part for our robot system should include.

## RESULT

We see the results we obtained by applying Canny Edge Detection technique to images, in detail, with all the images we got as output in each step. There is a wide variety of sensors present and it can be daunting at first which one to use, but according to some factors like cost, usage, life and scale, the sensors can be categorized and can be chosen as required. Some sensors for object detections are: IR (Infra-Red) sensors, RADAR (Radio Detection and Ranging), LIDAR (Light Detecting and Ranging), Ultrasonic sensors, SONAR (Sound Navigation and Ranging), Camera (vision sensor) and such. We can see from the obtained images as how the edge detection technique extracted the edges of the objects in the image.

## CONCLUSION

For the navigation used in robotics, for example, the detection of objects, it is an important thing that our object should be visible to it and the features which we are extracting will help the robot in making decisions based on the object visuals. It can compare the data to the data stored in the database to compare the features, thus helping in the image recognition feature along with edge detection. The drawback of using Canny Edge Detection technique is that it requires a lot of processing power as there are various steps in getting the result so it is necessary for our robot to have a good processor.

## References

- [1] MA Ansari, D Kurchaniya, M Dixit, International Journal of Multimedia and Ubiquitous Engineering 12, 1-12.
- [2] Chandwadkar, Radhika & Dhole, Saurabh. (2013). Comparison of Edge Detection Techniques. 10.13140/RG.2.1.5036.7123.
- [3] Crnokić, Boris & Rezić, Snježana. (2016). EDGE DETECTION FOR MOBILE ROBOT USING CANNY METHOD.
- [4] Adnan Khashman ,“Automatic Detection, Extraction And Recognition Of Moving Objects” ,International Journal of Systems Applications, Engineering and Development, Issue 1, Volume 2,2008.
- [5] Jacinto C. Nascimento, Member, IEEE, and Jorge S. Marques, “Performance Evaluation Of Object Detection Algorithms For Video Surveillance”, IEEE Transactions on Multimedia, Vol. 8, no. 4, August 2006.
- [6] Kinjal A Joshi, Darshak G. Thakore ,“A Survey On Moving Object Detection And Tracking In Video Surveillance System”,International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-2, Issue-3, July 2012.
- [7] Roshni V.S, Raju G ,“Image Segmentation Using Multiresolution Texture Gradient And Watershed Algorithm”,International Journal of Computer Applications (0975 – 8887) Volume 22–No.6, May 2011.
- [8] Y.Ramadevi, T.Sridevi, B.Poornima, B.Kalyani, “ Segmentation And Object Recognition Using Edge Detection Techniques”, International Journal of Computer Science & Information Technology (IJCSIT), Vol 2, No 6, December 2010.
- [9] Kavitha Ganesan,Shanmugam Jalla,“Video Object Extraction Based On A Comparative Study Of Efficient Edge Detection Techniques”,The International Arab Journal of Information Technology, Vol. 6, No. 2, April 2009.
- [10] Houari Sabirin and Munchurl Kim,“Moving Object Detection And Tracking Using A Spatio-Temporal Graph In H.264/Avc Bitstreams For Video Surveillance”,IEEE Transactions On Multimedia, Vol. 14, No. 3, June 2012.
- [11] Lu Wang and Nelson H. C. Yung, ,“Extraction Of Moving Objects From Their Background Based On Multiple Adaptive Thresholds And Boundary Evaluation”,IEEE Transactions On Intelligent Transportation Systems, Vol. 11, No. 1, March 2010.
- [12] Beant Kaur, Mr.Anil Garg ,“ Comparative Study Of Different edge Detection Techniques”,International Journal Of Engineering Science And Technology (IJEST).
- [13] Bindu Bansal, Jasbir Singh Saini, Vipam Bansal, And Gurjit Kaur,“Comparison Of Various Edge Detection Techniques”, Journal Of Information And Operations Management ISSN: 0976–7754 & E-ISSN: 0976–7762 , Volume 3, Issue 1, pp-103-106, 2012.