International Journal of Advanced Technology in Engineering and Science www.ijates.com

Volume No.03, Special Issue No. 02, February 2015 ISSN (online): 2348 – 7550

LINE FOLLOWING ROBOT BASED ON VISION TECHNIQUES

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ABSTRACT

A line follower robot is automated device programed to follow a specific path. They have a vital role in industries and domestic application. Some of the existing techniques used in controlling line follower robot are by using microcontroller, guided tape method etc. This paper aims at providing a machine vision based line follower robot. Machine vision is an image processing technique where in pre-programing algorithm are used to process the obtained image. A camera is used to obtain the image of the track and the obtained image is processed using suitableimage processing software and depending on the results generated the robot is tracked. Thus by using machine vision technique the line follower robot is guided along their track.

***Key words:** Automated guided vehicle, Image based process, Line follower robot, Machine vision.*

I.INTRODUCTION

A line follower robot is a robot which follows a certain path controlled by a feedback mechanism. The path can be visible like a black line on a white surface (or vice versa) or it can be invisible like a magnetic field.Sensing a line and guiding the robot to stay on course, while constantly correcting.Some of the practical applications of a line follower are industrial applications were these robots can be used as automated equipment carriers in industries replacing traditional conveyer belts in automobile.Some recent development is of line follower is seen in applications such floor cleaning, guidance in public places, library assistance [1], entertainment [2], education [3] etc. Most commonly used technology in line following robot are done by using microcontrollers and without using microcontroller .The idea proposed in this paper is by using machine vision to guide the line following robot.

The field of machine vision or computer vision has been growing at a fast pace .Machine vision is the technology and method used to provide imaging-based automatic inspection and analysis. Machine vision applications can be divided into four types from a technical point of view. They can be used to locate, measure [4], inspect [5] and identify.The operation of machine vision can be described in the following steps: image acquisition system gathers images to be converted into digital format and placed into computer memory; image processing where various algorithms are used to enhance elements of the image that are of specific importance to the process followed by feature extraction where the processor identifies and quantifies critical features in the image and sends data to controller. The technology is used in a variety of industries to automate the production, increase production speed and yield, and to improve product quality .Some of fields where machine vision plays a major role are food

packaging,robotics, Pharmaceutical industries etc. In this paper, a simple 2d vision algorithm is used to develop line following algorithm.

II.DESIGN OF SYSTEM

The line follower robot guided using machine vision consists of the following components

- Base
- DC motor
- Wheels
- Microcontroller
- Camera

These components are integrated together to form a line follower robot as shown in fig .1.

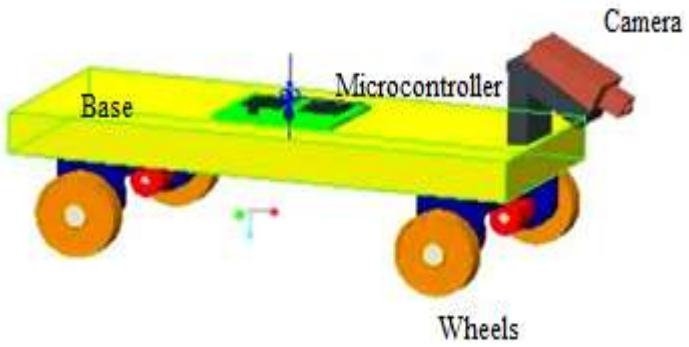


Fig.1: A 3D prototype of a line following robot with machine vision.

1. Base

It is the main frame of the robot which holds the microcontroller,Dc motor and the other components to be transported.It is usually made of low density materials so that they have low weight and high strength to suit the required needs. It is usually made of aluminium, inorder that overall weight of the robot is reduced.

2. DC motor

The ease in the movement of the line follower robot is achieved with the help of dc motor. Each wheel is driven by a separate dc motor and each of the dc motor is driven independent of each other.

3. Wheels

The movement of this robot is achieved with the help of wheels .There are a pair of front and rear wheels.

4. Microcontroller

It is the main component of the robot. It plays an intermediate role between the image processor and the motor.Each of the motor receive separate signal from the microcontroller depending on the signal received from the image processor.Now the obtained image is processed using the programmed algorithm.It converts the obtained image into its binary colour and its complement. Centroid and centre of the image is obtained and compared and depending on the result generated the robot is tracked.

5. Camera

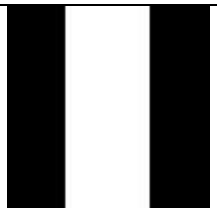
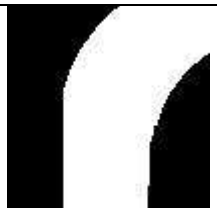
The camera is the basic requirement of the method because the movement of the line follower robot depends on the output of the camera.Resolution of the camera is not a problem in case of line tracking. Here only one camera is used which is placed in front of the robot at an tilt down position so as to capture the line track.

III.WORKING ALGORITHM

The line follower robot proposed in this paper is guided with the help of machine vision. The camera that is placed in front of the robot captures the track to be followed by the line followerrobot .Now the obtained image is processed in the image processing software using the programmed algorithm. The RGB image obtained from the camera is first converted into a gray scale image. Then the grey scale image is converted into its binary image and the complement of the binary image is taken. The complementary of the binary output is in such a way that the background is black in colour and the track is white in colour. Then the centroid of each image is calculated and is compared with the centre of the image. If the centroid of the image coincides with the centre of the image the line follower robot is programmed to go straight. If centroid of the image is shifted to the right of left from the centre of the image the robot is programmed to take a right or left turn. Thus the line follower robot is guided along its track.

IV.RESULT

Table 1.Captured and Processed images and their centroid and centre of various samples taken into study

Captured image	Final processed image	Centroid (x , y)	Centre (x , y)	Programmed output
		(50.5000,51.000)	(50.50,50.50)	Goes straight
		(45.9599,48.824)		Turns left
		(59.1700,47.6294)		Turns right

From the above results it is clear that the centroid for straight path coincides with the centre of the image. The centroid for the left curve is less than the centre of the image and the centroid of the right curve is greater. Thus depending on the position of the centroid with respect to the centre of the image the robot is made to move.

V.CONCLUSION

In this study, a novel algorithm for line tracking based on image processing was developed and tested. The 2D vision algorithm was implemented in a line following robot and was found to be an effective replacement for the existing sensor based image processing techniques.

REFERENCES

[1]. Thirumurugan. J, Kartheeswaran. G, Vinoth. M, Vishwanathan. M, Line following robot for library inventory management system, International conference on Emerging trends in Robotics and Communication Technologies, 2010, 1-3.

[2]. Colak, I. ; Yildirim, D, Evolving a Line Following Robot to use in shopping centers for entertainment, Annual conference of IEEE on Industrial Electronics, 2009, 3803-3807

[3]. Makrodimitris, M. ; Nikolakakis, A. ; Papadopoulos, E., Semi-autonomous color line-following educational robots: Design and implementation, International conference on advanced intelligent mechatronics, 2011, 1052-1057

[4]. Arsalan, M. ; Aziz, A, Low-cost Machine Vision System for dimensionmeasurement of fast moving conveyor products, International Conference on Open Source Systems and Technologies, 2012, 22-27

[5]. Norton-Wayne, L., The automated inspection of moving webs using machinevision, IEE Colloquium on Application of Machine Vision, 1995, 1-8