MECHATRONICS BOOK SERIES

SYSTEM DESIGN AND SIGNAL PROCESSING

VOLUME 2

Editors
Md. Raisuddin Khan
Md. Mozasser Rahman
Muhammad Mahbubur Rashid
Shahrul Na'im Sidek

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CHAPTER 26

PATH FOLLOWING AUTONOMOUS VEHICLE BASED ON VISION SYSTEM

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26.1 Introduction

One of the problems that have been in active research in designing an autonomous vehicle is related to its navigation system [1]. Currently, many robots rely on variation of line-tracking methods for navigation, thus require a system grid of some kinds in the layout [2, 3]. This method poses some disadvantages which links to a series of other disadvantages.

The line-tracking method limits the robots traversing speed. This is mainly due to two reasons. First, the robot has to travel according to the grid placed on the field. The robot will not be able to take the shortest route which is a straight line between point A and B. Also, if the robot needs to make a turn, it will have to stop at every junction and make the turn. This will add a huge amount of overhead time taken to reach the destination.

Second, the line-tracking sensor has a limited view of the line. This is in terms of resolution and also the range. When with control system, usually a system will not be static at the set point, instead, it oscillates. Furthermore, since the viewing range of the sensor is not all encompassing, the robot could not tolerate high overshoot. This will also result in low transient response, since high transient response would normally produce high overshoot. If overshoot occurs, the robot would be in a 'lost' state.

Another drawback of the line-tracking system is that, it is very susceptible to collision. If a collision were to happen, the robot might be pushed out of the viewing range of the line-tracking sensor. This would, again, causes the robot to lose its position, rendering it is incapable of further continuing the traverse to the destination.

Dead reckoning using wheel or shaft encoders are the other popular method of navigation system used in autonomous vehicle system. This method was mainly adopted for the vehicles that have relatively simple route and requires rapid movement. The trouble with this method is; it is neither accurate nor precise. It is suitable when the robot has to be within a certain bounded area. It is also very vulnerable to collision and also wheel slip which will give false current position of the robot.

Jung et.al. [4] have implemented a machine vision system for collaborative cleaning robot where it utilize histogram thresholding as the primary object recognition system feeding information to PID controller. Roth et. al. [5] meanwhile uses a high level topological system of the world being built based on color-blob and contour information from the camera. Takatori [6] and Illman et. al. [7] combined the use of vision system