Thesis title	Mobile Robot Navigation by Wall Following Using Polar Coordinate Image from Omnidirectional Image Sensor
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Abstract

In order to navigate a mobile robot or an automatic vehicle along the wall, the distance and the direction between the mobile robot and the wall have to be determined.

This thesis proposes the mobile robot navigation method by using the polar coordinate transformation from an omnidirectional image. The omnidirectional image is obtained from a hyperboloidal mirror, which has the prominent feature in sensing the surrounding image at the same time. When the wall image from the camera is transformed by the transformation, the straight lines between the wall and the floor appear in the curve line after transformation. The peak point represents the distance and the direction between the robot and the wall. In addition, the wall types can be classified by the pattern and number of peak points. They are one side wall, corridor and corner. To navigate the mobile robot, in this thesis, it starts with comparing a peak point obtained from the real image with the reference point determined by designed distance and direction. If there is a difference between the two points, the

system will compute appropriate wheel angle to adjust the distance and direction against the wall by keeping the peak point in the same position as the reference point.

The experiments are performed on the prototype mobile robot. The results show that for the determining distance from the robot to the wall between 70-290 cm, the average error is 6.23 percent. For three types of the wall classification, this method can correctly classify 86 percent of 15 image samples. In the robot movement alongside the wall, the system approximately consumes the 3 frame/s processing time at 10 cm/s motion speed. The mobile robot can maintain its motion alongside the wall with the average error $\pm$ 12 cm from reference distance.

Keywords : Navigation / Mobile Robot / Wall Following / Omnidirectional Image Sensor / Peak Detection