Development of Path Tracking Control for Omni-Directional Mobile Robot using Visual Servo System

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Abstract – In recent years, teleoperation research on the remote control of mobile robots using visual screens has grown increasingly popular. In this study, we designed a vision-based mobile robot navigation system. Furthermore, using this vision-based navigation system, we conducted path-tracking experiments of moving objects. For the moving object, we used an omni-directional mobile robot with excellent mobility. This paper presents various running experiment results relating to position and posture control by this navigation system.

I. SYSTEM CONFIGURATION

The high speed of personal computer hardware enables visual feedback to be managed in real time. This visual feedback system does not need to receive a feedback signal from the controlled object. It can be constructed as an independent control system. We constructed two different system types for this research. The first is the visual servo system; the second is the omni-directional mobile robot, which will be described later in this paper.

A. Visual Servo System

The visual servo systems used in this research consisted of a visual processing system and a feedback control system. The visual servo system is shown in Fig. 1. Images from a CCD camera are processed by the vision processing board. The vision processing program extracts coordinate data from the images. The coordinates generated are sent to the feedback control system.

B. Feedback Control System

We used two methods to control the omni-directional mobile robot. One was control of route following using appropriate directional capabilities of the robot. The other was the control of the alignment of the robot. Figure 2 shows the block diagram of the control system.

RESULT OF MOVING EXPERIMENTS

We experimented with several kinds of control for route following. For input data, we used the position data (x, y) and the orientation angle data (θ), which were calculated from the image data of the robot.

1) Path Tracking Control with Two Axes Simultaneously: Our experiment route followed a diagonal direction of 45 degrees from the x-axis. We performed the I-PD control of x-direction and y-direction simultaneously. The result is shown in Fig. 3.

CONCLUSION

We constructed a visual servo system for the mobile robot using visual recognition. We controlled the position and the alignment of the robot simultaneously through various control experiments for route following. We are planning to improve our visual servo system for a global system and to construct an automatic deviation system that includes local systems such as urgent action for collision avoidance. Such technology is necessary for remote control.