Vision-based navigation system for autonomous transportation vehicle

Morimoto E., Suguri M., Umeda M.

Laboratory of Environmental and Agricultural Systems Engineering, Graduate School of Agriculture, Tokyo University of Agriculture and Technology, Japan; Division of Environmental Science and Technology, Graduate School of Agriculture, Kyoto University, Japan

Abstract: Autonomous navigation using global positioning system (GPS) or geomagnetic direction sensor (GDS) to detect absolute position is widely used. An alternative system that detects boundary lines and intersections information can be achieved using machine vision based navigation systems. The objectives of this research are the development of the intersection detection method using machine vision and the approaching/turning at the intersection using dead reckoning method. Intersection guidance markers (IGM) were installed on farm road intersections. The method of intersection recognition involved the search to detect the IGM instead of the actual intersection, which would be difficult because the latter changes appearance through the season. Hough Transform and coordinate transformation was used for this purpose. A dead reckoning system for approaching and turning on the intersection was developed. Rotary encoders installed on both sides of the crawler sprocket are used as guidance sensors. RTK-DGPS and fiber optic gyroscope (FOG) were used for evaluating the track of autonomous traveling. The result of field tests (the speed was 0.8 m/s) showed the rms of intersection detection error and the dead reckoning error were 0.12 m at 8.64 Hz processing speed and 0.063 m respectively.
Author Keywords: Coordinate transformation; Dead reckoning; Hough Transformation; Image processing; Intersection guidance marker

Year: 2005
Source title: Precision Agriculture
Volume: 6
Issue: 3
Page : 239-254
Cited by: 5
Link: Scorpus Link
Document Type: Article
Source: Scopus
Authors with affiliations:

1. Morimoto, E., Laboratory of Environmental and Agricultural Systems Engineering, Graduate School of Agriculture, Tokyo University of Agriculture and Technology, Japan
2. Suguri, M., Division of Environmental Science and Technology, Graduate School of Agriculture, Kyoto University, Japan
3. Umeda, M., Division of Environmental Science and Technology, Graduate School of Agriculture, Kyoto University, Japan