Semi-guided navigation of AGV through iterative learning

In this study, we aim at realizing an accurate navigation system of Automated Guided Vehicles (AGVs). We propose a way of estimating positioning error with magnetic tape, which is widely used in a factory as an external sensor. However, flexibility for path relocation is insufficient, because, in general, the tape should be laid down on the floor from a start point to a goal point so that AGVs can reach their destination (Fig.1) [(1)].

To overcome this inefficiency, we firstly propose a semi-guided navigation methodology by means of two kinds of magnetic tapes based on an error analysis using the general model of wheeled mobile robots. Semi-guided navigation means that magnetic tapes are only placed at the start and the goal points individually (Fig.2). Therefore, this system enables us to remove most of the magnetic tape.

Moreover, we adopt the model fixed learning as the methodology of the iterative learning [(2)] to prevent stationary error, which is hard to be modeled such as the backlash of motors, while AGVs run iteratively. This method has advantages to lessen the trial number of learning and to be implemented easily in comparison with on-line learning [(2)]. This method aims to search a proper value so that AGVs achieve the purposed position, by shifting it purposely to the direction of counteracting the error.

Using the suggested method, we verified the effect of learning. We experimented with the 4DW4S (4 Driving Wheel 4 Steering) car, which was made by DENSO CORPORATION (Fig.3). The result indicates this navigation system lessens the positioning error gradually and the AGV came to reach at the goal precisely in a several times of learning on each path [(3)].

One of our prospects is to improve the proposed system by integrating a model parameter tuning with the iterative learning.

Keywords: Moving Robot, Positioning, Automatic Guided Vehicle, Magnetic tape

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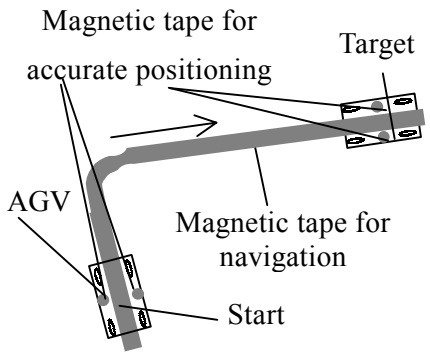

Fig. 1 Traditional positioning system

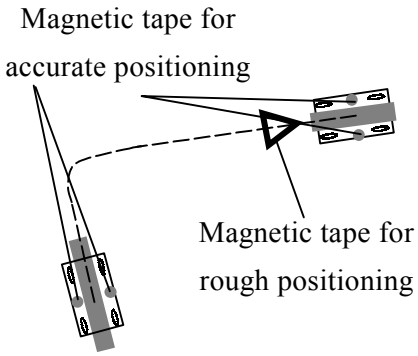

Fig. 2 Proposed positioning system

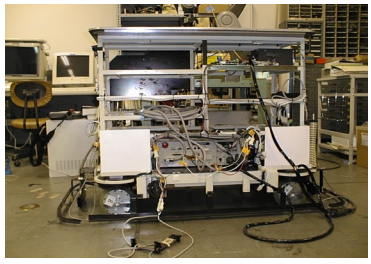

Fig.3 Experimental apparatus