

Automated Guided Vehicle (AGV) System for Film Roll Transport

Takeomi Miyafusa

Keywords Automated Guided Vehicle (AGV), Lift up, Film, Roll

Abstract

We recently supplied an Automated Guided Vehicle (AGV) system that transports film rolls from the winding machine to the temporary storage area and the slitting machine.

The system's AGV transfer method uses a structure that lifts up and down two Y-shaped load receiving sections to correct their position, in accordance with the V-shaped load receiving shape of the winding machine and the slitting machine. In addition, to improve the stopping performance of the AGV, feedback from front and rear magnetic sensors has been used to achieve a stopping accuracy of ± 10 mm forward and backward, ± 10 mm left and right, and a repeatability accuracy of within ± 0.2 degrees of the AGV's center attitude angle.

The system control panel sends wireless Local Area Network (LAN) instructions to the AGV based on the information entered by the worker on a tablet PC, and by replacing conventional forklift work with AGVs, we have achieved manpower, labor, and space savings on the transport route, improving workability.

1 Preface

In the winding and the slitting processes of film rolls at film manufacturers today, there is a demand for automation of equipment and labor and workload-savings to improve productivity and safety, against the backdrop of the need to reduce production costs due to intensifying competitions, and improvements are also required for the transport that connects the previous and next processes. This paper introduces an Automated Guided Vehicle (AGV) System that transports within the process, supplied in response to such market demands.

2 Features of this System

- (1) The transfer method of the AGV of this system adopts a structure in which two Y-shaped load receiving parts are lifted up/down to match the V-shaped load receiving shape of the winding machine and the slitting machine, and the core shaft of the film roll is received.
- (2) By adopting wireless Local Area Network (LAN), an information communication network is established between the AGV, the system control panel, and the tablet PC.

- (3) The system control panel generates AGV dispatch instructions from the data entered by the worker on the tablet PC, allowing the worker to give quick and accurate dispatch instructions.
- (4) The system control panel automatically performs AGV dispatching control and return control, optimizing transportation.
- (5) By improving the AGV transfer device and the AGV's repeated stopping performance, the conventional positioning mechanism is eliminated.

3 AGV System for Film Roll Transport

3.1 Transported Object

Fig. 1 shows the loading state of the film roll.

- (1) Packing: Film roll + core shaft
- (2) Dimensions: Product: Maximum $\phi 800 \times L2800$ mm
: Core shaft: $\phi 152.4 \times L3500$ mm
- (3) Mass: 1560 kg (product + core shaft)

3.2 System Configuration

Fig. 2 shows the system configuration. This system consists of an AGV, a system control panel, wireless LAN, a tablet PC, and an automatic charging device. The AGV receives dispatch instructions from the system control panel, which then dis-

patches the AGV dispatching control, by inputting destination and work data into the tablet PC by the worker. The specifications of the AGV adopted this time are as follows:

- (1) Model: 3MC-M30 (special type)
- (2) Number of units: 1
- (3) Guidance method: Magnetic induction
- (4) Travel direction: Forward, backward, traversing, spin turn
- (5) External dimensions: Vehicle width 1522 × vehicle length 3140 × transfer height 1500 mm
- (6) Charging method: Rapid automatic charging
- (7) Transport mass: 1560 kg
- (8) Minimum turning radius: 2000 mm
- (9) Climbing ability: 2%
- (10) Stopping accuracy: Forward/backward ±10 mm, left/right ±10 mm

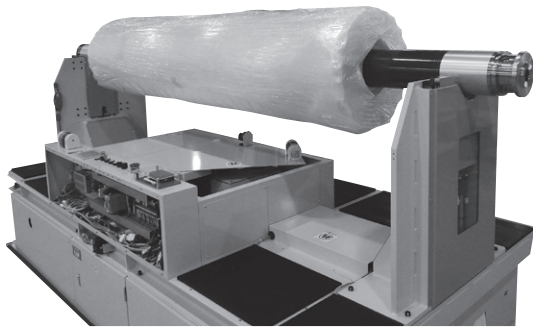


Fig. 1 Loading State of Film Roll

An external appearance of the film roll transport AGV is shown. A lifter unit is loaded.

3.3 System Operation

This system transports film rolls from the winding machine to the temporary storage area and the slitting machine in an unmanned manner. When the worker enters the film order data into the tablet PC, the system control panel queries the data in the cloud and issues dispatch instructions to the AGV via wireless LAN.

To simplify the structure of the AGV, two Y-shaped load-receiving parts are raised and lowered to match the V-shaped load-receiving shape, and the core shaft of the film roll is received to correct the position. To improve the stopping performance of the AGV, feedback control using front and rear magnetic sensors has been used to achieve stopping accuracy of ±10 mm forward and backward, ±10 mm left and right, and repeatability within ±0.2 degrees of the AGV's central attitude angle.

In terms of safety, the system achieves interlocking with the customer's equipment through communication between the equipment, and ensures safe transfer by inquiring about the equipment status and the presence or absence of loads. In addition, a mat switch is attached to the top of the AGV to stop the AGV during transportation so that the worker can get on the AGV, and a safety measure is taken to prevent the AGV from moving when there is a person on it.

In addition, since this system is a 24-hour operating factory, it achieves 24-hour operation with automatic charging. Fig. 3 shows the AGV traveling layout.

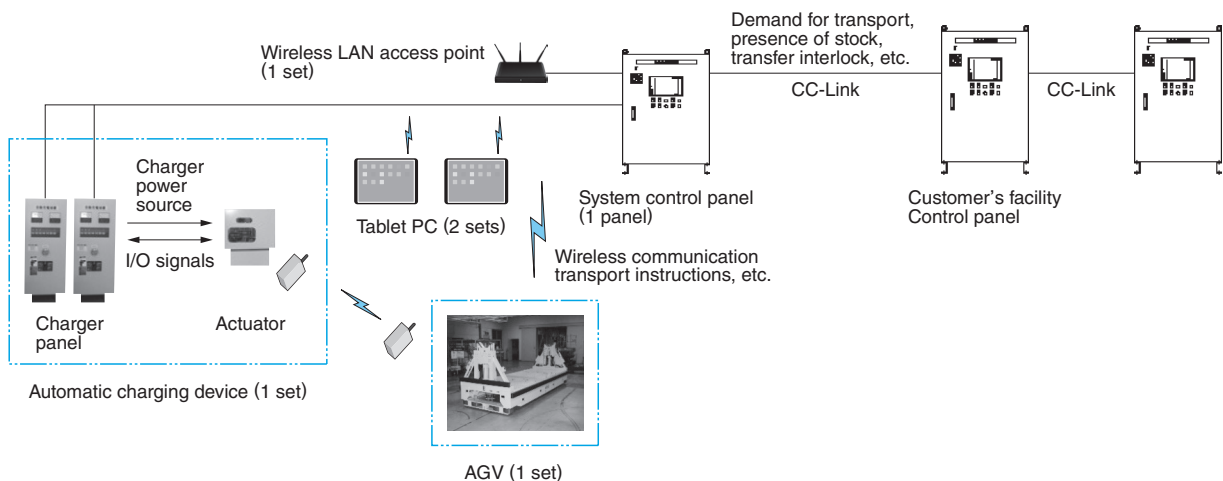


Fig. 2 System Configuration

A single unit of roll transport AGV is used to establish an AGV system.

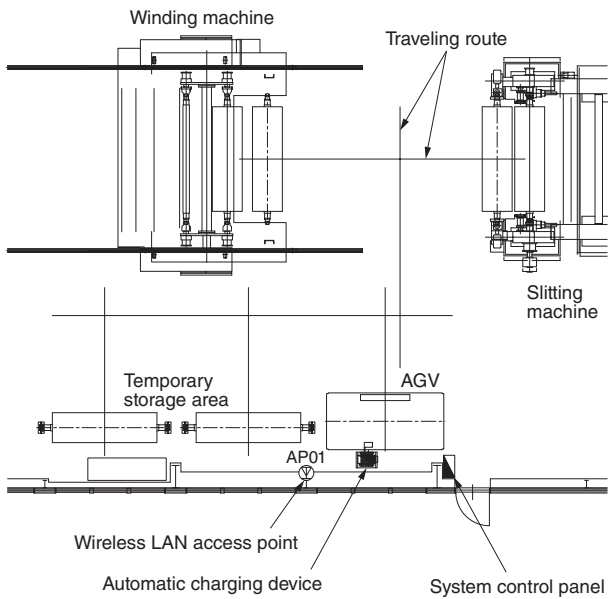


Fig. 3 Traveling Layout

In narrow spaces among customer's equipment and machines, the AGV system is operated in a motion of traveling, traversing, and spin turn.

4 Benefits of Introducing the System

- (1) By adopting an omnidirectional AGV, accurate, safe, and efficient transportation is realized on narrow courses.
- (2) By eliminating the conventional positioning mechanism, costs are significantly reduced, and

the simplified mechanism improves maintainability.

- (3) By adopting wireless LAN and tablet PCs, instructions can be given from any location.
- (4) By introducing AGVs, not only are labor and manpower saved, but accuracy and safety are also improved, and the burden on the workers is reduced.

5 Postscript

We introduced a case where film rolls are automatically transported between the winding machine, the slitting machine, and the temporary storage area by instructions from the worker's tablet PC at the final process of the film production line.

Data input on the tablet PC improves operability, and the simple mechanism and simple control that eliminates the conventional AGV positioning mechanism have achieved significant cost reductions and improved maintainability.

In the future, there will be a demand for low-cost heavy roll transportation for high-mix low-volume production, not just for film roll production, so we intend to provide the optimal AGV system for each production site.

- CC-Link is the registered trademark of Mitsubishi Electric Corporation in U.S. and Japan.
- All product and company names mentioned in this paper are the trademarks and/or service marks of their respective owners.