

On-Line Training Program

Module 4b

How do AGV Systems Work?

AGVS Product Section

of

MHI



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Summary

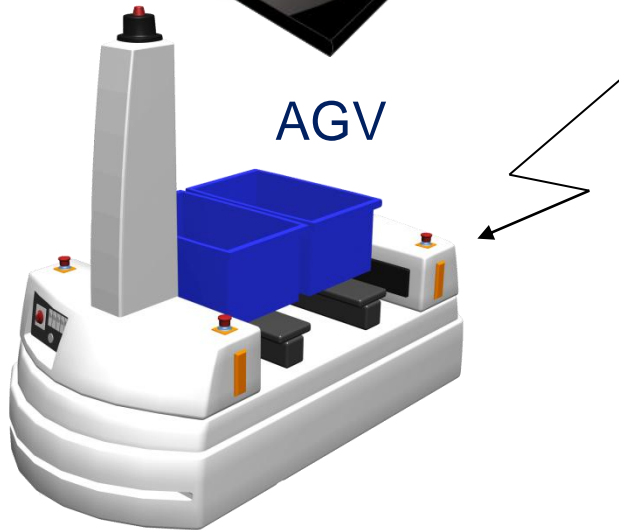
- Host computer/Server
- Graphical user interface
- Communication (RF, IR, Wire, etc)
- Order creation
- Traffic control
- Charging
- Integration into facility hardware (doors, conveyors and the like) and software (WMS, WCS, and the like)

System components

Operator interfaces

System controller

Host system



OPC IO



Common system functions

- Order handler
- AGV handler
- Traffic handler
- Digital I/O handler
- Communications – AGVs and other units
- Simulator
- Gather statistics
- Generate reports
- Diagnostics
- System visualization
- Backup and redundancy
- Black box / “Flight” recorder

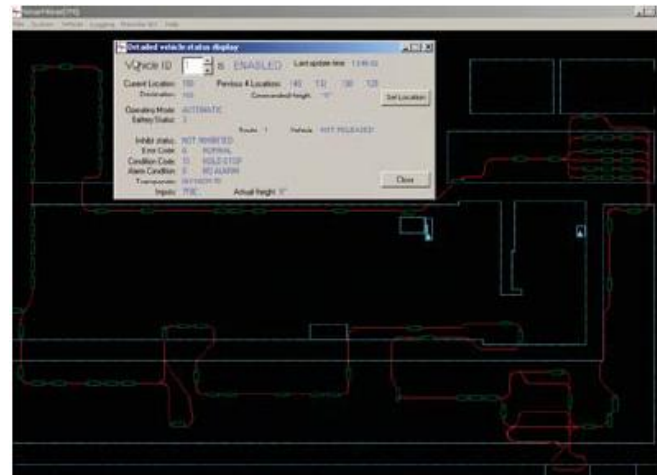
Server

- Usually PC based
- Network connected
- Database backend
- Backup



Graphical user interface

- Desktop, laptop or mobile device
- Graphical overview of the system
- Tracking of AGVs
- Visualization of peripheral I/O units (OPC)
- Event logs
- Order buffer
- System health
- Statistics and reports



Server connectivity

- Connected to the AGVs through
 - Wireless network
 - Radio
- Connected to other systems through
 - Ethernet
- I/O
 - Utilizes OPC



Basic communication with AGVs

Server

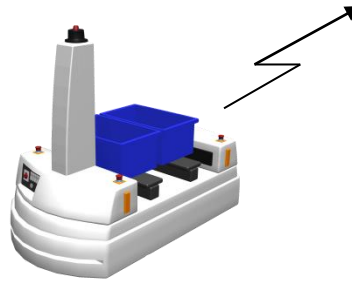
Traffic and order control



Command to a location and perform an operation



Vehicle position & status



Flexible I/O with OPC

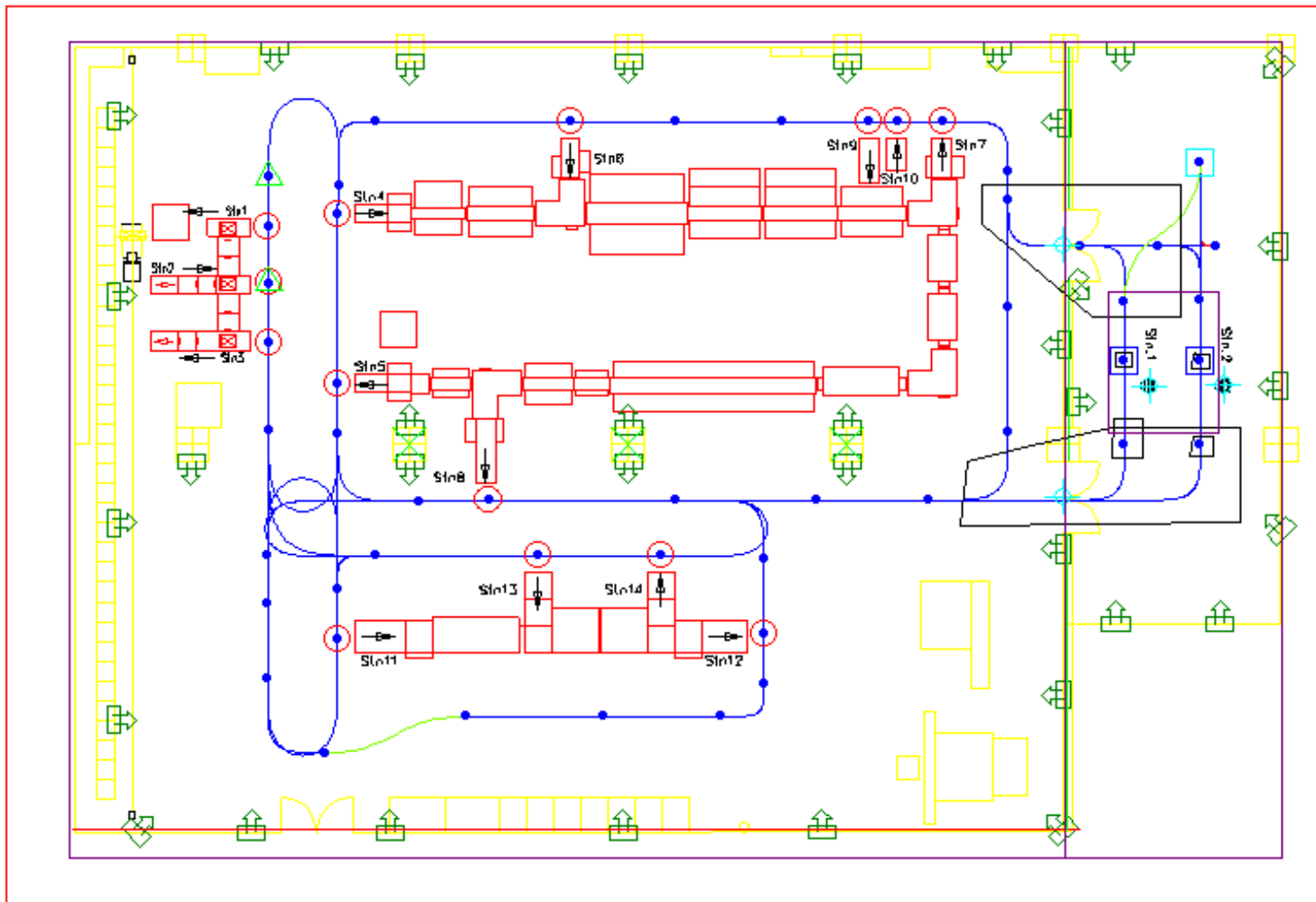
- Server can connect to an OPC server.
- OPC supports a number of field bus standards:

- CAN bus
- Profibus
- Interbus
- Devicenet.....



- Read about the standard at: www.opcfoundation.org

Layout



Layout

- Defined drive paths, where the AGVs are allowed to drive.
- Divided into segments/tracks and points
 - The points are valid targets
 - The segments are parts of the drive paths
- Some systems use stations where load operations are allowed

Layout-less systems

- Some systems run without a layout created in a definition tool
- These systems are typically based on magnetic tape or wire guidance

System Control

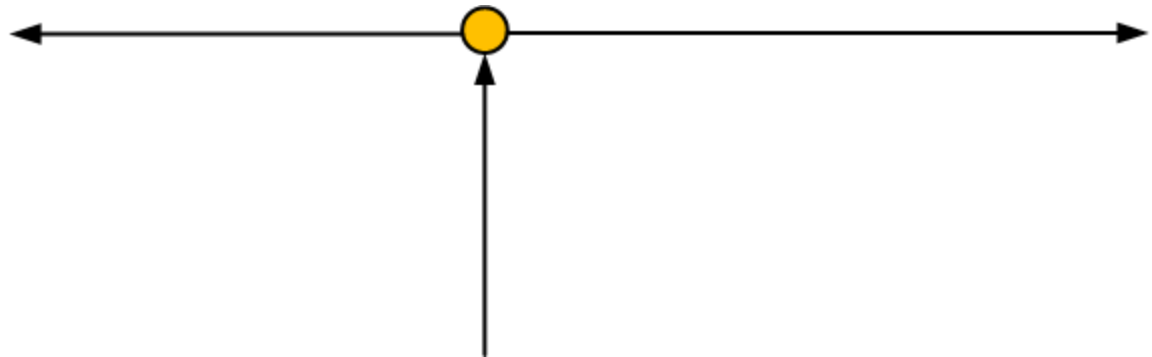
- Choose best AGV for transport
- Routing; Choose best path
- Manage blocking
 - Other AGVs in the drive path
 - Stationary equipment (automatic doors, stretch wrappers and the like)

Traffic rules - Blocking

- To maximize the movement of AGVs, there must be a set of rules that meters the flow of AGV traffic and eliminates the potential for traffic jams. This is often called blocking.
- Before the AGV is allowed to drive on the calculated path, it is checked to make sure that the path is free using the traffic rules set up for the system. The path, or a suitable part of the path, will then be allocated to that AGV.
- Auxiliary blocking will control the AGV as it interacts with external objects (doors, active machines, and the like). This is achieved by interacting with the objects through OPC or other I/Os.

Traffic decision points - Blocking

- A second approach to blocking involves decision points or tags
- Every time an AGV passes a tag, a script is run to evaluate the traffic situation and destination before acting accordingly



Order handler – Manages order assignment to AGVs

- Simple transports
 - Move container from location A to location B
- More complex multi-part order - Pick order
 - Move AGV through warehouse while operator manually places goods on the pallet. Automatically moves AGV to finish point when complete. Automatically deploys new AGV when needed.
- Charging
 - Move AGV to charger when AGV is idle or needs power and charger is available.
- Idling
 - Manages AGVs that have no order



Order

- An order defines one or several movements, to be executed by the AGV
- A typical order contains a pick-up-location and a drop-off-location
- When used in a pick application, an order may contain several stops, where items are manually added to AGV

Charging

- An automatic order for an AGV to go charge can be generated by the system
- Low voltage may trigger a charge
- Opportunity charging may also be used based on:
 - AGV being idle
 - AGV being close to a charger
 - Other customizable triggers

Programmability

- PLC or scripts on system level
- Customized logic
- Events and alarms
- Debugging
- Interaction with host systems

```
function Move(var location, var order) {  
  var agv = GetAllocatedAgv(order);  
  agv.Move(location, function(state) {  
    Notifier.NotifyHost(agv.ID, state);  
  });  
};
```

Host Integration

- AGV orders are commonly initiated by a host system such a WMS, WCS, MES or ERP (*)
- Standard or custom interfaces are defined for the host system to start orders, move AGVs and other tasks
- Integration options include standards such as SQL databases, message queues (MQ), Web services, FTP, TCP/IP sockets and more

* WMS = Warehouse Management System, WCS = Warehouse Control System, MES = Material Execution System, ERP = Enterprise Resource Planning system



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Handling of Idle AGVs

- Home location
 - A home location is a place where the AGVs go when not executing orders.
- Queues, parking and intermediate locations

AGV Allocation

- The best AGV for a specific order may be selected by the system manager
- Host systems may select an AGV for an order
- AGVs can manually be selected

For More Information:

Contact the
AGVS Product Section
of
MHI

<http://www.mhi.org/agvs>