AUTOMATED WAREHOUSE

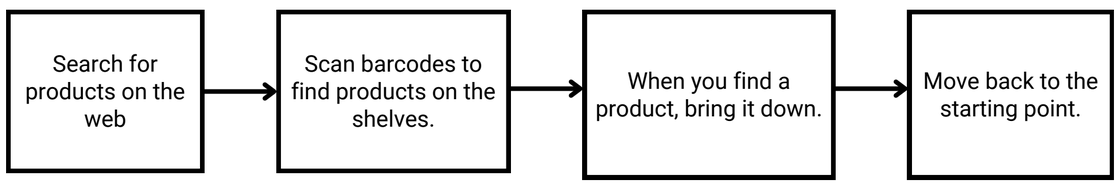
CONTROL SYSTEMS AND INSTRUMENTATION ENGINEERING PROGRAM

Sarida Prompila, Suthawee Ketluck, Advisor : Asst.Prof.Dr.Pranchalee Samanpiboon

Introduction

Currently, many businesses in Thailand have a manual warehouse system to manage. This causes delays in the warehouse system because employees have to check whether there is a product or not. Where is the desired product positioned and bringing it down will require manual labor to lift it, or if the cargo is high, it will require an elevator truck to bring the goods down, and it can also cause errors in finding the goods. Recognizing that problem, the team designed an automated warehouse system that helps manage warehouses. You can search for inventory and take out the items you're looking for. To help manage products to find products faster. Manage goods more systematically and can be more accurate.

Project Overview



Automated Warehouse The warehouse system will be simulated to have 2 shelves, each shelf will have 3 types of products on each floor, for a total of 6 types of products.

Start by searching for the desired product on the product search website, where there will be 6 types of products to choose from, and then the forklift will automatically move to search for the product. When you find the product you want to take it off the shelf to bring it back to where it started and can continue to search for it.

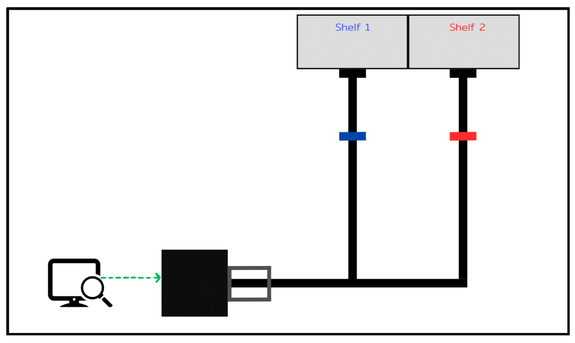


figure 1 Simulating the Automated Warehouse system

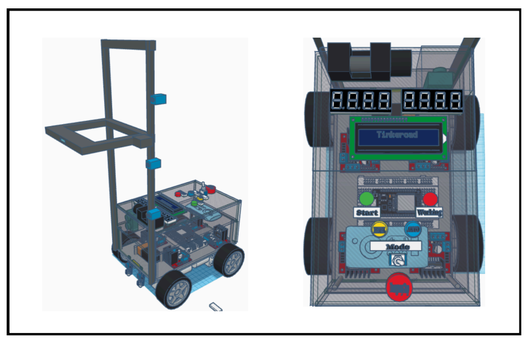


figure 2 forklift design

Methods

The operation of the Automated Warehouse system has 2 modes of operation

1. **Auto Mode** is an automatic operation in which the car follows the line from the start point by receiving input from 4 IR sensors attached to the front and back of the car to control the movement of the car. Using a color sensor to detect colored stripes stuck on the floor in front of the shelves

   ► **Movement path**
   - Start > Move forward to point A > Turn left > Move forward to the blue line at point B > Scan.
     - Case 1: If you find the product > move forward to point C (insert the fork under the pallet) > lift the product > move backward to point A.
     - Case 2: If the product is not found > move backward to point A > move forward to point D > turn left > move forward to the red line at point E > scan > move forward to point F (insert the forks under the pallet) > lift the product > move backward to point D.
   - Turn right > move backward to point A > Start > lift the fork to lower the product to the lowest shelf.

   ► **Search and scan barcodes**
   Product scanning uses a barcode scanner to scan the barcode attached to the pallet. Start scanning from the 1st shelf first, scan from level 1-3, then move to the 2nd shelf, scan from level 4-6, and use the inductive proximity sensor to stop the fork on different level.

2. Manual Mode The vehicle moves using the control from the radio remote control and the forks move up and down from the remote control to the electric wire rope hoist.

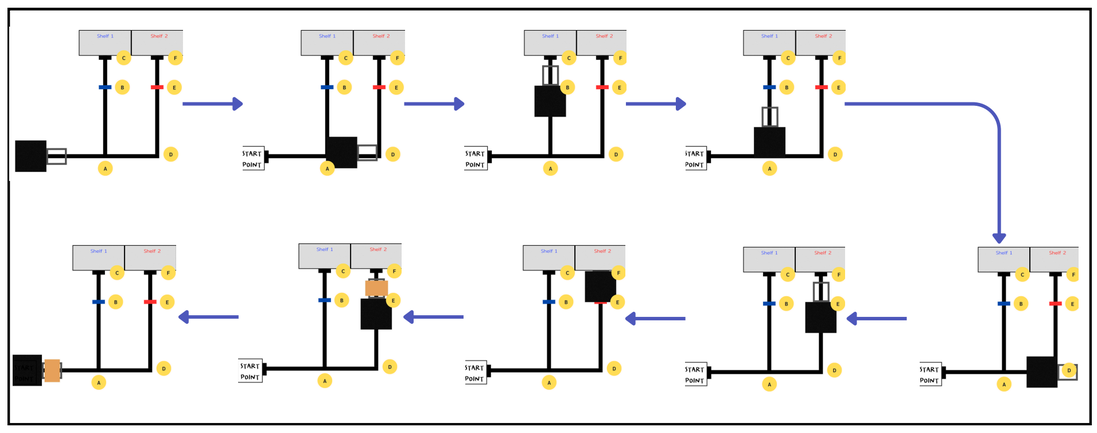


figure 3 Forklift movement

Results

Testing the movement of forklifts by following automatic lines

Table 1 Testing the movement of forklifts by following automatic lines

Times	Move forward	Reverse	Turn left	Stop point
1	✓	✓	✓	✓
2	✓	✓	✓	✓
3	✓	✓	✓	✓
4	✓	✓	✓	✓
5	✓	✓	✓	✓
6	✓	✓	✓	✓
7	✓	✓	×	✓
8	✓	✓	×	✓
9	✓	✓	×	✓
10	✓	✓	✓	✓
Accuracy	100%	100%	70%	100%

The test is done by creating a black line diagram to move the forklift according to the specified diagram. It is tested to move forward, backward, turn left, and stop at an intersection. The test results showed that the forklift could move in various directions accurately, but there were times when it was unable to turn due to incorrect turning sensors.

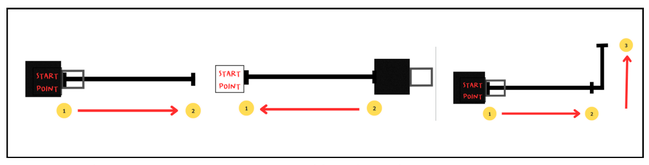


figure 4 Testing the movement of forklifts by following automatic lines

Data transmission efficiency test

Table 2 Data transmission efficiency test

Barcode	success	Accuracy
No.1	3	100%
No.2	3	100%
No.3	3	100%
No.4	3	100%
No.5	3	100%
No.6	3	100%

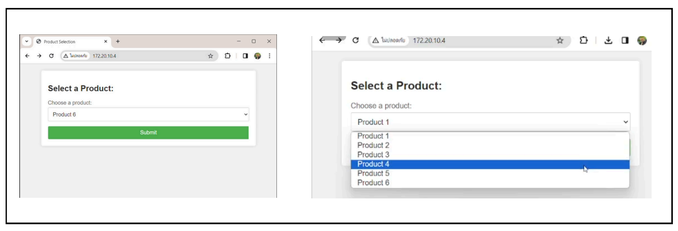


figure 5 web interface

It works in terms of searching for products via the web. and scanning the barcode to find the product by sending the product value through the website created in ESP32 and scanning barcode Found that the value can be sent successfully every time.

Conclusion

The operation of the Automated Warehouse system in product search can search for products correctly and match the products searched from the web. In terms of vehicle movement. It can follow the line 100% correctly in both forward and reverse directions and can stop as required, but the turning capacity of the forklift is not always achieved because the IR sensor detects the turn incorrectly. As a result, the received input does not match the defined logic. Therefore, the forklift does not make turns.

References

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Department of Control Systems and Instrumentation Engineering, Faculty of Engineering
King Mongkut's University of Technology Thonburi (KMUTT)