

Automated Guided Vehicle: The Inventory Solution

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Design: Prototype Approach

Our Physical Prototype Requirements:

1. Compact
2. Durable
3. Lightweight
4. Cost Efficient
5. Secure Cargo-Carrying Apparatus

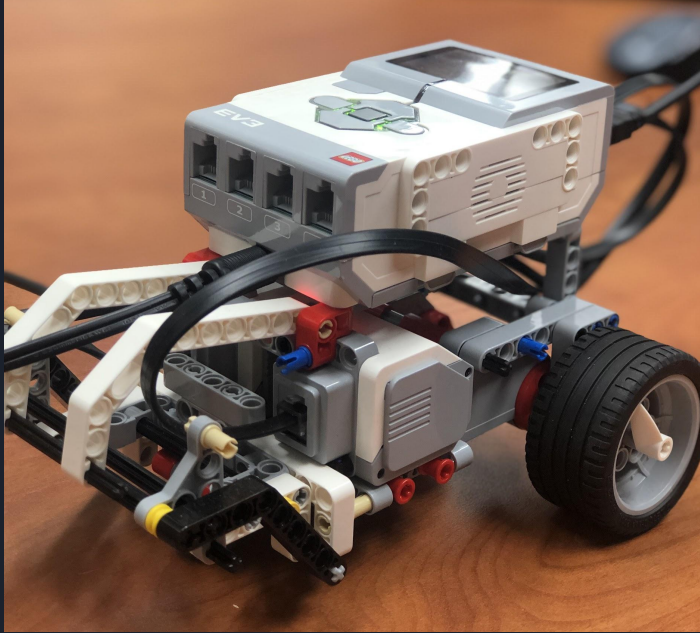


Trial and Error
Design Process
until desired
prototype was
created

Our Software Requirements:

1. Accurate Delivery and Retrieval
2. Efficient and Fast

Key Design Features:



Physical-

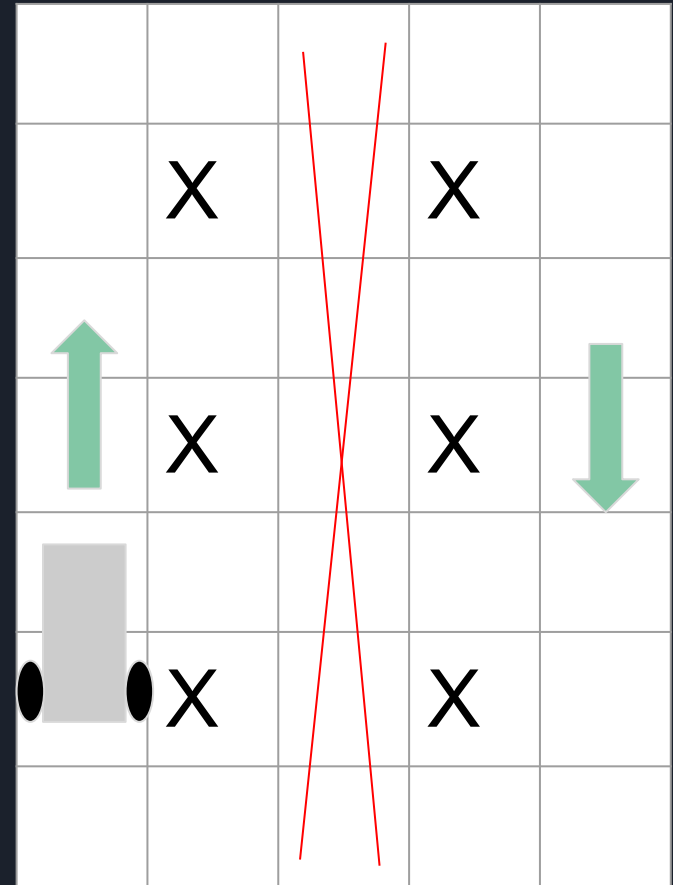
- Simplistic Design
- No additional infrastructure
- Storage Compartment
- High Speed Capabilities

Software-

- Prioritized bins that are located in the same aisle as the required packer
- Robot speaks to the operator to increase system transparency

Project Execution: Changes

- Original Concept:
 - AGV would navigate between inventory and shipping utilizing all aisles
- Revised, New Concept:
 - AGV utilizes only the outer aisles to fulfill orders, needing to be moved manually between aisles when necessary





Project Execution: Current Status

- Receives Orders
- Retrieves Proper Inventory
- Delivers Inventory
- Returns Inventory



Performs all required functions
effectively and efficiently

However, there is always room to
continuously improve a system such as this



Performance

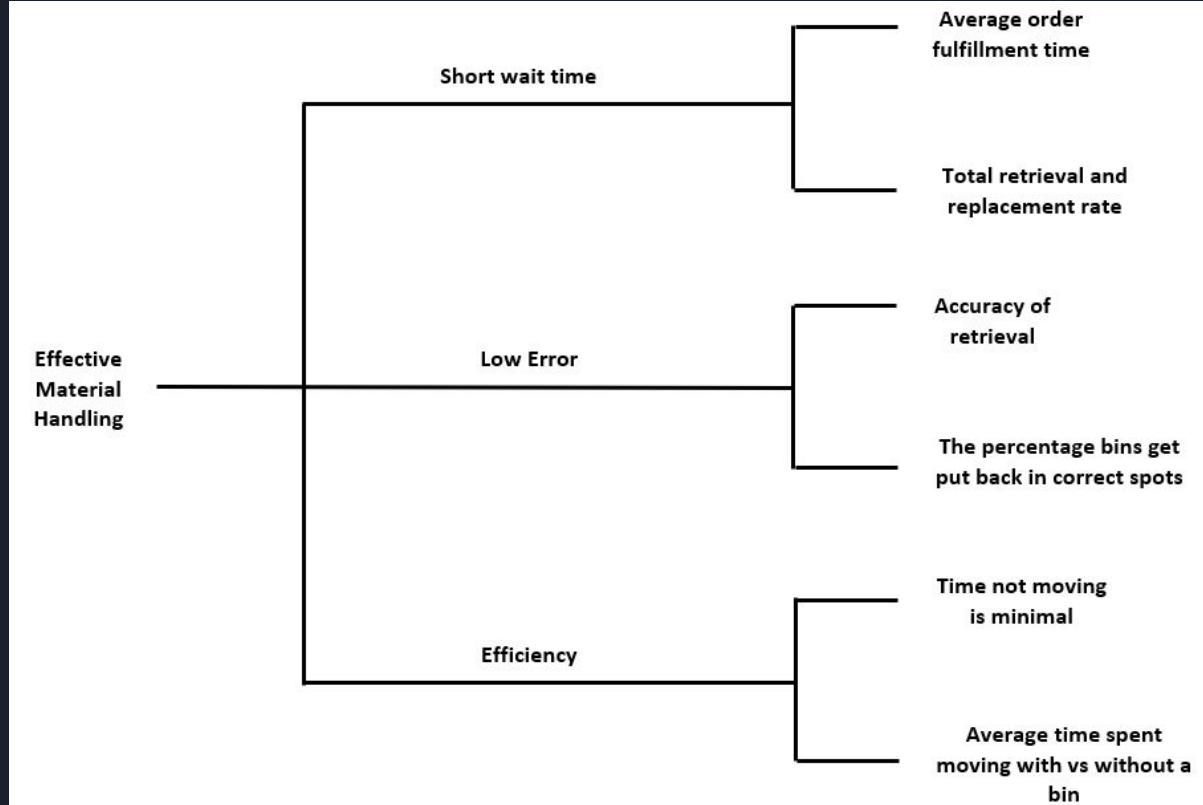
- The robot receives the orders and collects the appropriate cheese on a first come first serve basis.
- Robot only has to move forward and back in order to fill orders
 - Allows for faster order fulfillment
 - Keeps middle isle open for workers



Performance Measurements

- Speed: 2.5 grid squares per second
- When the robot signals us to move it to the other isle it pauses for 5 seconds
- At each order pickup/drop off, the robot will wait 5 seconds to be loaded or unloaded
- Rates of accuracy
 - Correct order retrieval
 - Correct bin replacement

Critical-to-Quality (CTQ) Tree





Comparing to CTQ

Old Statistics

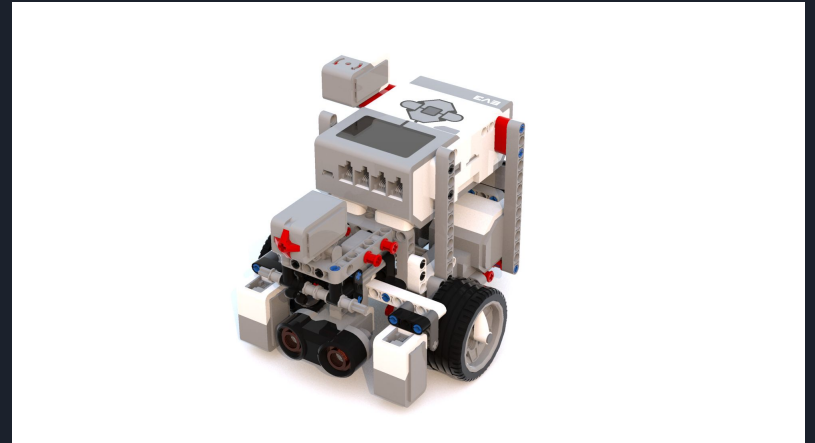
- Average cycle time: 49.64 Sec
- Average inter-arrival time:
16.92 sec
- Accuracy of retrieval: 100%
- Percentage of correct bin
replacement:100%

New Statistics

- Average cycle time: 16.33 Sec
- Average inter-arrival time:
16.92 sec
- Accuracy of retrieval: 100%
- Percentage of correct bin
replacement:100%

Recommendations: Improving Design

- Automating the storage compartment and add a clamp to reduce worker utilization and risk of damaged product
- Reducing size of wheels and overall vehicle to simplify further
- Shorter wires to eliminate bulk
- Building vehicle up instead of horizontally





Recommendations: Improving Overall System

- If technology and costs allow, add second robot to grid, using one in the left lane as well as right lane
- Instead of FIFO, let robot process all orders and select order based on which SKU is the closest
- Allow robot to know when the bin is placed inside the storage compartment