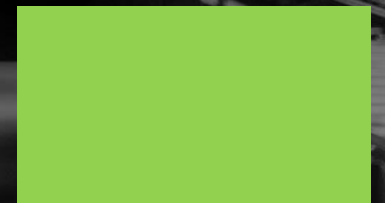


AI-Driven Flow Control: Using Next Generation Technology To Automate Decision Making In Your Warehouse

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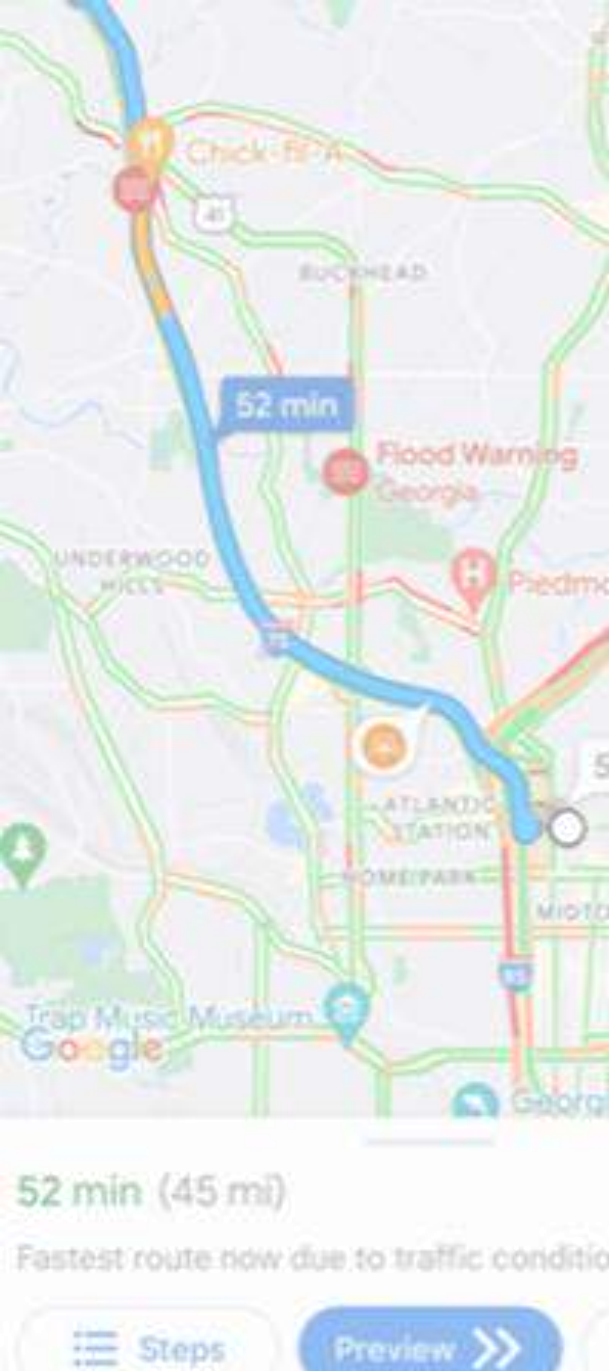
AI-Driven Flow Control:

**Using Next Generation Technology To
Automate Decision Making In Your Warehouse**

- With the need to respond lightning fast and analyze numerous data points, are humans making the best decisions to maximize your throughput?
- Can you achieve better results by removing human-decision making in your warehouse?

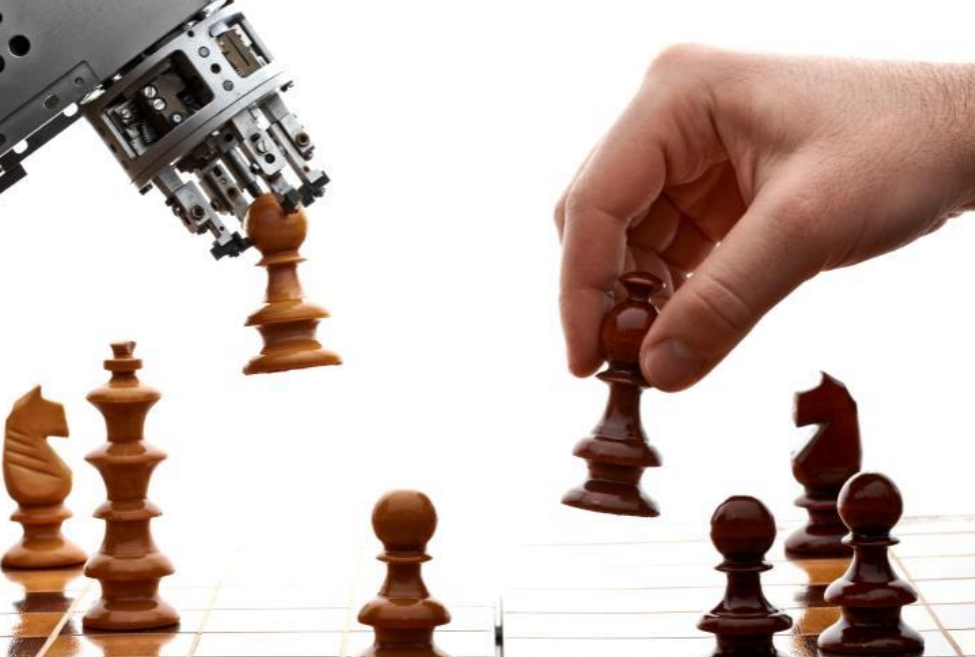
Automated Decision Making (ADM)

- What is it? It's all in the name.
- Software Decision Models
 - Software is making the decision to determine the best path forward
 - These are typically complex decision based on defined constraints, capacities and objectives; not just rule or condition based
 - Large data considerations (historical, static, real-time)
 - Multi-factored (taking many considerations into account)
 - Defendable: outlines why a decision was made and the impact it will have
- What do you do with the output?
 - Recommendations – software decides but human course corrects
 - Automated Optimization – software decides and directs activities to respond
- Example – Google Maps vs Self Driving Cars



The Power of Automated Decision Making (ADM)

- Where are we?
 - Yesterday
 - Repetitive Tasks; Data Processing
 - Today
 - Real-time Decision Making
 - Tomorrow
 - Software will make and execute decisions; humans will provide strategy
- The Real World (some examples)
 - Overtime scheduling of organized work force
 - Defendable & Documented Scheduling Enforcing Labor Contract Rules
 - Optimized picking; Flow Control
 - Coordination of Work (Consolidation)
 - Improved Density (carts, pick to pallet)
- Human Decision Making
 - Time
 - Too much data
 - Emotions / Biases; Tend to repeat prior decision making without re-evaluation



Look at real-world “simple” example

Situation

There are 3 high priority orders sent to the the warehouse that need to make the UPS Express Trailer (5pm pickup time). The orders have product from an each pick area that is picked by a human and placed on a cart with other orders and brought to a packing area where the product is packed into the shipping box, sealed and labeled.

Decision to be made

It's 10am, should I start processing these orders?



Human Decision Making

- It's high priority?????
- **DECISION:** Release them all...they are high priority....we need to get them ready to go!

Computer Decision Making Model

- When does the product need to get to the dock?
- How long will it take to process the order (based on performance of the staff this is picking in the areas)?
- Is there current congestion in a processing area (picking, packing, dock) that would be negatively impact if we add more volume?
- Is there capacity available?
- Will this order increase my pick density (am I going to be picking items for orders near locations that I need to travel to for this order)
- Etc. etc, etc
- **DECISION:** The orders need to start picking at 3pm to complete picking, packing and shipping prep. There is no additional capacity in picking. These orders should not be released.

Look at real-world “simple” example

Situation

An order is received by the warehouse that needs to be loaded on a UPS trailer that is being picked up at 5:30pm today. The order has product from an each pick area that is picked by a human and placed on a cart with other orders and brought to a packing area where the product is packed into the shipping box, sealed and labeled.

Decision to be made

It's now 12pm, should I start processing the orders?



Human Decision Making

- **DECISION:** They are being processed; there is a big backlog, but the pickers will get to them at some point!

Computer Decision Making Model

- **DECISION:** A cart is being created that will travel down the exact aisle needed for one of these orders (the picker will be walking right past the location!). Go ahead and release this pick to be processed. There is plenty of time to get this to the dock, but there is an efficiency savings to get it now! 1 order released.

Look at real-world “simple” example

Situation

An order is received by the warehouse that needs to be loaded on a UPS trailer that is being picked up at 5:30pm today. The order has product from an each pick area that is picked by a human and placed on a cart with other orders and brought to a packing area where the product is packed into the shipping box, sealed and labeled.

Decision to be made

It's now 1pm, should I start processing the orders?

Human Decision Making

- **DECISION:** They are being processed; still waiting!!!

Computer Decision Making Model

- **DECISION:** There is picking capacity available (the warehouse did not have the congestion created by the human decision-making release strategy). The pickers were more efficient because the system waited and created as much pick density as feasible. There is enough capacity to release 1 more order.



Look at real-world “simple” example

Situation

An order is received by the warehouse that needs to be loaded on a UPS trailer that is being picked up at 5:30pm today. The order has product from an each pick area that is picked by a human and placed on a cart with other orders and brought to a packing area where the product is packed into the shipping box, sealed and labeled.

Decision to be made

It's now 3pm, should I start processing the orders?

Human Decision Making

- **DECISION:** Are they done? One of them is stuck at packing...where is it? There are so many orders there.

Computer Decision Making Model

- **DECISION:** The order is needed at the dock. To get the last order picked, packed and ready for loading, we need to release this order by 3pm – Release it!



“simple” example

The Outcome

In the Human Decision Scenario

The orders made the truck, but a supervisor had to go to the packing area and find one of the orders. The release of too much work overloaded packing which led to frustrated workers and an inefficient process. The pickers did not complete picking until 5pm (a full hour past their shift) because they were not as efficient as possible.

With Automated Decision Making

The computer timed the release of the work to meet the shipping requirements and had the best outcome to reduce congestion points, keep pickers busy and create DENSITY!

We want a rushing river not a set of waves



ADM: Past, Present, Future...

Navigation Progression

Paper Maps

Downloaded Instructions (Garmin)
and PrePlanning (MapQuest)

Real-Time Turn By Turn but limited data inputs

Where Many People Are Today

- Leveraging Real-Time Tools
- Trusting the recommendations

Where The Industry Is Going:
Self Driving Cars

Warehouse Operations Management (WOM) Progression

Paper Pick Tickets

Directed Tasking / Wave-Based Order Release

Wave-Based Order Release / Conditional
Workflows

Where Many People Are Today

- Many Siloed Systems without orchestration between
- Waveless automated Releasing Based on Filtering, Conditional Workflows
- Human Planning & Decision Making

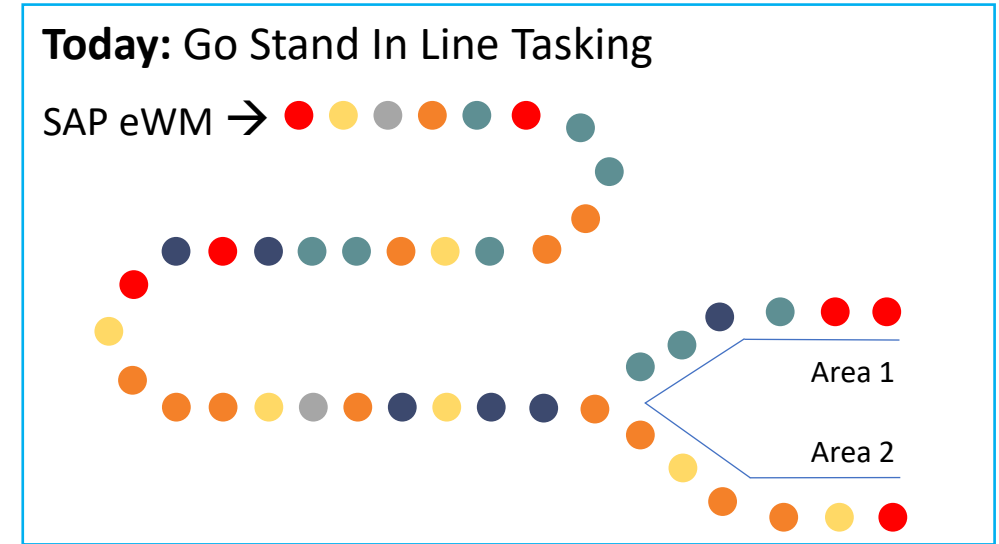
Where The Industry Is Going

- Orchestration Between Siloed Systems
- Constraint Based Planning
- Automated Decision Making; Real-time Adjustments



I have this today, don't I?

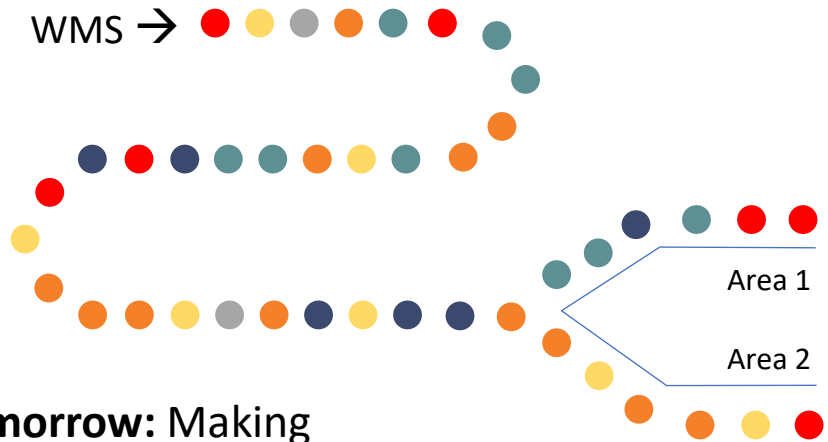
- Directed Tasking, Auto-Waving, & More
 - Today's systems divvy out tasks based on processing areas/types of work but do little to evaluate capacities, constraints and efficiency opportunities
- Go Stand-In Line Tasking!
 - Zone 1 - Processing time 30 minutes
 - Zone 2 – Processing time 3 hours
- Siloed decisions
 - Today's systems (WMS, Automation Control, WES) produce the best outcome for that area/system without taking into consideration the impact upstream and downstream work, they could be decreasing overall performance
 - Example: GTP system with the fastest retrieval time creating dock congestion
- Human Decision Making
 - All WMSs system (even the tier 1 systems) relay on humans to make decisions that have high impact on overall throughput.



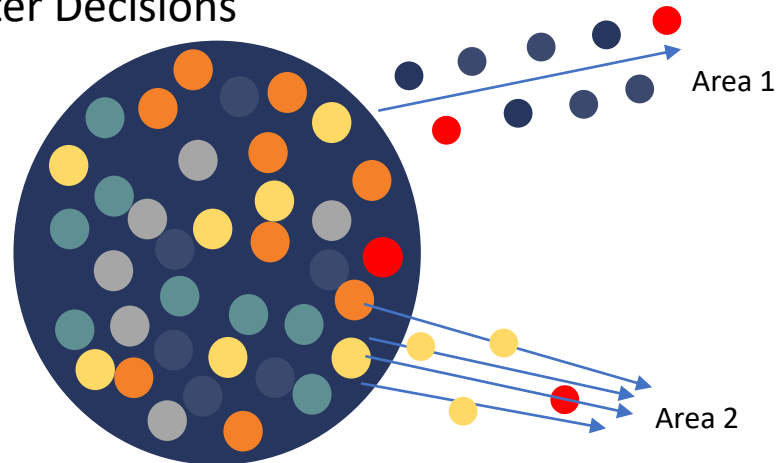
The Future

Flexibility & Agility

Today: Go Stand In Line Tasking



Tomorrow: Making Smarter Decisions



- The winners of tomorrow have systems that make smarter decisions, more quickly, supported by large amounts of data, and coordinate a human & robotic workforce
- Prepare
 - More paths drive to better decisions (think Google Maps' alternative routes); Examples: conveyor is full so add a manual packing area
 - Siloed efficiency will not be the only measure; additional manual packing area is less efficient but increases throughput of the warehouse (when needed)
- Plan
 - More accurate planning based on actual worker performance, constraints, workload
- Adjust (Orchestrate)
 - Real-time planning to adjust to a changing environment
 - Human, Robots and other fixed path automation being directed in unison (Silos Removed)
 - Allow for alternative paths to increase capacity
 - Recommendations / Automated Optimization to maximize throughput

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