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Flexible Automation of Kitting Process at Arla

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1. Introduction

Arla is a multinational dairy cooperative headquartered in Viby, Denmark, owned by farmers across Scandinavia, western Europe and the UK. The company manages its own complete 'farm-to-store' supply chain, including the production and logistics, of dairy products to stores nationwide in Denmark.

The Arla Hobro terminal consists of a dairy production unit and a distribution center, housed under the same roof. The scope of this project was centered around the activity specific to the kitting/picking areas within the distribution center at the Hobro terminal. The sequence of processes involved in this area are currently manual-intensive. The company expressed a desire to investigate opportunities for increased automation in the picking area of the distribution center to help increase overall efficiency and performance, and potentially reduce error rate and human impact on operations, while also aspiring to achieve any tangible improvements in safety, timing and costs.

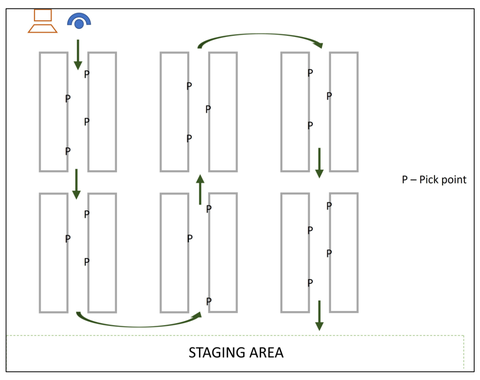
Problem statement
There is a need for improvements and increased automation in the Arla Hobro distribution center's picking processes to minimize overall inefficiencies stemming from highly manual-intensive methods currently in place.

Desired outcomes
- Working principle of autonomous mobile robot (AMR) to be used in the distribution center picking area
- Detailing of environment requirements for AMR integration in current distribution center layout
- Picking model conceptions for different combinations of human and AMR working

2. Industrial Practices

The primary concept that most distribution-center-based operations are governed by, comes down to the system of 'picking' that is employed to transfer product from the storage zones to the staging and loading area for the delivery vehicles. Broadly speaking, picking systems can be classified into two main types: order-based picking and zone-based picking

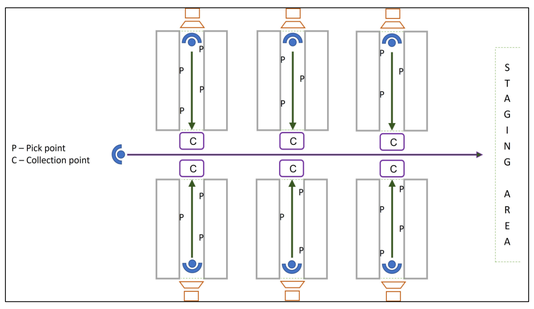
Order-based picking



'Pick and pack': Each order is catered to at a time by an assigned picker, who fulfils every order by picking every product on a provided list while going through each respective storage zone within the facility in which each product on the list is stocked

While order-based picking's greatest strength lies in its simplicity, its underlying drawbacks with regard to large product variety in warehouse storage zone, long travel times for each pick line in large warehouse settings, high congestion and traffic due to typically similar routes during picking, and typically higher error rates due to dependency on picking accuracy mean that this system of picking is the less preferred alternative in most established distribution centers.

Zone-based picking



'Pick and pass': The entire storage area of the warehouse is divided into smaller regions called 'zones', within which there is a systematic arrangement of product storage, usually organized in order of product size, or frequency of being ordered

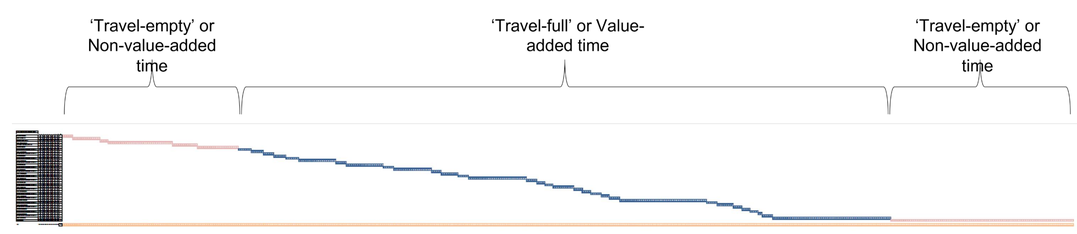
Each zone is typically manned by one or two pickers, or maybe more depending on the size of the zone, and these pickers' movements are restricted to within their designated zone. The reasoning behind the system being referred to as a pick-and-pass setup is that each picker picks product only within their picking zone and creates a sub-order or zonal pick line that then gets aggregated by a centralized collector, i.e., each picker 'picks and passes' their respective subset of the entire order to a collector who has their own route throughout the facility that involves only going to every zonal pick-up point to complete each order.

Having zones set up in a manner where the highest frequency products are stored in zones closer to the staging area and having more picking resources in such a zone, could greatly reduce the overall travel time for most pick lines. Picking accuracy also tends to be higher as the potential error rate for a lower spread of product variety in each zone means that pickers tend to have better command over their zones in terms of knowledge of product placement and thereby an increased speed of movement. Overall traffic and congestion in order-based systems are also addressed by segregating and isolating each zone and eliminating the need for multiple pick lines to interfere with each other.

3. Current State

Arla picking cycle
A calculation of the average time to complete all the steps, from the time the label is generated to trigger the start of a picking cycle until the fulfilled order is transferred to the loading bay and then back, in one picking cycle (of one picker) was carried out. The overall average cycle time is calculated to be 488 seconds, or just over 8 minutes to complete one cycle from label to label, by one operator.

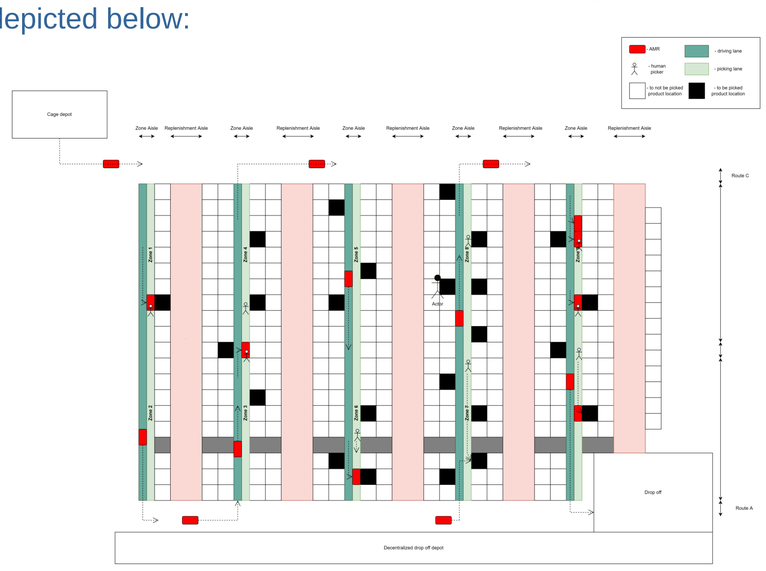
The company uses the term value-added or 'travel-full' to refer to processes where any movement involves transportation of product, while non-value added or 'travel empty' refers to any movement that does not directly involve any product being moved. The Gantt representation of the overall picking cycle timeline is represented below:



4. Innovation Proposition

The plan is to field a proof of concept (PoC) for picking assisted by AMRs (Autonomous Mobile Robots) in the distribution center. AMRs are robots that can perceive its environment and travel without the need to be monitored by an operator or the need for a fixed predetermined path. The idea is to have AMRs assist the human pickers in the picking process, which would reduce manpower requirements

The PoC is based on a hybrid of order-based picking and zone-based picking concepts, depicted below:



In the PoC, the human pickers' movements are restricted to one aisle, or one section of an aisle, denoting a zone, while the AMRs will move the handling containers and travel through every zone on the same order-based picking pattern being currently followed at Arla, while each human picker packs their sub-segment of the overall order in their respective zone during the AMRs' pass through that zone.

5. Results

By introducing AMRs into the current setup, the total cycle time would increase. However, since the majority of the traveling including the non-value-added movements of the current picking cycle would now be performed by the AMRs, the theoretical man hours needed from the picker has been reduced. This means for this one cage, the time needed from the picker has been halved from 7 minutes to 3.75 minutes, as derived from discrete event simulations.

Acknowledgement

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