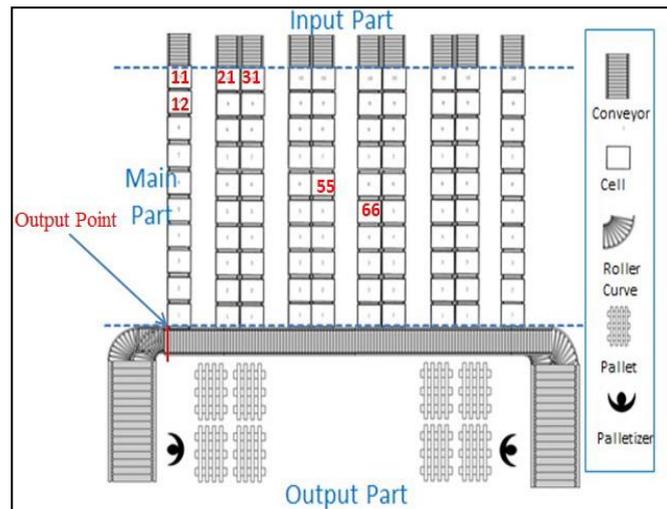


## Master/ Bachelor Thesis

### DYNAMIC FUZZY LOGIC TO ESTIMATE THE THROUGHPUT TIME FOR A NEW (FULL -CASE) AUTOMATED ORDER PICKING SYSTEM

There is a need for an enhanced automated order picking system with high efficiency in a bid to stay afloat in today's competitive business world. This thesis presents a new automated full-case order picking system. A dynamic fuzzy logic will be used to determine the average expected throughput time of the system and to find the mathematical equations for its description. It has been developed as a new technique that minimizes order picking time and other non-value adding tasks and maximizes performance. This new system will improve productivity, accuracy and speed of delivery in comparison with conventional automated full-case picking systems.



#### Thesis Objectives

Automated storage and retrieval system (AS/RS) is an equipment supported order picking system which is considered when the need for order accuracy is a critical factor. In pursuit of perfection and high throughput level during order picking operations in warehouses, there is a need for the design of a new automated full case order picking system. Automated cell storage and retrieval system (ACS/RS) is the new state-of-the-art design and it can simply be de-scribed as an enhanced version of the conventional automated order picking systems found in the market nowadays. The basic requirement for the system to function effectively in ware-houses is high quantity and low variety of products.

A dynamic fuzzy logic will be used to determine the throughput of the new system. This logic describes the expert's opinion about a statement A, instead of a single value  $a \in [0; 1]$ , we need to use a function  $a(t)$  that describes how this degree changes with time  $t$  unlike the traditional fuzzy logic which assumes that the experts degree of confidence do not change (Fanzhang Li 2001). When dynamics is taken into consideration, we can get a more adequate description of "and" and "or" operations, in which it is possible to distinguish between the cases when the statements are independent and when they are strongly dependent.

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