

## Chapter 3.1

# MICA: A Mobile Support System for Warehouse Workers

**Christian R. Prause**  
*Fraunhofer FIT, Germany*

**Marc Jentsch**  
*Fraunhofer FIT, Germany*

**Markus Eisenhauer**  
*Fraunhofer FIT, Germany*

### ABSTRACT

Thousands of small and medium-sized companies world-wide have non-automated warehouses. Picking orders are manually processed by blue-collar workers; however, this process is highly error-prone. There are various kinds of picking errors that can occur, which cause immense costs and aggravate customers. Even experienced workers are not immune to this problem. In turn, this puts a high pressure on the warehouse personnel. In this paper, the authors present a mobile assis-

tance system for warehouse workers that realize the new Interaction-by-Doing principle. MICA unobtrusively navigates the worker through the warehouse and effectively prevents picking errors using RFID. In a pilot project at a medium-sized enterprise the authors evaluate the usability, efficiency, and sales potential of MICA. Findings show that MICA effectively reduces picking times and error rates. Consequentially, job training periods are shortened, while at the same time pressure put on the individual worker is reduced. This leads to lower costs for warehouse operators and an increased customer satisfaction.

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## INTRODUCTION

The four fundamental processes of a warehouse are (Tompkins & Smith, 1998):

1. To receive incoming goods for storing,
2. To store goods until they are required,
3. To prepare requested goods for shipping (picking), and
4. To ship the picked goods (sometimes called packing).

Among all the processes of logistics, picking is the most problematic one because it is highly error-prone (Miller, 2004). Many different types of errors are known (Lolling, 2003): picking of wrong types or quantities of articles, complete omission of a type, and insufficient quality of delivered articles (see Figure 2). All these errors cause high costs for manufacturers and warehouse operators. Either because extra shipments and returns are necessary, or, in the worst case, because contract penalties have to be paid.

In today's lean production, where only small resource reserves are kept at the manufacturing site, the resources necessary for production are usually delivered to a customer just when he needs them. The orders are possibly known to the warehouse weeks before but delivery is expected exactly at the specified date. If an important item from the order is missing, this can mean that the whole production has to stop, incurring extra costs for the warehouse for courier delivery, and the customer who then lets the warehouse pay for the financial damage of the production halt. Besides causing huge costs, this certainly has potential to annoy customers. Accordingly, the primary goal for warehouses is to eliminate or at least reduce the number of errors.

Especially warehouses with human workers are confronted with returns caused by incorrect delivery of items. But although humans constitute the soft spot in this process, completely automated solutions are not an option for most warehouses

because human workers are much more flexible (see Figure 1).

During economic peak times, warehouses are forced to employ unskilled workers in order to cope with the increased workload. These inexperienced workers are not familiar with the structure and organization of the warehouse, yet have to be operational in a short time. They do not have the time to learn from experienced workers where an ordered article can be found, what the fastest routes through the warehouse are, what the exact processes are, or what a certain article looks like.

Nevertheless, work has to be completed without errors and under the same high time pressure that also skilled workers face. Picking errors and time pressure constitute the major problems for unskilled and skilled workers. Hence, there is a need for an intelligent assistance system that supports the workers. By preventing errors, such system also reduces the pressure put on each single warehouse worker. An assistance system for employees needs to support untrained workers as well as experienced workers in their usual way of working and not force them to change habits.

Based on an initial requirement analysis, we propose the Interaction-by-Doing paradigm, which was realized in a first MICA prototype. Its success led to the development of the second MICA pilot for field testing in a productive environment.

*Figure 1. Worker in a non-automated warehouse*



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