Self-configuring RFID System for Warehouses

Current approaches for installing and programming RFID systems for pallet tracking require intensive manual work as well as technical training. We present a solution to automate the deployment and programming of these systems. Our solution consists of a wireless sensor network, where each node runs a distributed algorithm that enables nodes to self-organize into RFID systems. These systems are adaptive to changes in sensor location and can dynamically add new sensors.

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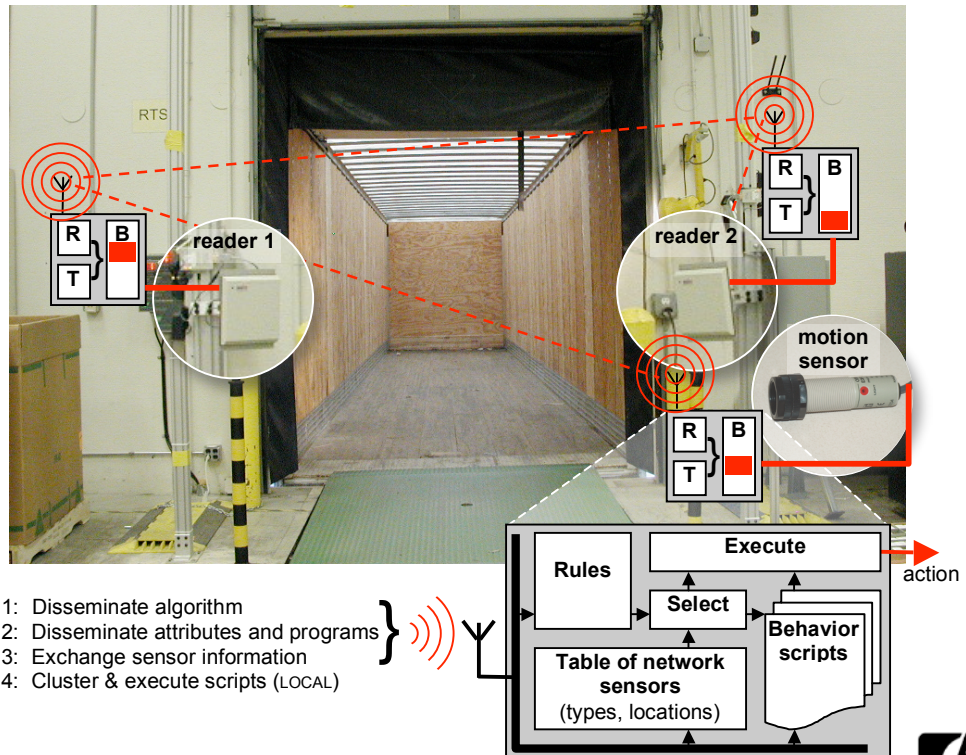1501 Page Mill Road
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Current pallet tracking systems in warehouses use a wired network of sensors (motion and RFID readers) to detect and read tags of products passing through dock doors. These systems require expert training to wire, setup the network and program the middleware that controls the sensors' operations. In a warehouse, where there could be hundreds of dock doors, the cost of labor to deploy, program and maintain these systems can be considerable. Wireless sensors could replace these systems simplifying deployment, but only if they are considerably easier to program and maintain. Current approaches for programming sensor networks require tedious individual node programming, thus the key challenge is how to program a multitude of diverse sensors, each running a different program for different applications. In this demo we show an innovative solution that allows sensors to autonomously program themselves based on their sensor types and location. The programmer merely specifies a set of attributes, such as sensor types and location that describe the desired sensor system, and the programs for each sensor type. The nodes then decide whether they match those attributes, and execute the appropriate programs. A distributed algorithm on each node is used to maintain the information about all nodes' sensors and locations and to perform the attribute matching and program selection. In this particular demo, we want to configure dock door sensor systems, where the attributes are the sensor types (RFID and motion sensors) and a target location of the door. At boot time we send these attributes as well as the programs for the two sensor types to the network, which propagates them. As the nodes discover their locations and sensors, they match them to the attributes and start loading their sensor programs. The system is also adaptive to changes in sensor state and location. A sensor malfunction causes the neighbor sensors to go into graceful degradation mode, and a change in location causes the node to re-evaluate its participation. When a new node is powered on, its neighbors discover it and send it appropriate commands and information enabling it to join the network and participate in a dock door system. Wireless sensors have the potential of bringing great benefits to industrial applications, but we need solutions for automating the process of programming and maintaining the sensors. This demo shows an application of a solution to this challenging problem.

STEP1: Disseminate algorithm
STEP2: Disseminate attributes and programs
STEP3: Exchange sensor information
STEP4: Cluster & execute scripts (LOCAL)

Wireless, self-configuring "smart" sensors