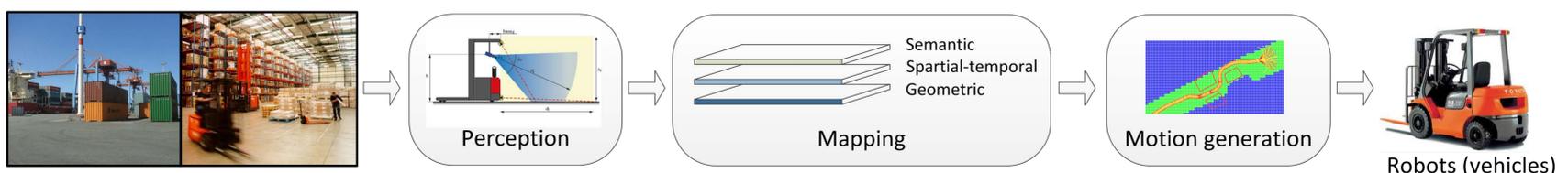


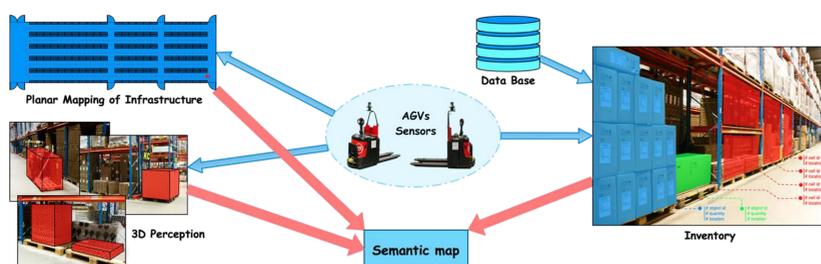
Awareness for autonomous vehicles doing intelligent material handling

At CAISR Intelligent Vehicles our research on autonomous vehicles focuses on making future Automatic Guided Vehicles (AGV:s) and mobile robots more **flexible**, **intelligent** and **safe**. This requires the ability to recognize and describe objects that the vehicle shall handle and the environment in which it operates (**situation awareness**). Furthermore, an important skill needed is the ability to reason on the information gained through perception to take actions that lead to a safer and more efficient (in terms of productivity) operation.



Research topics The awareness research questions are how robots (vehicles) can survey their surroundings, label them semantically (using prior information from experts), and build maps that can be used for action (e.g. navigation, task- and motion-planning). There is also research looking into safe autonomous material handling. Research topics include **perception**, **mapping** and **motion planning**. Applications areas are autonomous driving, safety systems, and intelligent material handling.

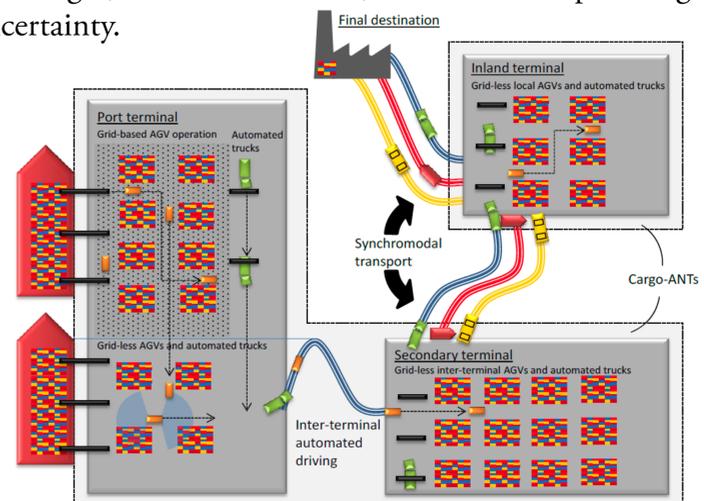
Perception The process of taking measurements using different types of sensors and extracting meaningful information from those measurements is referred to as perception. Awareness implies knowledge gained through perception or by means of information. Research is focused on object tracking, detection and classification. Sensors used are cameras, range laser scanners, structured light sensors and time-of-flight cameras.



AIMS Project, Overall Objectives and Motivations: An intelligent warehouse environment that autonomously builds a map of stock articles, and relates article identity from the database of the management system with the article's position (metric) and visual appearance in the environment.

Mapping A common approach in several projects is that we are developing a system, through which an awareness of the surrounding environment is embedded in a semantic map. Such a system requires situation awareness through different types of sensors, data fusion and employment of novel methods for interpretation of information. Research is focused on semantic mapping, multilayer-mapping and long-term mapping. Application environments are work- and ship yards, harbours and warehouses.

Motion planning Showing awareness requires an ability to perform actions, i.e. a truly autonomous vehicle should be able to reach its destination safely (avoiding collisions) and efficiently (minimizing time or path length) by itself. Research is focused on task-planning, path-planning, local path-planning (obstacle avoidance) and motion planning under uncertainty.



Cargo-ANTs project aims to optimize freight transportation by combining grid-less smart AGV operation in terminals and beyond fenced spaces, and AT operation in terminals and in inter-terminal driving.

The Projects

Cargo-ANTs is a 3-year project that began in September 2013. It is funded by the European Union under Framework Programme FP7. The partners of this project include TNO, Netherlands; AB Volvo, Sweden; ICT Automatisering Netherlands; CSIC, Spain; Halmstad University.

ANTWaY is funded by FFI. It started on May 2014 and runs for 3 years. The partners of this project include AB Volvo, Kollmorgen, Chalmers Tekniska Högskola and Halmstad University.

AIMS (Automatic Inventory and Mapping of Stock) is a collaborative project between Kollmorgen, Optronic, Toyota Material Handling Europe and Halmstad University. The project is a part of Centre for Applied Intelligent System Research (CAISR) funded by the Knowledge Foundation.

Vasco Project is collaboration between Volvo Group Trucks Technology, Advanced Technology and Research and Halmstad University under the framework of CAISR.

SASS (Situation aware safety systems) is a collaborative project between Kollmorgen, Optronic, Toyota Material Handling Europe and Halmstad University. The project is a part of Centre for Applied Intelligent System Research (CAISR) funded by the Knowledge Foundation.

Long-term Multi Layer Mapping is a collaborative project between Kollmorgen, Volvo Trucks (VT) and Halmstad University. The project is a part of Centre for Applied Intelligent System Research (CAISR) funded by the Knowledge Foundation.