Summary

Introduction

Over the last few decades warehouses and factories have undergone many changes regarding their material handling technologies. Where once only manual labor took place nowadays some places have virtually no manual labor left as almost all humans have been replaced by autonomous machines. One of these machines is an AGV, an Automated Guided Vehicle. These autonomous vehicles are used in situations where humans would not be safe or are not suited. Think of situations where toxic, radioactive or very heavy materials need to be handled, or when many different materials need to be sourced from a large warehouse.

The VRSI lab carries out research with small test beds, these are similar to the AGVs used in the industry but much smaller and focused on research. Research projects are carried out to simulate real-world environments, focussing on improving efficiency and running simulations to make predictions about future environments.

Problem statement

Projects in the VRSI cope with some of the same difficulties as the industry. Among other things, it is a really difficult task to use AGVs, or test beds, from multiple different manufacturers at the same time or together in the same environment. Manufacturers often use their own proprietary platforms and codes to fabricate AGVs. But when multiple AGVs are needed with different properties a selection can be hard to make due to interoperability problems. For example, often these AGVs from different manufacturers will use a different “language” to communicate. This means that to drive two different AGVs you will need two different management systems. Understandably this quickly becomes complicated when many different vehicles are needed. For the lab, this means that research is often limited to using only one type of vehicle at a time while using multiple different ones could result in better research.

Results

To solve this problem, first, a look at the existing industry solution was taken: a concept named middleware. Middleware (fig. 0.1) acts as a layer between the vehicles and a management system and translates the language from each of the different vehicles to a general one understood by the management system. Middleware can be complicated, but this works for the industry because new additions

Figure 0.1 , Middleware visualized, From https://www.sunriseintegration.com/learn/what-is-middleware-and-why-is-it-essential-to-your-business, by Sunrise Integration.

to the system are known and the resources, both time and money, are available. For the lab, this is not the case and an alternative solution is introduced here.

Instead of using middleware to translate the language that the vehicles are programmed into, the vehicles will be programmed to use one universal language. This means when adding new vehicles to the system (fig. 0.2), instead of knowledge about both the middleware and vehicles, now only limited knowledge about the vehicles is needed. Then, together with a fixed management system written in Unity the location and orientation of these vehicles are determined by scanning codes attached to the vehicles with a camera hanging above. With only this information, navigation and pathfinding are possible with vehicles from many different systems. The only requirements to use a vehicle in this system are very low and if needed easily adapted on the vehicle.

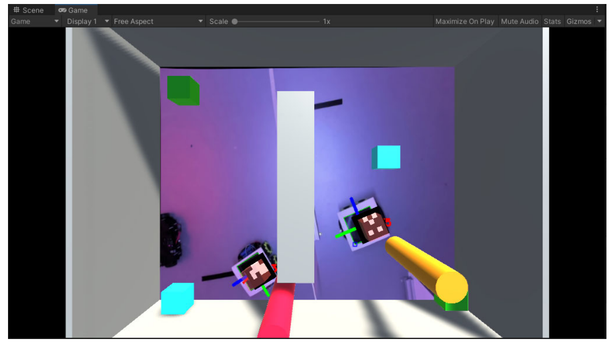

Figure 0.2 , The view from the system

This new, open-source & easily adaptable concept, allows for using multiple different vehicles in future research projects carried out in the VRSI *lab in a predictable and easy way.*