CoFleet
Cooperation-based Fleet for Short Distance Transportation

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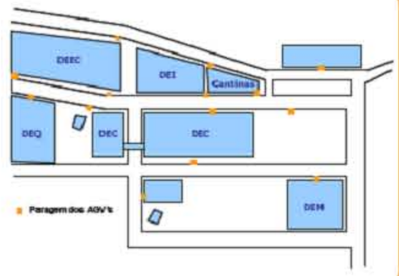
Introduction

The goal of this project is to develop a fleet of autonomous vehicles for transporting people in short distances and at a reduced speed (under 30 Km/h). They are a complement to the system of public transportation with the same flexibility of the private automobile.



The fleet being developed is aimed at deploying an experimental system for transporting people within the academic campus of University of Coimbra, pole II.

The vehicles are gifted with autonomy (batteries), an anti-collision system based on sonars, an embedded computer, wireless communication and an RFID reader.

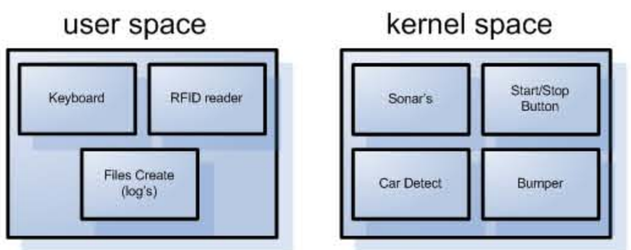
Software

Operating System

A linux operational system was selected due to its modularity. It allows to insert modules into the kernel to the extent of our necessities, or to install new services. It also makes possible using a compact and versatile distribution, so as to consume fewer resources of the computer (processor, memory and disk space).

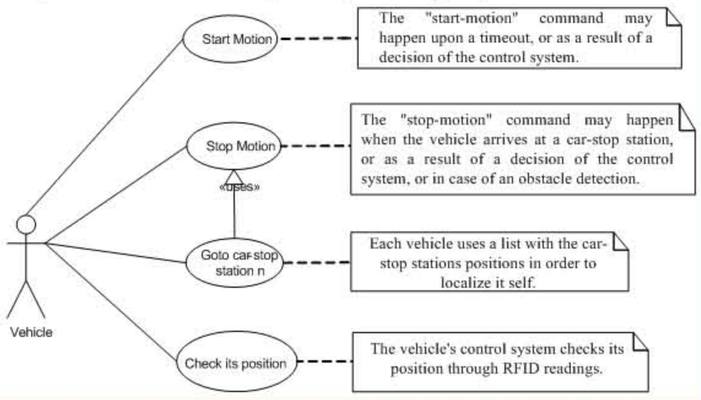
Modules

The developed software is based in corporation of two modules, "user space" and "kernel space".



Input / Output

This project intends to introduce several modifications in the vehicles to perform the use case diagram in next Figure, wherein several actions, which the AGV needs to perform when using its inputs/outputs, are showed.

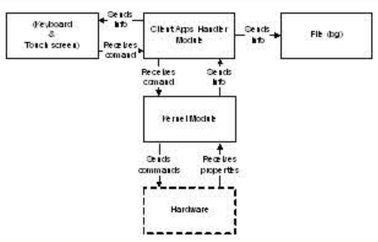


Emergency signals

The "Emergency vehicle signals" are directly sent by the vehicle to notify an abnormal situation. The emergency signals are:

- No wire detection
- Collision detection
- Semi-emergency button
- Bumper Switch
- Obstacle detection

Schema of the developed software

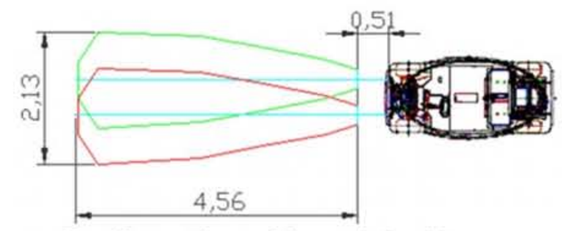


- The Connections Listener module needs to store the existing launched (dynamic) objects, because they must be deleted.
- The kernel module is a logical entity that represents a single physical vehicle. This entity is autonomous from the rest of the application server and has the ability to make some decisions by itself.

Hardware

Vehicle Specifications: information about the AGV and the built-in system.

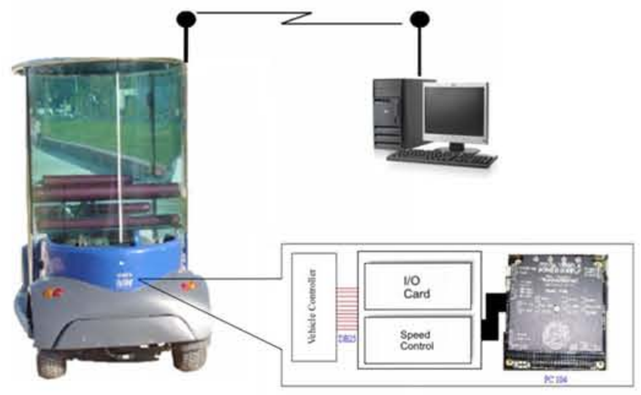
- Embedded Control Unit (on-board computer) with wireless interface.
- Hardware interface to control the vehicle through the built-in system.
- User Interface Software: user interactive information through a touch screen (one vehicle).
- Obstacle detection: Ultrasound.

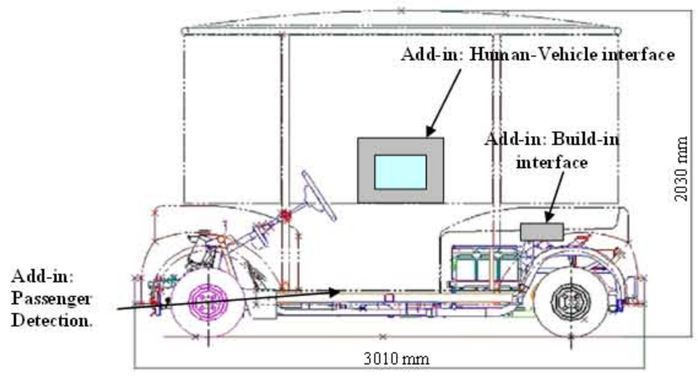


Configuration of the original beam

The equipment set, named Embedded Control Unit, has the following major characteristics:

- Embedded PC
- 11Mbps Wireless Network
- RFID reader for positioning
- Touch screen for Human-Vehicle Interface
- Build-in System Interface





The hardware interface to control the vehicle has the following major characteristics:

- I/O card
- Speed control module

AGV characteristics:

- Load: 4 people
- Max speed: 10 km/h or more
- Average speed: 8 km/h
- Range: 30 km

The AGV's were manufactured by "Yamaha Motores Europe" and have built-in wire-guided navigation.

Conclusions

- Integration of an embedded computer in the vehicle so as to increase its autonomy and robustness.
- Development of an anti-collision system based on NASSL & OHMIC sonars for increased navigation safety.
- Implementation of a localization scheme based on RFID's.
- Switching to diferent paths for the autonomous navigation.
- Development of the car managerment software.
- Wi-Fi comunication between vehicles and the base station to verify the state of the system .
- Control program of the fleet based on cooperation among vehicles.

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