X. Project Plan

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X.1 Specification

The following chapter describes the specification of the developed system. It is based on the customer requirements and correspondence with the customer. This chapter will be adjusted if requirements change, to provide clearance during the development process, as well as the maintenance process after releasing the system.

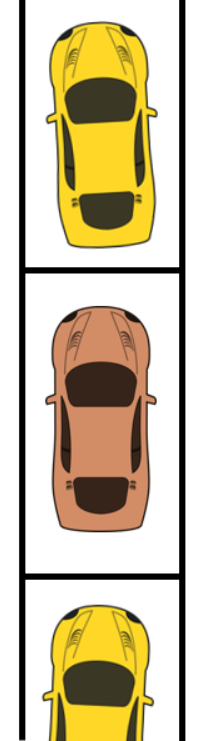
X.1.1 Project Scope

The system shall support a driver with taking his car out of a parking lot. The system is designed to work with the cars of the customer. It should use sensors, build around the car, to take the car out of every parking position in the most convenient and safe way. The system should provide a graphical user interface within the car display, to provide overview over the process of taking out the car.

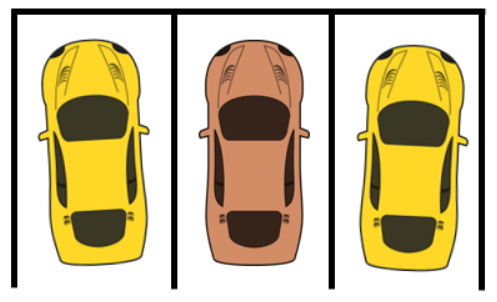
X.1.2 Supported parking positions

The two main parking positions shall be supported, as shown in the pictures below:

1. Parallel parking



1. Perpendicular parking



A car moved out of a lengthwise parking lot has to face the same direction as before being taken out, while a car taken out of a transversal parking lot is moved 90\* clockwise when being taken out. Angled parking lots are treated the same way as transversal parking lots, only the orientation of the car is not changed by the whole 90\*, but by a smaller amount. In all cases, the cars have to leave the parking lot entirely, and must not enter the opposite lane at any time of the process.

X.1.3 Sensors

The system uses a number of sensors placed on and within the automobile. They are used to ensure a secure process of taking out the vehicle off the parking lot:

* Speed Sensor

Acquire the current speed

* Distance Sensor

Acquire the distances between the vehicle and obstacles

X.1.4 Required Controls

The parking system requires the control or a possibility to interact with a number of car components to work properly and to its full potential:

* Transmission control

Switch between forwards and reverse driving

* Engine control

Set the desired car velocity

* Board computer control

Display the user interface

* Brake control

Decrease the velocity

* Steering control

Change the vehicles direction

The board computer is not mandatory for the system to work, but highly recommended.

X.1.5 Obstacles

The parking assistance system shall be able to take obstacles into account. There are two kinds of obstacles we are facing when running the process of taking out a car of a parking lot:

Static obstacles:

Static obstacles are not moving themselves. Their distance towards our vehicle controlled by the parking assistant system only changes by the movement of the vehicle itself. We do not have to predict where the obstacle might be positioned at some other point in time.

Static obstacles are objects like:

* Parked cars
* Houses
* Walls
* Burgundy
* Trees

Dynamic obstacles:

Dynamic obstacles have a movement, or the potential to move during our process of taking out the car of a parking lot. Their distance to our vehicle can change without our car having any velocity. If there is any possibility, an obstacle might interfere with our vehicle, or the predicted path of our vehicle, it has to be taken into account during the process. If the distance between an obstacle and our vehicle is reducing by a higher ration than the velocity of the car, the car has to stop.

Dynamic obstacles are objects like:

* Moving cars
* Human beings
* Animals

X.1.6 Country regulations

The system should primary work in Great Britain – thus the traffic rules of Britain should be considered when running a process of taking the vehicle out of the parking lot. The rules for the process do not differ in any country of Europe by any other factor than the side of the road the cars are driving on. Therefor there must be a setting to switch between:

* Right-hand traffic
* Left-hand traffic (default)

X.1.7 Graphical User Interface

The graphical user interface is a non-mandatory, but highly recommended part of the system. It shall initiate the process of taking a car out of its parking position. It shall be intuitive and use the corporate design of the customer. Furthermore, it shall monitor the process by displaying the following information to the driver:

* A top-down view of the car and the closest surroundings
* Predicted car route
* Vehicle velocity
* Driving direction
* Distance to the closest obstacles on each side of the car
* Warnings in case of dangerous situations

X.1.8 Implementation

The system should be implemented with the programming language C#. For the graphical user interface the framework WPF is to be used, as well as the corporate design of the customer for WPC controls styling. For sensor communication we will use CAN buses and extract the required information from the streams. An SQL database will be supplied to assure fast processing of the high amount of data in a small time and to ensure performance we will work with stored procedures.