Autonomous Car Project

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Contents

Problem

Autonomous Cars Analysis

Existing Solutions

Our Solution

Project Features

Problem

Emergency vehicle priority is an important issue in the traffic. If we clear the way for emergency vehicles as quickly as possible, we can increase the survival rate of the patients or people on the emergency situations. Our project aiming to add vehicle priority awareness feature to autonomous cars. Of course, autonomous cars not common for today but in the future, everyone expected to use them.

Autonomous Cars Analysis

We can examine autonomous car's features in five fundamental parts:

1. Localization
2. Perception
3. Prediction
4. Planning
5. Control
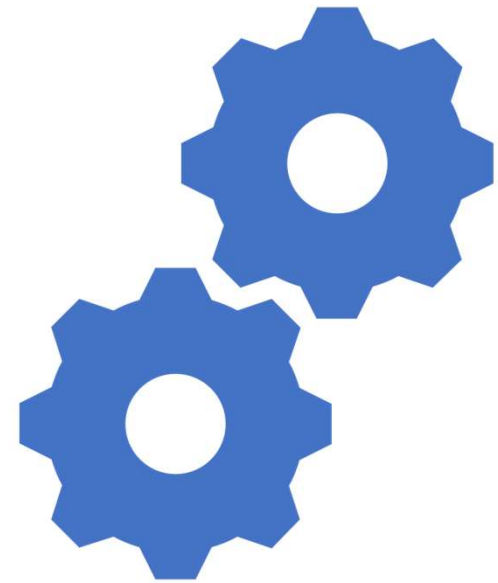
Localization

Localization is meaning of its own position known by the autonomous car. It's being possible by using sensors as LIDAR and GPS. And data is being calculated with an algorithm which is called as Kalman Filter. The Vehicle's exact position determined with the help of odometry. Odometry uses data from motion sensors to estimate change in position.

Perception & Prediction

Perception

Perception is how cars perceive from their environment. In this part, computer vision and neural networks takes the role. Studies such as recognizing objects and location of objects are being developed by using deep learning algorithms.

Prediction

In this part, the autonomous car tries to predict the behaviour of the other cars like how fast it is or which direction in it and behaviours of the pedestrians in their environment to be able to decide its own action. For this purpose, Recursive neural networks (RNN) is being used.

Planning & Control

Planning

For the route planning of the autonomous cars A* search (An algorithm for finding shortest path), Lattice Planning (An algorithm for basic and limited road networks) and Reinforcement Learning is being used.

Control

In the Control part the steering direction, speed of the car and braking are being set. The most commonly used method is called as Proportional Integral Derivative (PID) control. The steering direction changes according to output of the lane recognition system.

Existing Solutions

There are no official researches by big companies on the same problem, but some engineers wrote blogs and articles about it. They offered wireless communication system between cars to be able to solve the problem.
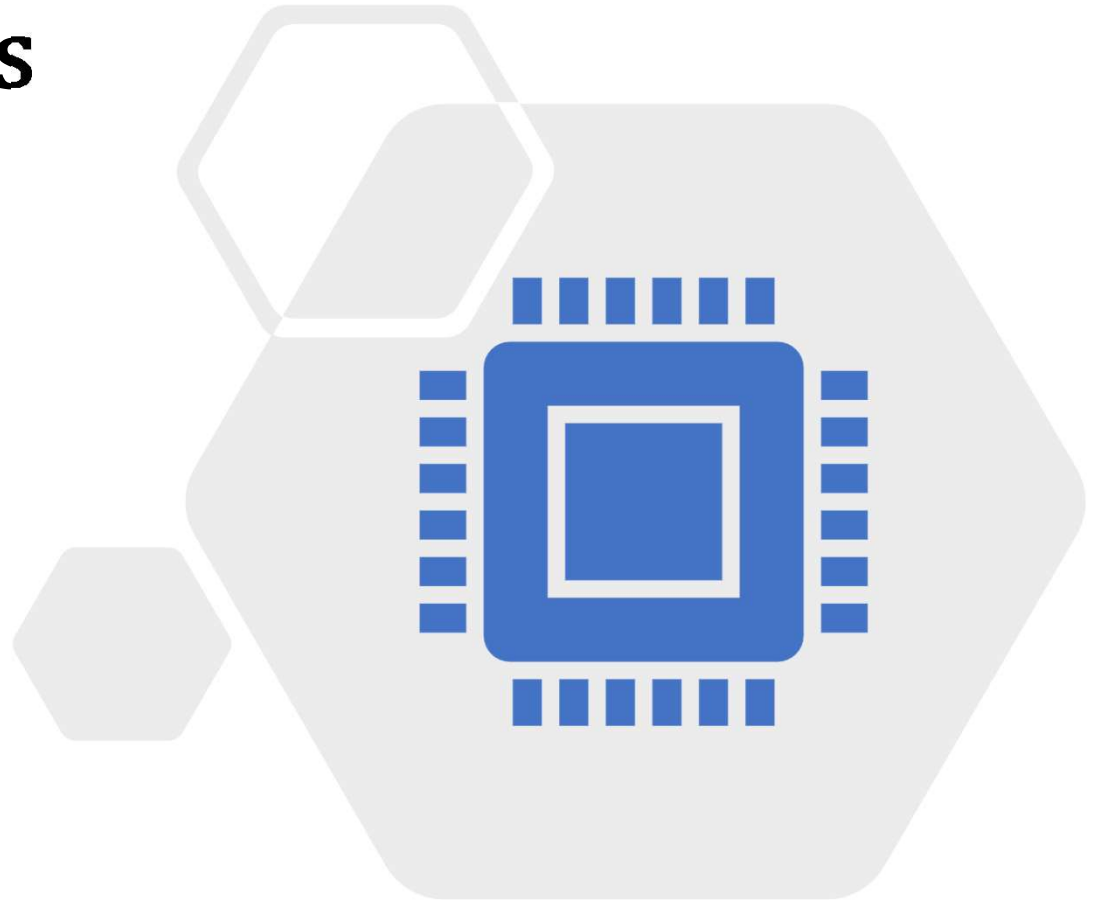
Solution

To solve this problem, one of our main solution is we will use cameras, audio sensors. Firstly, our car will check all the lane on the road if one right lane is available it will start driving from there to be able to balance the traffic on the road with the image data from the front camera. With audio sensor the vehicle will recognize sirens and with the back camera it will check if emergency vehicle is behind of the car and not on the opposite side of the road. After emergency vehicle move away the car will return its previous lane.

We will test our codes in simulation environment.
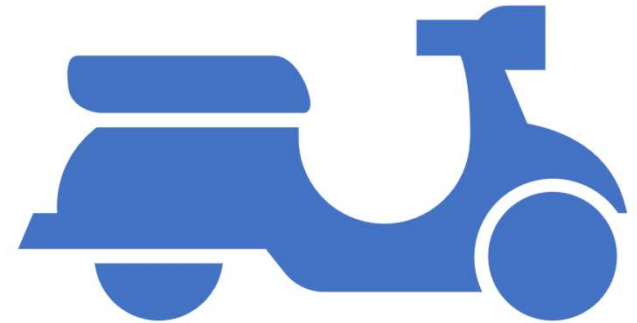
Solution..

We will use Webots Simulator and it's libraries for autonomous cars in Python.

We chose Webots because it is cross platform, open source, supports many languages including Python and has environment sound. It provides various sensors like LIDAR, radar, GPS and interface to simulate traffic. It does not provide emergency car models so we will try to create them in Blender and export to it. But modelling a car is requires modelling knowledge and skills so If we can not make it, we will add sirens with speaker to a normal car model which is the simulator provides.

For voice assistant we will use Google Speech to Text API.

Class Diagram
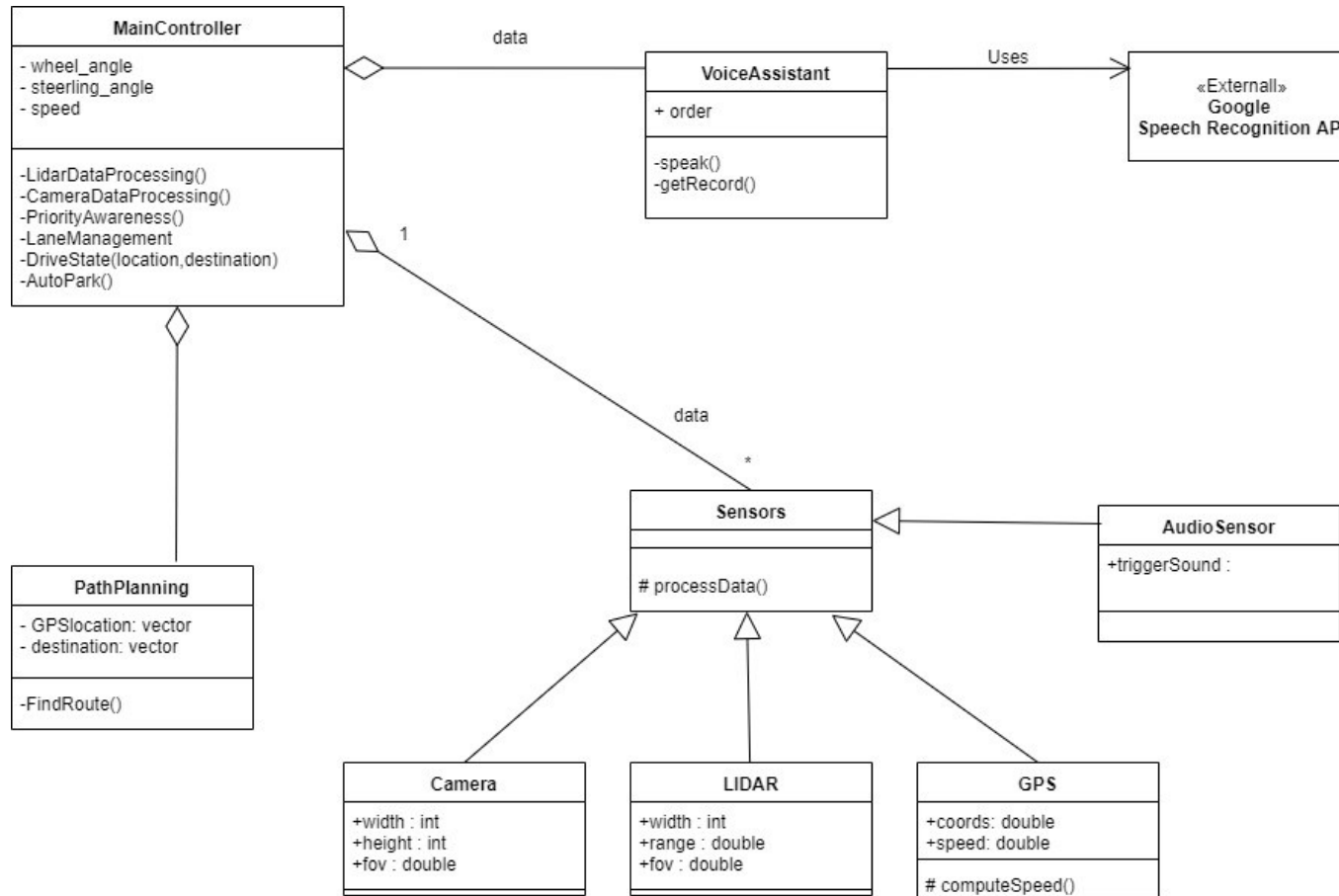
Project Features

Our system will include:

Lane detecting and following	Object recognition and auto brake	Virtual voice assistant	Route Planning	Emergency vehicle priority awareness

Current autonomous cars already have the first four of these features. We will add fifth one as a new feature to autonomous cars.

To be able to success on this project our car at least needs to follow the lane, not hit objects on the road and let the emergency vehicle pass by changing lanes. Other features may change according to the possibilities of the simulator.

Thanks… ☺

Any Suggestion?