

SIMULATION OF SELF-DRIVING CARS USING MATLAB SOFTWARE PACKAGE 2024

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Abstract: In this paper, we present the Matlab software package 2024 and the toolbars of the Matlab software package for the control of Self-Driving Cars. Driving of Self-Driving Cars is given. Simulation of Self-Driving Cars using Matlab software package 2024 is considered. These vehicles use various sensors, radars, lidar, cameras and artificial intelligence to continuously assess their environment and make driving decisions. Automated Driving Toolbox is a tool developed by Matlab to support the simulation and development of Self-Driving Cars. With this toolbox, different aspects of Self-Driving Cars can be modelled and simulated.

Key Words: Matlab software package 2024, Artificial Intelligence, Simulation of Self-Driving Cars using Matlab software package 2024, Automated Driving Toolbox.

1. DRIVING OF SELF-DRIVING CARS

Self-Driving Cars are vehicles that are capable of driving partially or fully autonomously without the need for a human driver. These vehicles use various sensors, radars, lidar, cameras and artificial intelligence to continuously assess their environment and make driving decisions. Self-driving is not a development but a revolution, because:

a. Self-Driving Cars use their sensors to detect traffic jams and always respect the speed limits! This significantly improves traffic safety. Because there are no traffic accidents due to speeding.

b. Humans do not have the ability to drive safely because of their perception/judgement of the environment: a sober, relaxed, alert driver, driving with a maximally alert road - even in the case of an environmentally aware driver, 0.8 seconds elapse from the moment of perception of an immediate danger - the reaction time of the driver - until the driver tries to avoid a traffic accident by accelerating or braking. This means, for example, that at a speed of 108 km/h, the car will travel 24 metres and nothing will happen. It is only after the 24 metres have been covered that the car starts to lose weight due to the acceleration or to reduce its speed by braking. In a self-driving car, because of the fast reaction of the sensors, it happens in a fraction of 24 m! This problem - in the case of the driver (human), is particularly significant if the: the driver is drunk or intoxicated, because then the reaction time of 0.8 s increases significantly - even by a multiple! In the case of self-driving cars, the sensors are never overloaded or under the influence of alcohol!

Man as driver: he does not talk to cars in front of him and to cars in front of him because he is gathering information, does not send data to the clouds, does not download - collect data from the clouds, does not process data collected from sensors. If the car is driving in smart car, the driver does not use the data from the sensors in the smart car, iot (internet of things) for safe driving, the self-driving car uses the data from the sensors in the smart car and IOT. As a public safety expert, I worked for 42 years between 1973-2015 and my data on the exact cause of traffic accidents shows that 90% of accidents were caused by human error. Every year 1,300,000 people die in road accidents in the world, and the latest figures for 2023 show that 97% of accidents are caused by the driver. The solution: a. the introduction of self-driving cars and b. collection of driving licences so that 1300,000 people in the world will be saved every year!

Self-Driving Cars are generally classified into several levels of self-driving capability. Self-Driving features can range from lane-change assistance and speed control to fully autonomous driving [1-10]. Car manufacturers and technology companies are making many developments in this area and Self-Driving Cars are already being tested and used in some cities and regions. Self-Driving Cars have the potential to offer many benefits, such as: - increased road safety, - reducing traffic congestion, - improving transport efficiency and - expanding mobility options, especially for those with limited driving ability. However, there remain a number of technical, legal and ethical challenges to the uptake of Self-Driving Cars. Self-Driving Car control is a process whereby a vehicle navigates autonomously in its environment without the need for human intervention.

The control of Self-Driving Cars is made possible by a combination of the following elements:

Sensors: Self-Driving Cars use a range of sensors, such as radar, lidar, cameras and ultrasonic sensors to continuously detect their surroundings. These sensors can detect nearby vehicles, pedestrians, cyclists, traffic lights, pavement signs and other elements.

Data processing: Computers and artificial intelligence systems in the car analyse the data collected by the sensors. These systems interpret and evaluate environmental information and make decisions about vehicle behaviour.

Control and guidance: The control systems in Self-Driving Cars are responsible for controlling the speed, direction and manoeuvres of the car. They make decisions that allow the car to drive safely in the environment.

Communication: Self-Driving Cars can communicate with other vehicles and infrastructure. For example, they can communicate with other cars and traffic systems about road conditions and traffic information.

An important goal for Self-Driving Cars is to drive safely on the road and minimise traffic accidents. The control of Self-Driving Cars attempts to mimic many elements of human drivers' skills and decision-making, while providing a number of benefits, such as reducing traffic congestion and improving traffic efficiency [11-26]. The development of Self-Driving Car control continues to be an active area of research and is constantly improving.

The article is organized as follows: in Section 1, Driving of Self-Driving Cars is given. In Section 2, Simulation of Self-Driving Cars using Matlab software package 2024 is considered. In Section 3, the Automated Driving Toolbox is given. Conclusions are given in Section 4.

2. SIMULATION OF SELF-DRIVING CARS USING MATLAB SOFTWARE PACKAGE

The simulation of self-driving cars can also be implemented using the Matlab software package. Matlab is a powerful computational and simulation tool that allows you to model the behaviour and environment of self-driving cars. The following steps will help you create a simulation of self-driving cars in Matlab:

Model creation: create a model of the self-driving car and its environment. Define the physical properties of the car, its sensors, control system and environmental factors.

Sensor simulation: sensors in self-driving cars, such as lidar, radars and cameras, detect their environment. We can simulate these sensors and their operation in a more mathematical way.

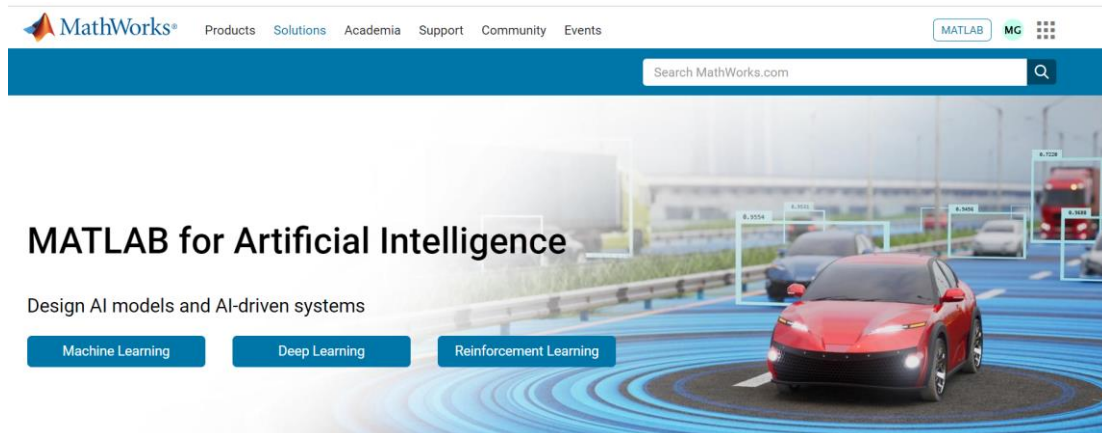
Algorithms and control: implement algorithms and control systems that allow the car to drive, such as lane changing, speed control and obstacle avoidance.

Environmental simulation: create an environmental model including roads, vehicles, pedestrians and other factors. In a model, you can simulate changes in the environment, such as changes in weather or traffic.

Test and optimisation: run the simulation and analyse the results. Test the car's behaviour in different situations and conditions and refine the algorithms for optimised driving.

3. AUTOMATED DRIVING TOOLBOX

Automated Driving Toolbox is a tool developed by Matlab to support the simulation and development of Self-Driving Cars. With this toolbox, different aspects of Self-Driving Cars can be modelled and simulated, Picture 1, 2.



Picture 1. Matlab for Artificial Intelligence. Design AI models and AI-driven systems.



Picture 2. Simulation of automated driving control.

The Automated Driving Toolbox can be used to perform the following tasks:

Sensor simulation: the toolbar allows you to simulate sensors such as lidar, radars, cameras and assign them to your car model. This allows you to test how the vehicle perceives its environment.

Tracking and Control: the toolbox allows you to model the control of your car, such as lane changing, speed control and obstacle avoidance. Testing and evaluation: run simulations and evaluate the behavior of the self-driving system in different traffic and weather conditions [27-38].

The toolkit also includes various metrics and evaluation tools for performance analysis. The Automated Driving Toolbox is a software tool that can help developers and engineers test and refine self-driving systems before they are tested in the real environment. Its use can be an efficient and safe way to develop and test self-driving vehicles. The toolkit works in integration with Matlab's computer modelling and simulation environment and offers the possibility to create realistic simulations.

4. AUTOMATED DRIVING TOOLBOX

In addition to the Automated Driving Toolbox in Matlab, the following toolboxes and toolbars can be used for simulating Self-Driving: WLAN Toolbox, Wavelet Toolbox, Vision HDL Toolbox, Computer Vision Toolbox, Vehicle Network Toolbox, Vehicle Dynamics Blockset, Sensor Fusion and Tracking Toolbox, Text Analytics Toolbox, SerDes Toolbox, Statistics and Machine Learning Toolbox, Simscape, Signal integrity Toolbox, Symbolic Math Toolbox, Satellite Communications Toolbox, Signal Processing Toolbox, Stateflow, SimEvents, Requirements Toolbox, RF PCB Toolbox, Reinforcement Learning Toolbox, RF Toolbox, Robust Control Toolbox, RF Blockset, Radar Toolbox, Powertrain Blockset, Simscape Electrical, Fixed Point Designer, Predictive Maintenance Toolbox, Optimization Toolbox, Navigation Toolbox, Deep Learning Toolbox, Motor Control Blockset, Model Predictive Control Toolbox, Mapping Toolbox, Model Based Calibration Toolbox, LTE Toolbox, Lidar Toolbox, Wireless HDL Toolbox, Simscape Driveline, Image Processing Toolbox, System Identification Toolbox, Instrument Control Toolbox, Image Acquisition Toolbox, SoC Blockset, DSP HDL Toolbox, HDL Coder, Global Optimization Toolbox, GPU Coder, Fuzzy Logic Toolbox. Self-driving toolkits provide algorithms for implementing and testing Self-Driving simulation. Thus, it is possible to: Design and test artificial vision, lidar, video system, fusion of sensors, implementation of path planning and control of the Self-Driving Car.

5. CONCLUSIONS

In this paper, we present the Matlab software package 2024 and the toolbars of the Matlab software package for the control of Self-Driving Cars. Driving of Self-Driving Cars is given. Simulation of Self-Driving Cars using Matlab software package 2024 is considered. The Automated Driving Toolbox is given. These vehicles use various sensors, radars, lidar, cameras and artificial intelligence to continuously assess their environment and make driving decisions. Automated Driving Toolbox is a tool developed by Matlab to support the simulation and development of Self-Driving Cars. With this toolbox, different aspects of Self-Driving Cars can be modelled and simulated.

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