Abstract

In the present world, electrical vehicles have gained high attention due to their cost-efficiently and environmentally-friendly capabilities. As the number of EVs is increasing, their charging features become completely significant. There are, also, autonom driving features included in some EVs. A large range size of autonomous drive systems are getting more popular in today's world. Our mission, in this paper, is to first analyze the past academic studies conducted on state-of-the-art autonomous EVs. Then, we will develop a new conceptual design of a digital-twin autonmous EV by considering both virtual/real world interaction and wireless charing mechanisms after demonstrating some of the sample robots already available on the internet.

Introduction

Electrical vehicles have been becoming parts of our daily lives. There are EVs seen both as large public vehicles and sport cars. Given that it is getting more interesting to encounter different type of EVSs in urban life. Recently, the academicians have become more interested in EV concept due to its unique nature of electiricity utilization. Indeed, the opportunity of numerous developing ideas make the area pretty competitive. To illustrate, the batteries and their charing systems gained the main attention since it is a challenging objective to develop new methods. Moreover, digital-twin creating is considered as the number one method to test the control system of up-to-date autonomous EVs. These two features require more challenging design steps since the it is needed to analyze the precise positioning for effective wireless charging while the safety neccesities must be fully satisfied to avoid the risk of pedestrians in urban life. In this literature review, we analyze the past studies on EV charging and X-In-the-Loop. After that, we will demonstrate the sample available robots on the internet. Then, our unique design will be discusses based on the hardware, simulation platform selection and the sample work-flow diagram design.

State-of-the-Art Technologies

There are several autonomous drive simulation analyses available on the internet. The simulation platforms vary from Webot platform to Siemens PLM software. While the critical analyses can be simulated on SYS1 to SYS8, Unitiy Engine 3.0 is becoming also a very usefull software for autonomous drive tests. (Szalay, 2020) Virtual simulations can create a realistic and case-sensitive approach. Especially, when we take the careless pedestrian scenario into account, sensor and brake control system must be executed immediately. Although the computational time can consist of error compared to the real-life vehicle, sufficiently similar results are achieved by Hardware-In-the-Loop utilization. (Baruffa and Pereira, 2020) Despite of that, Zofka et.al. (2018) proved that the unexpected environmental actions can be accurately simulated with multi-Lidar set up.

Autonomous drive system brings the human safety into consideration. While the following the front vehicle from a safe distance is a hard task, sudden encounter with a pedestrian is totally a crucial subject of study. Indeed, Baruffa and Pereira (2020) used aruco markers to provide virtual duties to the robots as

bus and ordinary vehicle and, he analyzed whether the rear autonomous driven vehicle protect the safety distance with the front bus. Robot operating system, here, was used to arrange all the sensor actuation and the communication between the virtual and real world. The safety became a significant concern. To satisfy the standards in this area, there are a large number softwares on the market such as Siemens PLM, Webot, Unity Engine and SYS1-8. (Szalay, 2020)

The batteries and their charging are another important issue. Charging approaches have become pretty diverse in EV field. To illustrate, while the drivers used cables to charge their cars initially, the present aspect has become wireless charging set up. (Khudwar and Gaur, 2016) Although cable usage used to be an applicaple way to deal with charging, it has become an impractical approach. Wireless charging , therefore, has gained attention.

There are multiple wireless EV charging methods developed during the last decade. Inductive power transfer (IPT) is one of the most common ways to build a wireless EV charging set up. It is fundamentally based on the Faraday's Inductive Law where the energy is transferred by the magnetic waves. Inductive coupling is made of use of in this approach. (Khudwar and Gaur, 2016) There were even some futuristic inventions having both sides charging multiple vehicles simultaneously. (Swain et. al., 2012)

Although the cables could be completely avoided with this way, time was taken into account as another important parameter. In other words, IPT required a considerable amount of time for drivers. In order to avoid this time-waste, Santhosh and Vasanthaseelan (2019) conducted a study on developing a road charging system. Their objective was to eliminate the time waste of IPT way. To achieve that, they built a model consisting of Aluminum road which was the conductive element of the model. While a mini-car was moving, it was getting charged below 45% of battery charge. Therefore, they developed a unique method to charge the cars in motion by using mutual induction principle.

Conclusion

To sum up, the project which will be conducted for ME462 courses results in a mini robot which can be conducted as one of the cheapest and compact simulation testing system. In addition to that students for the next years is going to get educated and improve the system by considering electronical, mechanical, software and agumented reality content. Our work explains how it can be done by considering commercial products and state of the art technologies. Literature survey will lights out the way we are going to work on.