The Catalonia Living Lab

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INTRODUCTION

The development and implementation of autonomous vehicles will positively impact society but will bring forth challenges at the same time, and the Catalonia Living Lab serves as one of Europe's leaders in research pertaining to these vehicles. The Catalonia Living Lab works with some of the largest transportation-related agents in Spain to aid in the testing of connected and automated vehicles through the use of testing facilities throughout Catalonia. Some of the motivating factors behind this research are the predicted societal benefits of this technology, such as improved road safety and mobility. However, the development of these vehicles will also bring forth challenges, such as the moral decision-making of the vehicles and necessary changes to policy and infrastructure.

TOPIC DESCRIPTION

The Catalonia Living Lab is a government sponsored public private program launched in 2017 with the hopes of bolstering the automated driving industry in Catalonia and providing an outlet for global research and testing [1]. The program, managed under the Connected and Automated Driving (C-AD) Forum of Catalonia, allows for automated vehicle testing in real-life roadway situations on a variety of different terrains and conditions. In addition, the Catalonia Living Lab partners with and draws sponsorship from numerous major companies in the automotive industry. As the program grows, the government expects more investment into this industry and into the region of Catalonia as a whole. In this way, the Catalonia Living Lab provides a platform for connecting major entities interested in research within this field.

RESEARCH

The Catalonia Living Lab joins together transportation entities and facilitates road testing to help bring forth the positive societal impacts sought by the development of autonomous vehicles despite the challenges presented by this technology. At full implementation, autonomous vehicles have the potential to improve road safety by eliminating human-related error and to improve convenience and mobility for people of all ages and abilities. However, the

development of this technology brings forth the challenges of programming moral decision-making in vehicles and changing the existing policies and infrastructure. With the help of the research done by the Catalonia Living Lab, leaders in the transportation industry will be able to address these challenges and achieve the societal benefits of autonomous vehicles.

Objectives and Relevance

The Catalonia Living Lab is an initiative promoted by the C-AD Forum of Catalonia as a global platform to advance the automated vehicle industry. The objectives of the Catalonia Living Lab are twofold: to i) provide sites for automated vehicle testing with appropriate safety measures in place and ii) connect parties invested in C-AD research [1].

The Government of Catalonia presented the Catalonia Living Lab initiative to provide an answer to the global need for safe spaces to test automated vehicles. This was only possible after the Spanish government published legal documents providing the framework for automated vehicle testing on public roads throughout the country in 2015. The Catalonia Living Lab adopted these regulations with the hopes of developing a total of seven enclosed areas covering 12 square kilometers, seven roads spanning 200 kilometers, and three closed circuits for public and private testing [2]. The diversity of these testing sites allows for a variety of different testing conditions in rural, suburban, and private sectors of Catalonia. The hope is that these conditions will provide research that encompasses all areas of transportation for both original equipment manufacturers and distributors.

In addition to providing safe and accurate testing conditions, the Catalonia Living Lab also intends to connect all parties invested in the C-AD vehicle industry in order to promote growth in this sector and attract new investments. Even though the Catalonian government created this initiative through the C-AD Forum of Catalonia, various companies in the automotive and mobility industries are major stakeholders in the public private partnership. These companies range from automobile distributors such as Nissan and Spanish company SEAT, to infrastructure management teams like Abertis Autopistas, to more specialized companies who work on developing telecommunication solutions [3]. The commonality between these diverse companies

is that they all benefit from a richer understanding of and more complete testing data on C-AD vehicles.

Societal Benefits

The motivation behind the research performed by the Catalonia Living Lab is due in large part to the safety and mobility benefits of connected and autonomous vehicles (CAVs). CAVs have the potential to eliminate human error, greatly decreasing roadway fatalities. These vehicles will also allow for increased mobility and efficiency for those without the ability to drive, such as elderly and disabled people, as well as the everyday driver and passenger.

Human error results in the vast majority of roadway fatalities, and by eliminating the driver, autonomous vehicles will also eliminate these fatalities. According to crash data gathered by NHTSA, driver error resulted in 94% of crashes in 2015 [4]. The remainder of crashes can be attributed to vehicle malfunctions and environment-related issues. Driver error is due to human flaws in recognition, decision-making, and performance. Once fully automated vehicles, or driverless vehicles, become the widespread form of transportation, these driver-related issues will no longer be relevant. Autonomous vehicles cannot become distracted, sleepy, or impaired, and they have much shorter reaction times than humans. For these reasons, “there are millions of lives that could be saved around the world every decade with fully autonomous cars” [5]. Fully autonomous vehicles are still many years from becoming fully implemented, but with the help of organizations like the Catalonia Living Lab, the full safety benefits will eventually be realized.

In addition to creating safer roads, autonomous vehicles will allow for convenient transportation of people of all ages and abilities. A large portion of the world’s population is deaf, blind, elderly, or otherwise impaired, and transportation becomes a huge barrier for these groups of people [6]. With the help of connected and automated technology, these people will be given a new freedom. By eliminating the responsibilities of the driver, these vehicles will allow the disabled and elderly to travel independently. In addition to those unable to drive, the mobility of the everyday driver will also improve. It will be increasingly more difficult to travel efficiently as cities become more saturated. However, when fully autonomous vehicles reach a 100% penetration rate, roadway capacity is predicted to increase by up to 80%, which will decrease

congestion and delay, making the roads more efficient for everyday travel [7]. Expanding the capacity of the roads as the population grows will become necessary for the function of cities, and the development of autonomous vehicles will allow for this expansion.

Challenges

Although there is potential for automated cars to bring many positive changes to society, there are also accompanying challenges and concerns, including the ability of the car to make moral decisions in a moment's notice and the future of policies and infrastructure. Despite the Catalonia Living Lab's work toward the development of CAVs, the public will still face the challenges of integrating these vehicles into daily life.

One of the most commonly debated issues that relates to self-driving cars is their ability to make moral choices. For example, consider a car turning at a cross section with oncoming traffic when a child runs onto the street at the very last second [8]. The self-automated car must choose between halting mid-turn and endangering its own passengers to the oncoming traffic or protecting its passengers by continuing the turn but hitting the child. The main concern in this situation is that the car would react inappropriately and cause more harm than would have occurred if a human had been in charge of the car. To complicate the situation even further, it should be noted that not all people agree on the same moral solution. In the past example, some might argue that it is best to stop and save the child, whereas others might argue that it is better to run over one single child than endanger all the passengers in the car and those in the oncoming traffic. This is problematic for the programmers because the standard for how cars are programmed could have large scale impacts, especially when self-driving cars become widespread.

Additionally, the implementation of CAVs necessitates unforeseen changes in policies and infrastructure. As of right now, not much is known about the extent of the impacts of the self-driving cars, so policy-makers do not have much information to use to discuss possible policy changes [9]. For this reason, the future of policy will remain a large challenge as the use of self-driving cars increases. Infrastructure might also change dramatically with the implementation of self-driving cars. This is because humans rely on signals like stop lights to know when to stop

and go so that there will be no collision. Automated cars, however, depend on constant communication with each other, so there may be no need for these stop lights and other mechanisms that human drivers currently rely on [9]. This is just one of the many ways that infrastructure will need to change with the realization of a society with automated vehicles as the primary mode of transportation.

CONCLUSION

The Catalonia Living Lab, in its attempts to connect parties with resources to further CAV research and provide the facilities for testing of these vehicles, has become a leading research center with a focus on the future. The research that is done here has the ability to bring huge impacts to society and greatly influence day-to-day transportation. CAVs have the potential to severely reduce the amount of fatalities by human error and increase the quality of life of those with limited mobility by making transportation entirely automatic and easily accessible. With the potential for such positive change comes challenges that society will face in the process of implementing these vehicles into daily life. Some of these challenges include programming the vehicles to respond correctly in difficult situations, writing and enacting new policies, and changing the existing infrastructure. Overall, the initiative from the Catalonia Living Lab takes a step in the right direction by uniting interested parties to collaborate and research the vehicles that are crucial for the future of our society.

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