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Research Paper on Autonomous Vehicles

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Abstract: *The article discusses the short, medium, and long-term effects of Autonomous Vehicles (AVs) on the urban transportation and environment by means of a systematic review of the extant literature on the subject matter. A corpus of 130 articles was collected from multiple sources using selected keywords. The review critically analyzes key findings of these papers in the light of a SWOT (Strength, Weakness, Opportunity, and Threat) analysis. Although the technology remains to be commercially deployed, broad consensus is found in the literature. First, AV would influence urban transportation and human mobility by reducing vehicle ownership, public and active travel, Vehicle Miles Traveled, traffic delay and congestion, travel costs, and by increasing accessibility, mobility, and revenue generation for commercial operators. Second, AVs would have long-term effects by encouraging dispersed urban development, reducing parking demand, and enhancing network capacity. Third, AVs would reduce energy consumption and protect the environment by reducing Greenhouse Gas emissions. Fourth, AVs would reduce traffic crashes involving human errors and increase the convenience and productivity of passengers by facilitating for multitasking. However, most people are very concerned about personal safety, security, and privacy. Finally, the study identifies critical research gaps and advances priority directions for further research*

Keywords: Autonomous vehicles, Cooperative driving, LiDAR Security, Ultrasonic sensors

I. INTRODUCTION

People have used the automobile as a primary mode of travel within and between urban areas since the mid-twentieth century (Howard & Dai, 2014). Nowadays, it has become an integral part of urban life. Technological advancements such as the introduction of Internal2Combustion Engines (ICEs), transmission systems, electric motors, steering and cruise control, and emission control technologies are easing people's life and reorganizing city structure (Kim, 2018). While providing benefits to populations, automobiles are also adversely affecting human societies and their environment. The massive use of Single-Occupancy Vehicles (SOVs) is associated with travel delays, traffic congestion, traffic crashes, energy consumption, air pollution, and urban sprawl. Mutation of the transportation system by shifting from ICEsato Electric Vehicles (EVs), and by introducing Intelligent Transportation Systems (ITS), ride-sharing, on-demand services, and Travel Demand Management (TDM) measures has shown evidence to reduce energy use and carbon emission, traffic crashes and congestion (Bansal & Kockelman, 2017; Howard & Dai, 2014). However, a combination of these strategies has the potential to bring dramatic changes to the transportation system, to urban mobility in terms of where people live, where they work, shop and recreate individually and collectively, and hence to the spatial structure of urban environments. This study investigates the impacts of Connected and Autonomous Vehicles (CAVs) on urban transportation and on the geography of urban environments by conducting a state-of-the-art review of the literature. Other benefits can include reduction in traffic congestion, reduction in fuel consumption and optimal usage of the road infrastructure. These vehicles further aid in reducing traffic accidents which in turn provides cascading benefits like reduction in insurance costs, reducing loss of human life. Other benefits include reduction in carbon emissions and lesser air pollution. Autonomous vehicles have various technologies like radars, sensors, global positioning system (GPS) and on-board cameras that help it to detect the surroundings and navigate. The parts of an autonomous vehicle are highlighted in Figure 1. The data which is sensed using these technologies are fed into advanced. control systems present in these vehicles

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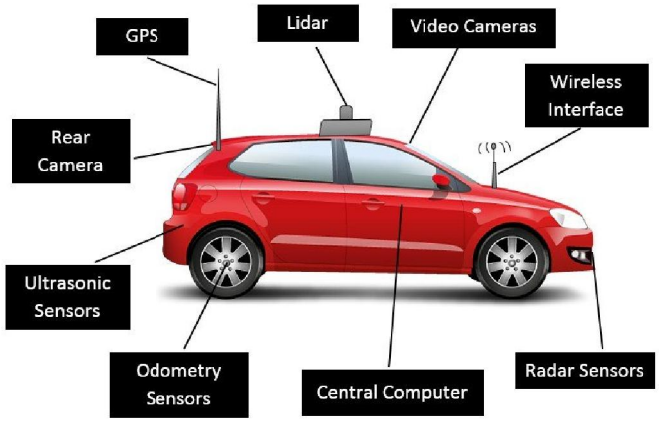
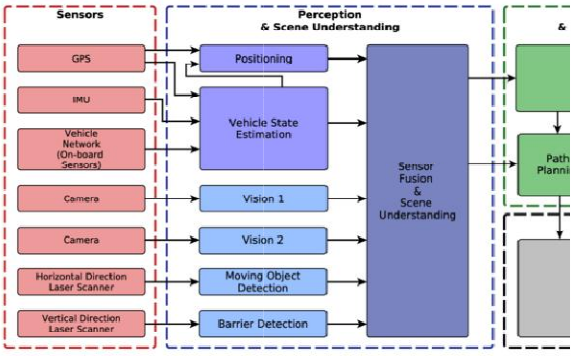


Many companies including Google are involved in the development of these autonomous cars and several of the Google cars have competed around 2 million miles across various cities in the United States (US). But other companies like Uber technologies and Tesla motors are fast catching up and introducing their own autonomous vehicles on the roads [5]. This paper will be looking at the market penetration of autonomous vehicle and security issues related to the adoption of autonomous vehicle. Technological and non-technological issues related security of autonomous vehicles implementation will be looked at. The first section of the paper will address the benefits of autonomous vehicles, and the later part will cover the implementation issues with a specific look at security attacks against autonomous vehicles. The paper will be finished off by policy recommendations to address these issues with related tosecurity and general adoptability of autonomous vehicles.

II. BENEFITS OF AUTONOMOUS VEHICLES

The automation system of automated vehicles follows three phases depicted in (i.e.`Sense', `Understand', `Act'). The automotive sector is going to be revolutionized by the adoption of autonomous vehicles. It needs to be seen if the adoption of these vehicles will outweigh and counteract the negatives associated with it. There are several benefits associated with the use of autonomous vehicles in transportations. The technology can be used in different type of vehicles like buses, where they can co-exist with a smart city to offer adaptive routes based on low and high-demand routes. They can also be used as taxis which can cater to people's needs. Another area of use is, heavy hauling trucks on long distance transportation between far reaching cities. These vehicles can also be effectively used in the military so that soldiers' lives are not put at risk while encountering dangerous warzones [6]. The following section will look at some of the far reaching benefits associated with autonomous vehicles and associated use .



Data flow in autonomous vehicle

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