DYNAMIC ORDER GENERATION FOR AUTOMATED TESTING

HOW AUTONOMOUS VEHICLES WILL IMPACT SOCIAL PERCEPTION OF VEHICLE SAFETY IN RURAL AMERICA

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science

By
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November 1, 2021

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

According to the World Economic Forum, automation technologies, if implemented successfully in all industry sectors, have "the potential to save 10 million lives per year" (2021). These technologies will also increase efficiency in many areas, saving people time that can be spent on more important tasks (Ellingrud, 2018). For a multinational conglomerate e-commerce business which for the purposes of this project will be referred to as Company X, this means creating new tools to automate repetitive tasks in order to save the time of engineers. One task that required a significant time commitment from Company X engineers was sample online order creation for testing. To remedy this issue, an application was developed that could automatically generate sample orders based on a few given specifications. The final technical deliverable, a complete discussion of the application created, will evaluate what additional preparation students need from the university in order to succeed in the workforce.

Another automation technology with great potential is autonomous vehicles. Each year, road vehicles emit substantial amounts of carbon dioxide into the atmosphere and 1.3 million people lose their lives in road related incidents (World Health Organization, 2021). If successfully implemented, autonomous vehicles would eliminate these unnecessary deaths and would also lead to great social and environmental benefits (Rose-Harman, 2021). However, even though autonomous vehicles would be several magnitudes safer than human drivers when perfected, a large factor influencing their use would be how their safety is perceived by the public. The second proposed project in this prospectus is a research paper that will be produced containing an analysis on how different factors will affect social perception of autonomous vehicle safety and how to design autonomous vehicles in order to maximize public adoption.

Dynamic Order Generation for Automated Testing

A multinational conglomerate e-commerce business which for the purposes of this project will be referred to as Company X offers online shopping services to its customers. Customers can place orders online and either have the items delivered to their homes or pick them up in-store. The quality engineering team in Company X spent a significant portion of their time creating sample online orders for use in pre-deployment testing. Online orders were sent through XML (Extensible Markup Language) files. These XML files were used to store all of the details associated with an order. Creating each sample order involved creating several layers of XML and manually inserting all of the order information into the file, a process that required a substantial time commitment from engineers. Furthermore, once an order was created, it needed to be published to the correct development environment. Engineers also performed this task manually, and needed to publish each sample order separately. Not only did these inefficient tasks waste the time and talent of engineers, time spent creating these orders increased testing time and therefore increased overall cost for Company X.

In order to reduce time spent by engineers creating XML files, an application was created to automate the sample order generation process. This application allowed Company X engineers to create sample orders by executing a few lines of code and eliminated the need to manually write up the order file. Similarly, the application had the ability to publish the newly created sample order to the appropriate development environment. This also allowed engineers to perform order publishing programmatically rather than manually.

This application decreased the amount of time needed to complete pre-deployment testing by twenty to twenty-five percent. This decrease in testing time, along with the increase in availability of quality engineers to work on other projects, is likely saving Company X a

significant amount of money. A possible expansion of this application would be to add the ability to not only generate and publish sample orders but also track published orders and ensure they are successfully routed to the correct team. The final technical deliverable for this project is to create a detailed design document for the application built for Company X. This document will discuss considerations made when determine which technologies to use as well provide a detailed overview of each component of the core system architecture.

How Autonomous Vehicles Will Impact Social Perception of Vehicle Safety in the U.S.

Each year, approximately 1.3 million people lose their lives in traffic accidents around the world (World Health Organization, 2021). In the United States alone, there are around forty thousand traffic fatalities a year (McMillin, 2010). Furthermore, fifty seven percent of these traffic fatalities occur in rural areas despite the fact that only twenty one percent of the U.S. population live in these areas (National Highway Traffic Safety Administration, 2005). It is estimated that ninety three percent of traffic accidents can be attributed to human error (Othman, 2021). If this statistic is correct, autonomous vehicles have the potential to eliminate all of these accidents and prevent any associated fatalities.

AVs will also have a large environmental impact. Whether it be gas or electricity, AVs will use less energy than human drivers due to more economical driving styles (Rose-Harman, 2021). Additionally, AVs will likely decrease the number of vehicles that are produced. Since the average car spends ninety five percent of its lifetime parked, AVs present the opportunity to reduce this number and increase vehicle utilization (Morris, 2016). AVs will also give time back to society. The average American spends around one hour of their day in a car (Steele, 2021). This time is usually lost since driving safely requires all of the driver's attention. AVs would give this time back to drivers for more productive uses.

Many of these benefits of AVs rely on mass adoption from society. A societal lack of perceived safety is a large obstacle that may block mass adoption of AVs. If AVs are not perceived as safe by the public, adoption of the critical technology will likely be lessened. A considerable influence on perception of safety is the amount of control a person perceives themselves to have. Actual safety is only one of the many factors that influence human perception of safety (Maynard, 2013). For example, despite the fact that driving is the "leading cause of deaths among Americans ages 1 to 34," driving is widely viewed as a low-risk activity (McMillin, 2010). One explanation for this behavior may be due to differences in perceived control that drivers feel when driving themselves when compared to being driven by an AV. High perceived control over a situation can lead to people accepting more risk and feeling safer (Horswill, Mckenna, 2006). The variations in society's perceived control between manual and autonomous driving will be crucial in understanding the impact of AVs on vehicle safety perception.

Another point of concern that could affect safety perception is AV ethical decision making. It is likely that AVs will still face situations where an accident is imminent and unavoidable and will therefore need to be programmed to handle them. Several studies have found that survey respondents believe that AVs should be programmed to save as many lives as possible in an accident (Gent, 2017). However, many of the same respondents stated they would not want their personal vehicles to have the same programming rather their vehicles should always protect the vehicle passengers (Gent, 2017). An analysis of how AVs will impact social perception of vehicle safety in rural America will provide insight into how to design and implement AVs to maximize safety perception and lead to mass adoption of the technology.

AV safety perception has a substantial number of stakeholders each with different connections between one another. For this reason, Actor-Network Theory (ANT) will be a useful framework to use to understand this issue. ANT is a framework that investigates the relationships between different stakeholders (actors) of a larger problem or network (Cressman, 2009). ANT will be used to map actors such as drivers, passengers, pedestrians, AV manufacturers, AV engineers, the government, etc. The associations between these actors will help reveal how they influence each other and influence AV safety perception overall. A large criticism of ANT is that almost any two actors can be connected through some association, leading to "endless chains of association" that do not help with understanding the problem (Sheldon, 2010). In order to avoid an unnecessarily complex network, punctualization will be used to black-box complex actor-networks and convert an "entire network into a single point" (Cressman, 2009). For this problem, the United States government and AV manufacturers will be punctualized as the role of specific manufacturers or branches of government to avoid a redundant network. Additionally, associations will be investigated through social construction of technology (SCOT) and technological determinism in order to avoid associations erroneous to the problem. Technological determinism will help to analyze the effect of AVs on vehicle safety perception and SCOT will help determine the effect of public vehicle safety perception on AV development.

Methodologies

Research Question: How will autonomous vehicles influence social perception of vehicle safety and road related accidents and vice versa in rural America?

To answer this research question, documentary research methods and historical case studies will be used. The analysis will begin with background information being provided on AVs and detailing the main factors that impact societal perception of AV safety. Documentary

research methods will be used to research perceived control in AVs and AV ethical decision making. Research will include finding sources explaining the impact that perceived control has on driver perceived safety and risk taking. Research will also include how AVs will impact perceived control of vehicle passengers. For AV ethical decision making, government policy on AV ethics as well as public surveys on what kinds of ethical decisions society thinks AVs should make will be studied. This research will be used to investigate how AV ethical decision making may impact AV safety perception. In searches, key phrases such as perceived control in AVs, AV ethical decision making, and the trolley problem will be utilized. Controlled research studies, credible government documentation, and surveys will specifically be sought after.

Historical case studies will be used to investigate how social perception of plane safety has evolved from when air travel was first commercialized. AVs and airplanes are similar in that in both vehicles, passengers do not have direct control over the vehicle. These studies will show how the social perception of airplane safety evolved with time and as airplane safety increased. How plane travel safety perception was impacted will provide insight into how AV safety perception may change with time or with new developments in AV safety.

Conclusion

This paper discusses sample order creation optimization for a multinational conglomerate e-commerce business and investigates how autonomous vehicles will affect vehicle safety perception in rural American society and vice versa. An application will be created that can automate the order creation process and allow engineers to complete the process programmatically. This application is expected to decrease time spent by quality engineers on pre-deployment testing by twenty to twenty-five percent, decreasing total testing cost for the business substantially.

With the potential to save millions of lives per year, it is imperative that AVs are adopted on a massive scale as soon as safely possible. This is especially important in rural areas where traffic accidents are disproportionately more fatal. Specifically, this paper will explore how a perceived lack of control in AVs and AV ethical decision making will impact safety perceptions. By exploring how AVs will impact public vehicle safety perception, this research will determine the largest obstacles barring their mass adoption. The research will also provide direction on how to design AVs to maximize safety perception from a skeptical public.

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