

AUTOMATION OF WEIGHT TRAINING
SELF-DRIVING VEHICLES AND LEGISLATION

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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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General Research Problem: Ensuring the Safety of Smart Technology

Over the past decade, smart technology and automation has taken over the daily lives of consumers. We have seen this paradigm shift in phones, TVs, refrigerators and hundreds more everyday objects. Smart technology defines a broad range of devices that provide some sort of automation or wireless connectivity. By definition, automation has been suggested to assume control over a part or whole task that was previously performed by a human (Clegg and Blitch, 2013). The desire to make our lives easier pushes innovation in this field.

Weight training is only one example of an activity that has seen large improvements through innovation in technology. Lifting weights offers many benefits such as stimulating muscle growth and improving mental health. Moreover, it can be automated by using technology to track progress and plan workouts. Software solutions have been designed for this purpose and are used to provide information that would otherwise require a personal trainer. However, there are still steps toward improvement and one possible avenue could be providing real-time feedback, much like a personal trainer. Such a solution would mitigate some of the injury risks associated with improper training. The technical project presented in this prospectus aims to tackle this issue and bring about an automated solution to guide novice and experienced weight lifters toward a perfect workout routine.

While technology can certainly be exploited to eliminate safety concerns, they can just as easily contrive them as well. One of the most prominent examples of this in the past several years is the rise of self-driving vehicles. Many attempts and much research has been put into this notion of making our lives easier by removing the need for humans to have to drive their own vehicles. Automotive companies have begun to integrate technologies that are able to avoid collisions and mitigate pedestrian crashes for example. These advanced driver assistance systems in today's

motor vehicles are already helping to save lives and prevent injuries. This includes technology capable of preventing drivers from drifting into other lanes and automatic braking if a vehicle ahead stops or slows suddenly (National Highway Traffic Safety Administration, 2017). The concept is not perfect and is still constantly making improvements today, but there exist many criticisms against autonomous driving and its potential dangers. The STS research outlined in this prospectus will explore the evolution of autonomous vehicles and its accompanying legal regulations as a result of societal pressure.

Implementing Real-Time Dynamic Feedback for Weight Lifting Exercises

Developing consistent exercise routines is one of the most significant factors in a work out. However, consistency is subject to a variety of factors such as overall energy and motivation of the athlete. Novice weightlifters may be unprepared for changes in these factors and as a result, compensate with imperfect form. This could lead to several undesired consequences such as an increased risk of injury or imbalances in muscle development. Veterans to the sport may be unaware of these bad practices and will be unable to detect flaws in their form, putting them at serious risk of injury. Good habits and proper form are essential toward reducing risk and the longevity of the athlete's progress. Our technical project will provide users with instantaneous feedback for form correction and offer various methods of data collection on successful repetitions.

Appropriately named The SmartBell, the technical product would be able to track completed reps, resting time between sets, calculate an estimate of calories burned, and suggest correct form and technique through an accelerometer and software. The device will feature an array of LEDs, used as a visual indicator of the barbell's stability and orientation with respect to the ground. This feature will be accomplished by periodically sampling accelerometer readings and displaying the output. This will also be accompanied by an LCD that will deliver useful

information to the user about their workout, during and after they perform their routine. This project requires the use of a microcontroller to integrate hardware components which will handle feedback and data collection and software to perform real-time calculations on proper form repetition information.

The Role of Legislation in the Development of Self-Driving Vehicles

To what extent has the development of self-driving vehicles and legislation been mutually shaped?

A new wave of technology known as self-driving vehicles serves one ultimate goal, to eliminate the need for a human driver at the wheel. Much like how the goal of the technical project is to improve the safety of weight training, this aims to improve the safety of the roads through automation. This is not only useful in general-purpose driving, but also in situations of high risk such as elderly or alcohol impaired operation of a motor vehicle. Approximately one third of all motor vehicle crash fatalities involve alcohol-impaired driving (Centers for Disease Control & Prevention, 2010). Hanna (2015) claims that recent developments in autonomous vehicle technology could reduce or eliminate DUI-related accidents within the next decade. However, many concerns have been brought up about the feasibility of such a technology. Much of the current legal infrastructure is not designed to handle the actions of autonomous systems. For example, in the case of fatal injury involving multiple parties, it is unclear who could be held responsible for the cause. Current legislation is built around holding persons liable, but the advent of autonomous systems may bring about a paradigm shift. The technology in this sector is growing fast, and having a clear picture of how to approach this rapid change will be important as automation and artificial intelligence improves.

The goal of this STS research is to examine the mutual shaping of self-driving vehicles and its legislation. Specifically, this research will attempt to observe the evolution of self-driving

technology and how it has developed around existing driving laws as well as evaluate the effects of public criticism on its development. Gathering information on public opinion may provide insight on what kind of bills will be passed and frame an understanding of the type of pressure the government is subject to. There will be a primary focus on United States legislation as well as the development of this technology among companies based in the United States. The US government at the federal and state levels will be a primary target of investigation. Both levels will exhibit different outlooks which could provide insight on regional differences in perspectives. It will also be helpful to investigate public statements made by companies who are actively pursuing to develop this technology.

Much of the literature related to this problem will be on the analysis of autonomous systems and artificial intelligence. Works that discuss their interaction in society and legal documents will prove to be the most useful. For example, the role of autonomous vehicles in drunk driving has previously been explored and it will be interesting to see what kind of parallels can be drawn from it in other arguments promoting self-driving. Conversely, the remainder of the research could be drawn from other sources such as company statements and public polling data.

My plan to investigate this problem is to examine different types of data that represent changes in the development of self-driving vehicles or pertinent legislation and organize it into several categories depending on my findings. Such categories could arise from many factors such as political bias, regional differences, or even influences from current events. My initial procedure for determining these categories will be to group information based on similarity and extrapolate common themes. These varying factors should provide insight on different levels of progress throughout the United States regarding the legalization of autonomous vehicles. I will be able to observe this issue framed in various social contexts and its corresponding legislation. By

evaluating bills and various documents from federal and state governments, I hope to not only gain a greater understanding of the current rulings behind self-driving vehicles, but also discover any regional trends and ongoing legalization processes. Through looking at press releases and company statements, I should be able to assess the progress of self-driving technology alongside the development of government regulation. Examples of such companies include, but aren't limited to, Tesla Inc. and Uber Advanced Technologies Group. Lastly, I will look into academic literature for additional perspectives on this and related topics in order to gain a deeper understanding of varying opinions.

By the end of my research, I would like to be able to discover some sort of trend or lack thereof between the advancements of self-driving in the automotive industry and the legislation surrounding autonomous vehicles. Analyzing policy at different levels of government would expose regional biases that are apparent throughout the United States. Deliberate actions from technology companies will also provide insight on the effects of the law. In doing so, I believe that it would provide a clearer understanding of what this technology could provide for society in the near future and years to come. For example, it is possible that positive sentiment toward autonomous driving is increasing and it is likely that new policy will be cemented in legislation to support this new landscape of technology.

Conclusion

This research project attempts to explore how advancements in technology could bring up ethical and political concerns among the public and how society attempts to deal with it. More precisely, safety is a concern that is constantly being shaped through innovation. Reliance on automation technology has the power to both mitigate and introduce safety hazards and I feel that it is necessary to have a good understanding of how that is happening. By the end of this project,

I hope to learn about the current state of self-driving technology and how it continues to influence and challenge our current legislation. Furthermore, it will equip me with the knowledge to formulate my own opinion on this issue and inform others who may be interested. The advent of autonomous vehicles along with other smart technologies will continue to challenge our understanding of safety. It is imperative for people to be educated about the concerns that automation can bring up so that society can focus on building technology around them.

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