

**A Space-Based Solution to Truck Parking and Management in Virginia**

(Technical Paper)

**Analysis of Excessive Data Collection in Relation to Consumer Privacy Concerns**

(STS Paper)

A Thesis Prospectus Submitted to the  
Faculty of the School of Engineering and Applied Science  
University of Virginia • Charlottesville, Virginia  
In Partial Fulfillment of the Requirements of the Degree  
Bachelor of Science, School of Engineering

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Fall, 2020

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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**

The insufficient management of truck parking in the state of Virginia has led to illegal parking habits and overcrowded truck stops, causing traffic safety issues along major interstates. Trucks are not always able to find parking spaces at rest areas or commercial truck stops, and often choose to park on roadway shoulders, ramps, and mainlines rather than designated locations (“Virginia Truck Parking Study,” 2015). Additionally, many parking facilities are not designed to meet the size requirements of trucks, leading to the damage of light poles, sidewalks, curbs, and landscaped areas. According to stakeholders, there is a lack of real-time information given to truck drivers on available parking spots throughout the state (Bayraktar, 2012). Our goal is to collect the necessary data to design a system in which empty spots in truck lots can be identified and relayed to truck operators. Considerations will include space-based data collection techniques, data dissemination, and the viability of our solution.

Although the technical portion of this prospectus concerns identifying the optimal data collection techniques for truck parking and management, it is imperative to explore the question of surveillance and data security in general. For the technical project, it is necessary to only collect information that will assist truck drivers in finding locations to park. However, the idea of limited data collection to satisfy a clearly defined objective is not always a common practice. The STS thesis explores big data and the question of “how much data collection is too much?” By studying the current atmosphere and culture of data collection, I will explore how security and hackability can be compromised when design objectives are not clearly defined.

## **Technical Topic**

The poor management of truck parking has led to illegal parking and overcrowding, causing traffic and safety issues along major interstate highways in Virginia (“Virginia Truck Parking Study,” 2015). Truckers must adhere to legal requirements regarding maximum vehicle operation time, and parking is expected to occur at waypoints and designated locations.

However, as there is no centralized system to locate vacancies and relay that information to truckers effectively, parking stations often become overcrowded. This leads drowsy truckers to either illegally park on the highway or continue driving in search of an available space, endangering themselves and other vehicles on the road (Garber, 2004). The larger issue that has been identified is the lack of total parking spots, for which greater infrastructure changes must be made. For the purposes of this capstone project, the aim is to develop a space-based solution to conduct remote sensing of trucks and parking spots and then construct a systems architecture to process the data and disseminate it to truckers in a non-intrusive way.

We have partnered with the MITRE Corporation under the mentorship of Dr. Cj Rieser and Dr. Michael A. Balazs, as well as our technical advisor Professor Chris Goyne, to investigate and tackle the problem. We have also reached out to the Eastern Transportation Coalition, I-81 Corridor Coalition, Owner-Operated Independent Drivers Association, and the American Transportation Research Institute. Interviews with the first three organizations have already been conducted, and the common consensus explaining the lack of truck parking spaces is the local governments’ failure to implement such infrastructure. Thus, it falls into the hands of independent research groups to explore this problem.

Despite the limitations, past organizations have attempted to remedy the truck parking problem in localized areas using different data collection and management techniques. Crowd-

sourced tracking apps, in-ground sensor networks and on-site cameras with truck detecting algorithms are all solutions that are currently commercially available; however, all of these solutions have major inefficiencies. The tracking apps require truckers to input and update current data, a method with obvious drawbacks as drivers without the app or infrequent users can lead to outdated data (“Virginia Truck Parking Study,” 2015). In an interview with the I-81 Corridor Coalition, the use of in-ground sensors was discouraged due to the Virginia Department of Transportation’s (VDOT) apprehension of damaging existing infrastructure, such as pavement, to install the sensors. On-site cameras are currently the most favorable solution; however, this still requires the installation of a camera at every parking site and the establishment of a communications network between them (Morris, 2017). From interviews with the organizations listed, and research on current solutions, we have gathered that our solution needs to have a relatively high data collection frequency and should be widely applicable, avoiding the installation of sensors or cameras at every parking location in the state.

Due to the largely research-based nature of this project, there are minimal initial resource requirements necessary to complete this semester’s tasks successfully. One requirement would be ample access to the stakeholders previously mentioned, as they provide first hand accounts about where the problem lies and what solutions have been implemented in the past. Additionally, the mentorship of Dr. Cj Rieser and Dr. Michael A. Balazs provides valuable input on gaps in our team’s knowledge and on possible shortcomings of proposed space-based solutions. The last resource requirement would be access to literature on the current state-of-the-art. Due to the collaborative nature between our capstone team and the MITRE corporation, success is defined by MITRE’s willingness to incorporate our final solution into their project. During the final presentation to MITRE in April, our team will receive feedback from the

company on the success of our proposed space-based solution by taking cost, resource requirements, and general feasibility into account.

To divide work within our team, we created 5 sub-teams tackling data collection, relay diagnostics, geographic boundaries, legal concerns, and system architecture. This semester, I have been researching key highways and geographic locations within Virginia that face the highest rate of truck parking issues. I have also researched prior art, such as on-site cameras at truck parking stops, in order to more clearly define the problem.

### **STS Topic**

Due to the explosion of “big data” within the last twenty years, more than ninety-eight percent of the world’s information is now stored digitally (Cukier & Mayer-Schoenberger, 2013). The term big data refers to structured and unstructured data that is so complex in quantity and variety that it is too difficult to analyze with traditional methods. However, organizations can use the high volume of data to provide strategic business insights for the advancement of their company. Consequently, as data collection has increased in popularity, so has the need for regulations concerning privacy issues and protection against potential hackers. Regulation only becomes more challenging when organizations collect excessive amounts of data that goes largely unused or unnoticed. In fact, estimates show that fifty-five percent of all data that is collected is “dark data” (Briggs, 2017). This term refers to data that companies know has been captured but do not know how to organize and use. It is vital that companies are aware of the harm that excess data collection can cause to an individual’s privacy. Through the lens of government regulation, this research will explore examples of excess data collection leading to privacy concerns and the legal ramifications of such an occurrence.

The issue of unwarranted data collection causing privacy concerns is seen when exploring the rise of smart devices, such as the Amazon Echo. Smart speakers and similar smart home devices consistently collect information that would be valuable to advertisers and product designers. In 2019, Amazon unveiled a line of Echo paired devices that raised all sorts of privacy concerns among consumers; the primary concern was that the smart appliances could keep track of questions consumers ask and record conversations to eventually develop a catalog of information regarding consumer behavior (Day, 2019). Although these instances may seem inconsequential alone, when accompanied with the rest of a consumer's data, the device can essentially fill out a record of one's common behaviors. Smart devices perfectly encapsulate the idea of excess data collection. Is it necessary for a device to record conversations and track consumer movements? In response to these concerns, companies such as Amazon, Google, and Apple have stated that there are measures in place to prevent employees and contractors from abusing access to customer voice recordings. However, the likely next frontier is for these companies to monetize the cache of personal data through advertising efforts by selling consumer behavior data (Davies, 2019).

This large collection of consumer behavior data is potentially problematic when remembering the negative consequences of collecting excess dark data. For instance, the International Data Corporation states that not analyzing and processing unstructured dark data means that companies run a larger risk of a significant data breach (Nalawade, 2019). In response to these concerns, the European Union has developed the General Data Protection Regulation plan to give people the right to compel companies to stop using their personal information and delete their data. For instance, in January of 2019, Google was fined \$56.8 million by the French data protection authority for failing to inform users about how their data is

used for advertising (Badoni, 2019). Additionally, a California law from January of 2020 now gives residents the right to know how their information is being collected and shared, and also allows residents to deny the right to sell it. Several other U.S. states have considered similar legislation, pointing to an increased awareness by governments about the potential consequences of excess and unwarranted data collection.

We can begin to develop a framework for analyzing the ramifications of excess data collection by examining the emergence of government regulations, especially in the European Union. Firstly, it is important to understand the concept of third-party tracking: a practice which allows a tracker to harvest extensive amounts of user data from a variety of first-party sources to build a comprehensive user profile (Robertson, 2019). The data that is collected may range from the websites the user has visited, products the user has shown interest in, or photos and messages posted online. In 75% of cases, the third-party will eventually become aware of a user's identity (Robertson, 2019). These third-party sources include the smart devices previously mentioned, or even browser extensions that are largely controlled by a small set of select companies. The large amounts of data collected from third-party sources give rise to issues such as privacy, democracy, consumer welfare and competition. Based on this, it is easy to imagine how excess data collection can lead to targeted advertising that has political and social ramifications if not handled properly. Because only a few select companies manage most third-party tracking sources, excessive data collection and dark data can be discussed within the framework of competition law and antitrust laws. For instance, privacy protection can be seen as an extension of the "quality" of a product, and thus collecting too much data can be seen as a competitive advantage for a company (Choi et al., 2019). This has the potential to limit the information that corporations collect on individuals through third-party tracking apps. Additionally, the global

trend regarding data collection is to follow the “informed consent” approach, where data collection is allowed if consumers are aware of the practice. The most popular example is the EU’s General Data Protection Regulation. This regulation imposes strict rules on controlling and processing personal information for all individuals within the EU. However, current theoretical models predicting an individual’s privacy concerns show that this informed consent approach alone may not be an effective enough enhancement of privacy protection (Choi et al., 2019).

By analyzing the current regulations limiting excessive and unnecessary data collection on consumers, I hope to assess how corporations such as Amazon, Google, and Facebook can effectively move towards limited data collection by more clearly defining their objectives. I plan to explore how data can be a strategic asset, but only if it is used constructively and safely to deliver appropriate results. To do so, I will examine case studies of companies that do and do not ask specific, goal-oriented questions prior to the data collection process and analyze how it may ultimately impact legal consequences. While peer reviewed articles concerning big data and privacy will be important to this research, I would also like to speak with stakeholders at tech companies to learn their current reactions to growing privacy regulations and if stronger regulations change company behavior. Furthermore, I would like to explore consumer reactions to excessive data collection and determine how knowledgeable the general public is about the extent of third-party sources. Through this analysis, I plan to determine if there can be a healthy balance of data collection in which both parties, corporations and consumers, are satisfied.

## **Next Steps**

From the initial research, it is clear that the current landscape of data collection calls for improvements to be made on how much information is collected and for what purpose. For the

rest of the semester, I will research examples of companies that exhibit opposite data collection views and the social and political effects their products have had on society. Early in the Spring semester, I will contact employees and data scientists at companies such as Amazon or Facebook to gain a better understanding of how their company typically responds to growing concerns of privacy. By the end of my research, I hope to clearly answer the question of “how much data collection is too much,” and how corporations can limit privacy concerns by increasing transparency, managing dark data, and defining objectives early on.

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