Identifying and Relaying Information on Available Parking Spaces to Truck Drivers
(Technical Paper)

Investigating the Psychology Behind Decision Making to Park Illegally
(STS Paper)

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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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Making Truck Parking More Accessible to Make Driving Safer in Virginia

In the US, the most popular way to transfer goods is through the use of tractor trailers. The number of trucks on the road has only increased with the rise of consumer needs. The federal government implemented a law in 2003 which stated drivers could only drive a total of 11 hours within a 24-hour time period before having to take a rest break. In the past there was no way to monitor the total hours, but with the increase in technology, "federal rules went into effect …. require[ing] truck drivers to have an electronic monitoring system in their trucks" to track the number of hours a truck operator has been driving (Boyd, 2018, n.p.). With the increase in the amount of trucks and this new law, finding a place to park during these rest breaks has become increasingly difficult causing truck drivers to park illegally on exit ramps. This puts other drivers in danger as "people come off the exit ramp [and] might not be paying attention" causing them to crash into the back of the truck (Boyd, 2018, n.p.). In Virginia, a study done by VDOT (2015) concluded that the two most important things they could do to "provide a safe and secure transportation system," would be to "partner with private industry and local governments to increase capacity and related improvements" and to "provide accurate and real-time information about truck parking supply and availability" (p. 6-7).

In an attempt to make the road safer for all drivers, the technical project outlined in this prospectus seeks to deliver a method of identifying parking spaces and relaying the information found to remove parking from entrance and exit ramps. Utilizing cameras, sensors, and road signs, the design will be able to identify parking spaces in the state of Virginia. The STS research will focus on the factors that cause drivers to pass open spaces in hopes that there will be some ahead. With this new method of identifying parking spaces, although truck companies are

pushing drivers to get their products to the destination as fast as possible, drivers will be more likely to park in legal designated spaces.

Technical Topic: Identifying and Relaying Information on Available Parking Spaces to Truck Drivers

As described before, the poor management of truck parking has led to illegal parking and overcrowding, causing traffic and safety issues along major interstate highways in Virginia. 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. 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. The MITRE Corporation is funding our project as they partner with public and private organizations to address national challenges. Our team is under the mentorship of Dr. C.J. Rieser and Dr. Michael A. Balazs, as well as our technical advisor Professor Chris Goyne, to investigate and tackle the problem.

We have reached out to the Eastern Transportation Coalition, I-81 Corridor Coalition, and Owner-Operated Independent Drivers Association. The Eastern Transportation Coalition and I-81 Corridor Coalition do research along the East Coast to identify problems that arise and then hold seminars to determine the best course of action to fix them. The Owner-Operated

Independent Drivers Association is comprised of drivers who identify problems and lobby the government to make necessary changes. Interviews with these three have already been conducted, and the common theme regarding the truck parking problem is that there is a lack of initiative from the government, despite it being a roadway safety issue. Thus, it falls into the hands of independent research groups to explore this problem. Although this problem extends beyond the borders of Virginia, a comprehensive solution will take more cooperation and awareness from other state governments to implement.

During discussions with multiple organizations, attempts to remedy the truck parking problem have been implemented in localized areas using different data collection and management techniques. As part of our process, we conducted research on the state-of-the-art, where current solutions and developments were discussed. Crowd-sourced tracking apps as well as "detectors installed in the ground, and video cameras for additional monitoring" with truck detecting algorithms (see Figure 1 below) are all solutions that are currently commercially available; however, all of these solutions have major inefficiencies (I-95 Corridor Coalition, 2009, p. 5). 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 (Woodrooffe, 2016, n.p.).
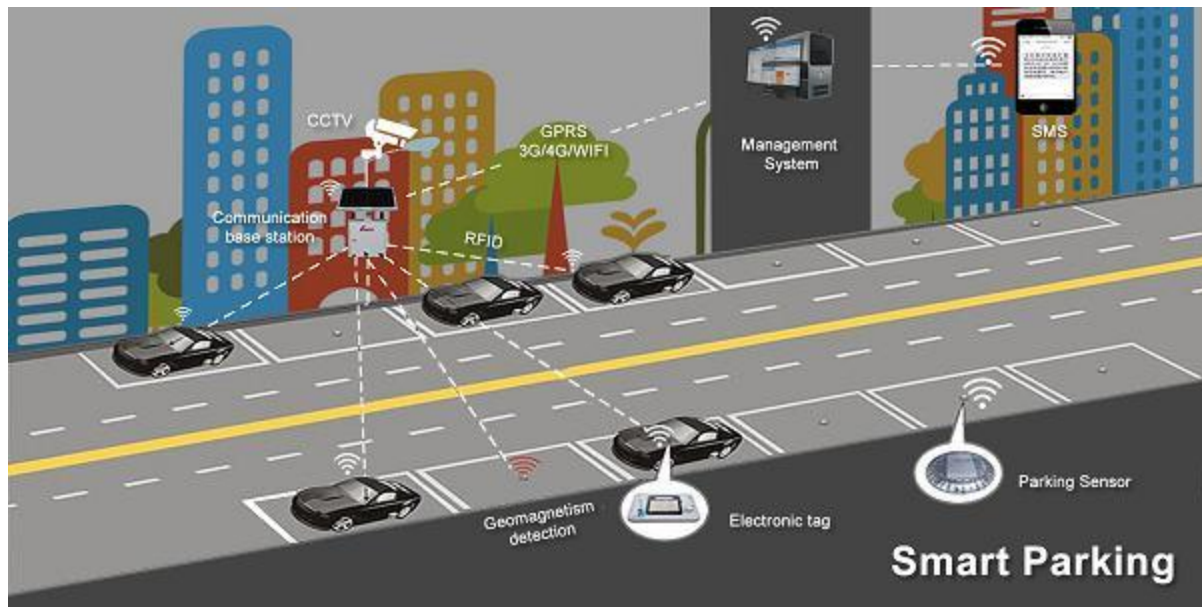
Figure 1: Example of a sensor-based parking system with video cameras to demonstrate the inefficiency of this design. This type of system is used in different states, but is not feasible in Virginia due to restrictions put in place by VDOT. (Research N Reports, 2018, n.p.)

In an interview with the I-81 Corridor Coalition, in-ground sensors cannot be used due to the Virginia Department of Transportation's (VDOT) apprehension to damage the existing infrastructure, the 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, n.p.). 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, as knowing there was a space available hours ago is not useful, and should be widely applicable to the installation of sensors or cameras at every parking location in the state.

Due to the research and design emphasis 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. C.J. 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 solutions in place.

This capstone project is broken down into 12 tasks, the first three of which have been completed. The next three will be completed this fall semester, and the final six will be completed in the spring semester. Our 11-member team has already presented its initial progress to MITRE and will present again at the end of the semester.

STS Topic: Investigating the Psychology Behind Decision Making to Park Illegally

As previously explained, before there was a federal law in place that prohibited truck drivers from driving more than 11 hours in a 24-hour time period, it was up to drivers to decide when they were tired enough to take a rest break. However, the companies that employed truck drivers would tell these drivers to drive as long as they could because they wanted products to arrive as fast as possible. Even after the law was implemented there was no way of knowing how long someone had been driving. One driver stated that they would "cheat to get more hours" meaning they would "take pills and drive all night, 24 hours straight" (Winter, 2019, n.p.). Truck drivers would need to drive overnight since "rest time isn't usually paid – because truckers are usually paid per mile, not per hour" (Premack, 2020, n.p.). With the hour trackers (see Figure 2 below) put into the trucks, along with federal judge's ruling that it is illegal to not pay rest hours, truckers are starting to take the breaks that are required.

Figure 2: Picture of a system installed by companies into trucks to monitor the number of hours that have been drive. The system also displays how much longer a trucker can drive before they must take a break. (Gallagher, 2020, n.p.)

This is an advance in safety as it takes drowsy drivers off the road, but it also creates a problem of parking location. The problem becomes that a truck driver wants to drive the maximum number of hours, but fails to think about where they will stop to park. If there is no available parking nearby, drivers are forced into illegal spots because they have already reached their maximum hours, which puts other drivers at risk.

Even with accurate information of available parking spaces, truck drivers will keep going if they have more time left on their driving log. This can be attributed to the psychology of decision making. When people are put in a situation where they have to make a decision that can benefit themselves with only a minor chance of impacting others, people will take this option. There are two ways people rationalize decisions to themselves, prospective and retrospective rationalizing. Prospective rationalizing is when someone rationalizes a decision before making it while prospective rationalizing is when the rationalizing is done after the decision (Dwyer, 2019,

n.p.). When drivers are nearing their maximum hours they can drive, they are forced with a decision of whether to stop in a legal place with time still left to drive or use every minute of their time, but potentially have to park illegally. Often drivers will rationalize to themselves, whether prospective or retrospectively, that using every minute is the best decision for them. This type of decision making can be seen in the energy sector as well, with fossil fuels starting to run out and the refusal to switch over to renewable energy. If there are fossil fuels still available, people will try to use all of them before finding another solution. Although it may seem logical to the drivers to use every minute of their hours, as there can be repercussions in place if they do not, it is a much more serious matter as lives are put in danger. However, if there are no parking spaces available when they do reach their maximum allotted time they will have to resort to parking in "vacant areas alongside the highways including roadsides, shoulders, highway exit and entrance ramps … and in the median of divided highways" (Davis, 2019, n.p.). As stated, this can be extremely dangerous if other drivers are not paying attention and do not expect the truck to be there. The best way to combat this behavior is to demonstrate to drivers when they are nearing the end of their driving time and if there are available parking spaces coming, they should take them. By doing so, they will benefit themselves by preventing the possibility of receiving a ticket or being told they must leave when they do not have any more hours left to drive, but more importantly they will help keep other drivers safe by removing themselves from a potentially deadly situation.

Conclusion

With the advancement of cameras, cell phones, sensors, and GPS tracking, truck drivers have more opportunity to be aware of available parking spaces. The technical portion of my thesis project will culminate in the spring with a report on a design that can identify available

parking spaces for trucks as well as relay this information to drivers. The STS research paper

will attempt to use the psychology behind decision making, whether that be energy resources or

driving time, to understand why truck drivers continue to park illegally.

The design will be conceptual, but VDOT and MITRE may find the approach useful and

decide to implement this idea in real life. With an approach that can find available parking

spaces, truck drivers will be able to identify their resting location and reduce the number of

illegally parked trucks along entrance and exit ramps. The combination of the information and a

commitment to act on it has the potential to create a driving experience that is safer for all drivers

and reduce the number of accidents and deaths in the state of Virginia.

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