THESIS PROJECT PORTFOLIO

The Transformation of Vehicle Controls to Drive-By-Wire

(Technical Report)

Predictive Policing in the US: How Far is Too Far?

(STS Research Paper)

An Undergraduate Thesis

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Artificial Intelligence (AI) and advanced data analysis systems are used everywhere due to their ability to automate complex tasks and reveal patterns in vast datasets. AI is well established in diverse fields, including pharmaceutical chemistry, water treatment and seawater desalination, education, systems that improve accessibility for persons with disabilities, and manufacturing. However, their extraordinary capacities can inspire undue confidence, which in turn can tempt administrators to forego the financial and time costs of expert human judgment. Problems arise when digital methods do not merely inform or guide the judgment of experienced experts, but displace it. To prevent this, it is incredibly important to study the impact these systems have on their respective fields, whether the problem at hand is vehicle automation, law enforcement, or any other data-intensive human problem.

The overarching objectives of the technical research project are to create a Ford Escape that is able to map its surroundings in real time and make decisions regarding what actions to take in order to safely reach its objective. These goals are not expected to be completed in their entirety by the end of the year, and are more reflective of the long term, multi-year goals of the project. For this year, the main objectives of the project are to design and integrate functioning steering, throttle, and braking drive-by-wire systems into the car, as well as create a design for the essential sensors for progress in future years. To plan for such a project, the first semester was dedicated to researching existing technology, gathering potential customer needs, concept generation and selection, and time and priority management. A final design was created from the information gathered which was capable of drive-by-wire steering, throttle and braking, as well as some basic sensor integration and emergency stop functions. Over the course of the second semester the design was constructed, which involved physically hacking the car with electrical splicing and writing Python programs to control its functionality. Each subsystem was

completed, and the car was able to be fully teleoperated using an external controller by the end of the second semester. This accomplishment will allow future teams to work on sensor integration and software to allow the car to autonomously operate itself.

The goal of the sociotechnical thesis was to discuss how advocates, law enforcement agencies, and tech companies compete to determine the proper extent and applications of predictive policing in the United States. The ideal role of a police force is to fairly maintain a safe and orderly environment for their communities, but this is rarely the case. Decades of abuse of minorities at the hands of police officers have led to a strong and deep-seated distrust of police by those groups. This issue is only exacerbated by the introduction of predictive policing software, which relies on historical crime data to distribute their officers to areas deemed at-risk of crime. This becomes problematic due to the huge social biases already ingrained in the data and leads the software to end up enforcing these biases to a much larger degree, in turn creating a very dangerous feedback loop of unjust policing efforts that unequally and negatively impact minority communities, especially African Americans. Bias present in both modern day policing and software systems are observed and proven through various sources. This culminates in the discussion of predictive policing and how the problems in both software and modern policing can combine to create even stronger biases in policing. Concepts for potential solutions for both software and policing are brought up, and it is concluded that predictive policing is not an inherently bad thing but has the potential to further entrench biases already present in modern policing if proper steps are not taken to remove bias from its operation and from police forces around the country.

While the goals of both projects were met, there is still much more progress that can be made in both fields. The technical project is still in its infancy, and following groups have plenty

of work to do to take advantage of the drive-by-wire capabilities of the Ford Escape in order to make it into a fully functioning autonomous vehicle. In addition, while the sociotechnical project attempted to emphasize the effect predictive policing has on bias, it could not offer a comprehensive solution. Much work is still needed in software and policing to understand the origins and scope of bias, as well as the role that it plays, in order to reduce or eliminate it.