

**IMPLEMENTATION OF ELECTROMECHANICAL DRIVE-BY-WIRE SYSTEM ON  
FORD ESCAPE**

**DATA ACQUISITION OF AUTONOMOUS VEHICLES AND IMPLICATIONS ON  
USER AND PUBLIC PRIVACY AND SECURITY**

An Undergraduate Thesis Portfolio  
Presented to the Faculty of the  
School of Engineering and Applied Science  
In Partial Fulfillment of the Requirements for the Degree  
Bachelor of Science in Mechanical Engineering

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May 9, 2022

## **SOCIOTECHNICAL SYNTHESIS**

A new form of transportation is being rolled onto the street that will forever change mobility services in society. Autonomous vehicles, if implemented correctly, could give greater freedoms to the elderly and disabled, create safer roads, and save commuters hundreds of hours. The objective of the multiyear technical project is to create an autonomous vehicle from a 2008 Ford Escape. The goal of the team this year is to implement an electromechanical drive-by-wire system in order to control the vehicle with an external practical controller using proportional derivative integral (PID) feedback systems and the controller area network (CAN) bus. The CAN bus of a car controls communication throughout the entire system and is localized in each vehicle, but this would not be the case in autonomous vehicles (AVs). In AVs the CAN bus will require connections to outside sensors and processors to understand the complex and everflcutating driving environments. This requires mass data collection and leaves the car vulnerable to external malicious hacking. Through the lens of the Social Construction of Technology Theory the transfer of this technology will be analyzed to interpret the potential dangers such vehicles will have in society.

The technical report explains the process of implementing a drive-by-wire system of sensors and actuators to control a vehicle. The project focuses on controlling the three subsystems required for driving control: braking, throttle, and steering. Then the CAN bus is used to create feedback closed-loop controls for the subsystems to ensure safe and reliable driving through the joystick. Sensors have also been mounted on the car such as LiDAR and forward looking infrared (FLIR) cameras to begin collecting data for further autonomous applications.

The three subsystems are currently controllable through a single controller and a PID controller is being tuned for steering control. Future work for the next team will be to begin using the data collected by the mounted sensors to create more complex looped controls for the car's subsystem such as speed control, automatic braking, and self-parking. Additional future work will also include taking full control over all systems in the car such as gear changes and less important subsystems like window, AC, and stereo control.

The data collected by this and other autonomous vehicles will have to be regulated in regards to its other practical uses. The research paper will aim to identify the potential threats such data collection can have over the privacy and security of users and the public alike by examining the integration of this technology to relevant social groups. The Social Construction of Technology theory by Pinch and Bijker helps critically analyze the effectiveness of AVs through a social lens which allows for a comprehensive examination. Currently, there are little legal restrictions on the power car companies will have over the mass amounts of data being collected by AVs. There are dangerous applications like spying on dissidents or celebrities that must be regulated to protect public data.

The necessity of an Internet of Things (IoT) software architecture in AVs also requires protection from malicious hacking. There have previously been numerous successful data spoofing and vehicle control hacks done on AVs that present a clear danger to their implementation in society. While firewalls and algorithms are already being developed to protect against these hacks, there are still many obstacles to overcome to ensure complete vehicle safety for users, other drivers, and pedestrians alike.

Autonomous vehicles are an incredible feat of technology that, if regulated and protected sufficiently, could change transportation forever. However, before this technology can be

transferred to the relevant social groups in society, these regulations and precautions must be executed to ensure the general safety of the community. Technology has always been a double edged sword, and before it is wielded a sheath must be fitted for use.

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#### **DATA ACQUISITION OF AUTONOMOUS VEHICLES AND IMPLICATIONS ON USER AND PUBLIC PRIVACY AND SECURITY**

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