

SENIOR DESIGN PROJECT: AUTONOMOUS FORMULA SAE ABSTRACT

Technology is rapidly changing, especially in the automotive industry; and we need that industry to meet the needs of our ever-changing society. For this reason, the automotive industry is rapidly advancing in the fully autonomous direction, and we need to develop a platform to exceed the expectations and the needs of the driving public.

We began this project with the foundation of autonomous driving by creating a drive-by-wire system that will control the basic functions, such as acceleration, braking, and steering of the vehicle. This is the foundation to build upon and create our fully autonomous vehicle. We worked to implement the knowledge from our research and related courses that we have taken to draw out a design and begin the exciting journey of creating an autonomous driving system that provides for and meets the needs of our society. Drive-by-wire acceleration is controlled using an electronic throttle body with an input signal from a potentiometer connected to the throttle pedal. Drive-by-wire braking is actuated by a linear pneumatic cylinder that pulls a cable, which in turn pulls the brake pedal. The cylinder is regulated by an electronic to pneumatic transducer with air supplied from an air tank. Drive-by-wire steering control is accomplished by using a brushless DC motor to turn a ball screw that is mounted to the steering rack. The input signal for the steering system is a rotary encoder attached to the steering wheel. All these systems are controlled through an Arduino Mega with supporting systems like L298N H-Bridge and a Flipsky electronic speed controller.

With each of these components and systems, we have a fully drive-by-wire system that is adaptable and provides us with data so that we can improve upon and apply each concept to different vehicles. Creating a drive-by-wire control system for acceleration, braking, and steering is the first step that will set up the next research team to carry this task further into making the vehicle fully autonomous. This could radically change the way that we, as a society, view the automotive industry, as well as simple transportation. It is not an easy task to create a system that meets the needs of the people; but with some research and hard work, it is possible to provide a system that society needs and that will hopefully make driving safer for generations to come.

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