## Our Mission

The goal of the V.I.T.A.L.S. system is to preserve the life and property of the end user; this is accomplished by actuation of a mechanical brake system in the case of a medical emergency.

Drivers are the V.I.T.A.L.S. direct stakeholder, where during a market VSD analysis, privacy concerns were raised surrounding the collection of drivers' biometric data. Everyday drivers told us that if any bio data was to be processed through the vehicle's ECU, they would not trust where that sensitive information ended up. We agreed, and that meant designing a safe, private system without connection to the car's ECU, and built on proprietary hardware AND software.

Objective

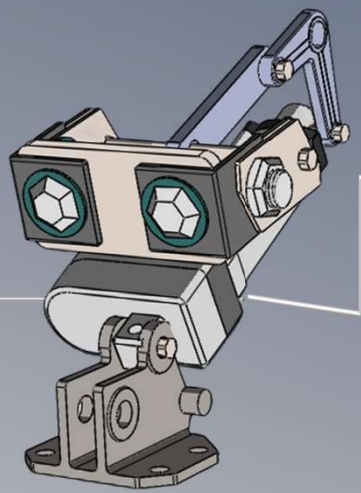
Design Philosophy

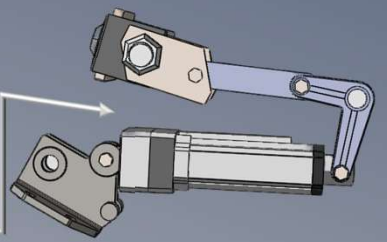
"Any Make. Any Model Year"


The V.I.T.A.L.S. system can be broken down into 2 major components: The *Clip* & *Horseshoe*. Each system runs on 12V *LiFePO4* (Li-Iron Phosphate) packs to ensure steady-state operation and instant power access for microcontroller and linear actuator operation; "Any Make. Any Model. Safer Cars for ALL".

We Are HERE

Mechanical Construction





The actuation process often results in a kick-back reaction force, which would displace the actuator if mounted freely. To mitigate this, a stabilizing platform we call the *Ski* is being created to mount the actuator in tension to the, ensuring the systems is rigid and can operating in a steady-state environment.

Electronic Control

# V.I.T.A.L.S.

***V**ehicle **I**ntegrated **T**racker for **A**utonomic **L**oss **S**eatbelt*

*By: Dylan Grniet, Hamza Kiyani, Ethan Scheer, & Eduardo Guerra*

## State of The Art

Other systems similar to the V.I.T.A.L.S design are embedded in the car's CPU and utilize IR/LIDAR/Motion sensor tech. Where V.I.T.A.L.S differs AND improves is its emphasis on modularity. And the use of multi-biometric data capture through advanced ECG equipment. The system allows for the easy installation while offering the safety feature usually only found in the ownership of an entire smart vehicle.

## Testing Methods

The V.I.T.A.L.S. system is to be validated using a custom static vehicle simulation environment; this rig will consist of a mounted seat, seatbelt assembly, and pressurized brake pedal. This setup allows for controlled testing of our major metrics without the need to step into a moving vehicle. This system will help relay performance, measured through response time, actuation force output, false-trigger rate, and repeatability under varying test subjects and vibration conditions. This controlled approach ensures safety, feasibility, and consistent performance prior to in-vehicle deployment.

## The *Horseshoe*

The actuation-plate system consists of an actuator that provides 14mm of actuation stroke per second in addition with a max usable actuation force of 1000N. The actuation force is adjusted to meet the necessary force requirement to slow down and eventually stop the car which requires an averaged 500N applied force/second.

## The *Clip*

Comprised of a custom textile ECG electrode array in tandem with an AD8232 front-end configuration, the V.I.T.A.L.S. e-control utilizes data derived from the driver's cardiac activity.

An MPU6050 IMU also measures belt/torso motion, and a buckle switch to confirm when the belt is latched properly.

An ESP32 microcontroller samples these signals, estimates heart rate, and classifies driver state (NORMAL / WARNING / EMERGENCY). In the EMERGENCY state, the ESP32 drives a relay that removes power from a demo vehicle's motor controller and activates a 12V hazard-light bar; it can also broadcast a distress flag via sim module akin to On-Star/AAA