



# Project Requirements Document

## Project Summary

This overall goal of this project is to address two main issues that exist in the interface between drivers and their cars today. The first problem represents the lack of feedback given to promote better driving habits. Currently, although cars themselves are being designed to perform better, how they are driven can greatly improve gas consumption and the amount of money people save. The second issue is the lack of safety people face with the distracting features of the new fancy interfaces in vehicles today. People turn their gaze to interact with the music playlist on screen, when they should be staring at the road in front of them. To address these safety and efficiency concerns, we aim to create an infotainment system that is easily navigated with limited distraction to the driver while still providing extensive functionality and feedback to the driver about their driving. We will remove the existing center console of a Chevy Malibu and replace it with our custom built screen with a bezel overlay that designates the top half for dynamic content, and sliders on the bottom half for interaction. The screen will be controlled with a minicomputer which is hidden in the space of the center console. We will make use of the CAN protocol to provide meaningful feedback and comments to the user on improvements they can make to their driving habits. We will also implement vibration and gesture sensing cues to encourage less distractive visual interaction with the system.

## Deliverables

- Screen powered by the minicomputer in the center console of the car
- Three functional applications: Climate Control, Music, Driver Feedback
- Blindfolded demo of apps, vibration, and gesture sensing

## Critical Features

- Climate Control: Users can control the complete set of Malibu climate control functions (fans, temp, defrost, direction, driver/passenger)
- Music: Music can be played through auxiliary input, external USB, and internet radio. Songs can be paused and volume can be adjusted.
- Driver Feedback: Users can control interface through use of sliders to view
  - Their profile page with information averages such as average mpg
  - Their trips page with overall information on trips taken with the car

- Real-time suggestions for the optimal accelerator pedal position
- Safe to Use: Drivers of the car can safely operate most features without removing their eyes from the road thanks to hand-gesture recognition and intuitive touch-feedback.

## Performance Metrics

- Functionality of the apps
- Ease of navigation through the apps without looking
- Performance of vibration feedback
- Accuracy of gesture recognition

## Milestones

- Week of April 28<sup>th</sup>: Determined Leap gestures to use. Microprocessor and motor architecture designed. Climate Control app fast, smooth, and robust.
- Week of May 5<sup>th</sup>: Prototype control of vibration motors. Music app fully functional.
- Week of May 12<sup>th</sup>: Haptic feedback hardware connected and communicating with minicomputer. Driver feedback app fully functional.
- Week of May 19<sup>th</sup>: Haptic feedback and gesture sensing components assembled in car. App functionality and interaction is very tight, perfected, and smooth.

## Team Responsibilities

**Mitchell:** Project manager, application developer

**Vinod:** Weekly lab notebooks, application developer

**Nate:** Treasurer, hardware engineer for vibration sensing

**Ryan:** Hardware engineer for vibration feedback

## Budget

Vibration motors - \$70

Microcontrollers - \$50

Leap Motion - \$85

## Risks

- Our user interface may display information in a way that distracts the driver from the road. We have to be careful to prevent this as much as possible.
- The Leap Motion is impacted by sunlight. We need to figure out how to mount it to mitigate this risk.
- Due to the large mass of the screen and the rigid mounting structure, vibration feedback introduced to the screen may translate too much into the car itself, making it less noticeable to the user compared to having the full power translate to their touch-point. The screen may need to be isolated via rubber or other suspension from the rest of the car.