## Executive Summary

Vehicle accidents cause significant damage to one's health, and finances. One factor contributing to such accidents arises from users being unaware of obstacles in their blind spot. As a result, lane changing becomes a dangerous maneuver. To account for this issue, we are prototyping a system that will warn users of obstacles present, or approaching their vehicle's blind spot, as well as preventing them from making unsafe lane changes.

The design is intended to be used on a scaled down remote controlled vehicle. It consists of three main modules: obstacle detection, output, and automation. The obstacle detection module uses ultrasonic sensors, and a microcontroller to identify obstacles present or approaching the user vehicle's blind spot. The microcontroller calculates the obstacle's position, relative speed, and the amount of time required for it to reach the blind spot (if not already present) using the sensor's distance values, and the trigger rate. This information is then communicated to the output module, which consists of two LED lights providing qualitative feedback (blinking frequency corresponding to safety levels), and an LCD display providing quantitative feedback (microcontroller's calculated distance, speed and time values). Finally, the automation module allows the microcontroller to assume control of the user vehicle. The purpose of this module is to prevent collisions by locking the steering of the user vehicle towards the obstacle.

In order to validate our design, several test cases are to be utilized for each module. The obstacle detection module must be able to measure distances accurately within the defined blind spot region. In addition, relative velocities must be calculated in order to anticipate obstacles. The LED must blink at frequencies corresponding danger levels, and the LCD must display the microcontroller's calculated values. These features will be verified by placing obstacles at known distances from the user vehicle, travelling at known relative speeds. The microcontrollers calculated values, in conjunction with the behavior of the output module will then be compared against these known values. Finally, the automation module will be verified by placing obstacles in situations where the user has less than two seconds to make a lane change, and ensuring the steering of the user vehicle is locked to prevent dangerous lane changes.

The main component of the design is the microcontroller, as it is responsible for integrating all of the modules. The microcontroller will be programmed using C++. Knowledge required to complete the project has mostly been gained through previous experiences and research over the summer period. Further knowledge regarding device operation and vehicle dynamics will be acquired throughout the year. Material resources have already been obtained. The overall cost of the project is expected to be $243.

The main risks associated with the project depend on the operation of the sensors. If the sensors fail to obtain or calculate values accurately due to external factors such as lighting, weather, and unintended obstacles, the operation of the device is at risk. To mitigate these risks, more advanced sensors may be required if the problem cannot be solved with compensational software algorithms. In addition, validating the obstacle anticipation module is risky as keeping both the user vehicle and obstacle at constant relative speed may be difficult.