**Visual Light Communication (VLC)**

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**Abstract**

The Visual Light Communication (VLC) team has designed and built a system for light communication between cars. Our solution can easily be incorporated into both the headlights and taillights of any car that uses LEDs. This type of line of sight communication between vehicles can be used to provide drivers and vehicle computer systems with information that can increase their spatial awareness and therefore increase driver safety. It also can change the way autonomous vehicles operate. With this type of communication autonomous vehicles of different brands and manufacturers would be able to “talk” instead of relying solely on individual sensors to get from point A to point B.

In order to operate, Visual Light Communication (VLC) requires 3 main components. First is specific C code for both sending and receiving messages. On the transmit side, this code will enable cars to Manchester encode messages from their on-board diagnostic (OBD) computer and then create packets to be sent through the headlights. On the receive side this code deconstructs packets to obtain the sent information and then displays this information to the driver through the on-board infotainment system or feeds directly into the vehicles safety systems. The second component is the transmit circuit. This circuit needs to consist of a controller connected to the LEDs of the headlights. This circuit will be responsible for modulation of the LEDs to match the Manchester encoded message. Finally, the receive circuit will consist of a photodiode that is able to receive the packets based on the light modulations. Manchester encoding played a pivotal role in our messaging capabilities. This type of encoding allowed us to send messages at always 50 % duty cycle. This concept is what enabled us to always have the headlight always modulating and send messages without the human eye being able to notice the changes.

For testing and validation, we built a full send and receive system with a model headlight. We made sure to make the circuits as compact as possible. This allowed for easy transport indoors and outdoors and allowed us to bring the system into vehicles for real world testing. Specifically, we visited Draper Laboratories to test on their Lincoln car. Using this vehicle gave us a concrete way to ensure we were receiving correct data from the on-board diagnostic (OBD) computer. Another important aspect of testing was weather conditions. We wanted to ensure that regardless of whether it was rainy cloudy or sunny, we would still be able to send messages.