Collision-Free Commutes: Designing a Blind Spot Detection System for Cyclists Using an Ultrasonic Sensor and Computer Vision

Johnstone, Evan (School: Breck School)
Getnick, Noah (School: Breck School)

Riding a bike is a carbon-efficient mode of transportation and a positive way to maintain fitness. However, the inherent difference in speed and size between cars and bikes makes it dangerous for them to share the roads. Each year, in the United States, there are approximately 49,000 automobile-cyclist collisions, over 700 of which are fatal. Although there have been many advances in safety technology in automobiles, this technology has not been carried over to bicycles. Experimental solutions to warn bikers of approaching cars have been proposed using various sensing technologies, like cameras, LiDAR, and ultrasonic sensors. However, single-sensor systems struggle to verify that objects detected are actually cars or determine whether they pose a significant threat. We designed a system that uses a camera and an ultrasonic sensor to warn cyclists of approaching cars. The system is small, light, and easily mounts to the back of a bicycle's rear bike rack. We programmed the system using a Raspberry Pi, and trained a custom TensorFlow Lite object detection model to automatically detect cars that come into the camera's frame. The ultrasonic sensor complements this data by detecting nearby objects, which helps to confirm if a car detected by the camera is close enough to pose a significant threat. Warnings are transmitted to the biker through a set of LED lights mounted on the handlebars. We hope that our device will improve bicycle safety and encourage more people to try this healthy and environmentally-friendly activity.