

# Improving Bicycle Safety through Automated Real-Time Vehicle Detection

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Technical Report DCS-TR-665

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August 2010

## Abstract

The manner in which people use bicycles has changed very little since their invention in 1817. In that time, though, roadways have become congested with a dramatically less environmentally friendly mode of transportation: automobiles. These vehicles and the motorists who drive them represent, at times, a serious threat to the safety of both road cycling enthusiasts and bicycle commuters alike. Since bikers typically ride with the flow of traffic, the most dangerous situation for them is when they are being passed by a motorist from behind. As a result, a biker must spend a substantial amount of her cognitive and physical ability to periodically scan for rear-approaching vehicles, reducing her capacity to handle the bicycle safely and maintain continual awareness for both the forward and rearward situations.

To improve road cycling safety, we present a system that augments a standard bicycle with audio and video sensing, and computational capabilities. This Cyber-Physical bicycle system continuously senses the environment behind a biker, processes the sensed data utilizing audio processing and computer vision techniques, automatically detects the occurrences of rear-approaching vehicles, and alerts the biker in real time prior to the encounter. In this paper we present *(i)* the design of our prototype Cyber-Physical bicycle system and *(ii)* the results of our evaluation using video and audio traces collected from bikers. These results demonstrate both the feasibility of the system, exhibiting a high degree of detection accuracy while operating under the real-time and energy constraints of the problem scenario.