

Development and Testing of an Integrated, Versatile Bicycle-Based Data Acquisition System

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ABSTRACT

The development of comprehensive automotive data acquisition systems (DAS) over the past two decades has enabled large-scale naturalistic data collection to become a viable research methodology for automotive safety research. This methodology has allowed unprecedented insight into how drivers behave in the real world without experimental intervention or overt observation, and has resulted in numerous novel findings on driver behavior and driver interactions with other road users, infrastructure, and technology [1]. In recent years an effort has been made to extend comprehensive instrumentation capabilities to other modalities including heavy trucks [2], motorcycles [3], and bicycles [4]. However, bicycle instrumentation has faced challenges regarding scope and/or flexibility due to the restrictive constraints of weight, cost, weatherproofing, security, and battery power.

The goal of the current project is to develop and demonstrate a novel instrumentation approach for bicycles that is based on a weatherproofed version of the Virginia Tech Transportation Institute (VTTI) Mini-DAS. The Mini-DAS was developed as a low-cost, self-contained instrumentation system for use in automobiles and motorcycles, and has been adapted for unpowered bicycle use to run off a battery pack mounted inside a water bottle. It consists of a single main unit measuring approximately 165mm x 133 mm that contains two video cameras, a nine-axis IMU, and GPS tracking with WAAS error correction, enabling continuous and epoch-based data collection. A mounting system has been developed to allow flexibility of placement across different types of bicycles; the typical location is attached to the head tube, which allows unobstructed forward view as well as views of the rider's face, approaching vehicles, and hands, depending on bicycle geometry.

This presentation will describe and illustrate the development and current configuration of VTTI's bicycle DAS, as well as provide examples of pilot data collection.

Keywords: Instrumentation, Naturalistic, Bicycles, DAS.

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