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AIM Mobile Traffic Acquisition: Instrument toolbox for detection and assessment of traffic behavior

Deutsches Zentrum für Luft- und Raumfahrt e.V.,
Institute of Transportation Systems *

Instrument Scientists:
- Sascha Knake-Langhorst, Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institut für Verkehrssystemtechnik, Braunschweig, Germany, phone +49 531 295-3474, email: sascha.knake-langhorst@dlr.de
- Kay Gimm, Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institut für Verkehrssystemtechnik, Braunschweig, Germany, phone +49 531 295-3453, email: kay.gimm@dlr.de

Abstract: The AIM Mobile Traffic Acquisition as part of Test field AIM (Application Platform for Intelligent Mobility) are field instruments for detection and assessment of traffic behavior based on a mobile and flexible architecture approach. They serve as a tool box for the purpose of analyzing natural traffic behavior and phenomena, e.g. safety related phenomena, based on trajectories. Thus, the facility can be used for a number of applications in the field of intelligent mobility.

1 Motivation

Test field AIM (Application Platform for Intelligent Mobility) is built-up by Institute of Transportation Systems of German Aerospace Center (DLR) in Braunschweig, Germany to support and conduct research and development in the field of intelligent mobility (Schnieder & Lemmer, 2012, 2014). It consists of different large research infrastructure facilities providing a wide range of services covering simulation environments, test tracks and field instruments. One of these services is called AIM Mobile Traffic Acquisition, which consists of three installations to be combined to work as instrument for detection and assessment of traffic behavior in measuring campaigns.

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2 Technical description

The facility AIM Mobile Traffic Acquisition consists of three portable sensor poles. They share their functional and software architecture with another service, the stationary AIM Research Intersection mentioned in Institute of Transportation Systems (2016).
The following sections will describe the sensory set-up and give an overview about the primary output of the facilities.

2.1 Sensory set-up

Figure 1 exemplarily shows the technical architecture of a sensor pole. The installation can roughly be divided into the pole itself holding a sensor head and different antennas and a weather-proof cabinet, holding the different processing computers as well as several electric and electronic devices. Every pole installation is based on a transportable concrete foundation.

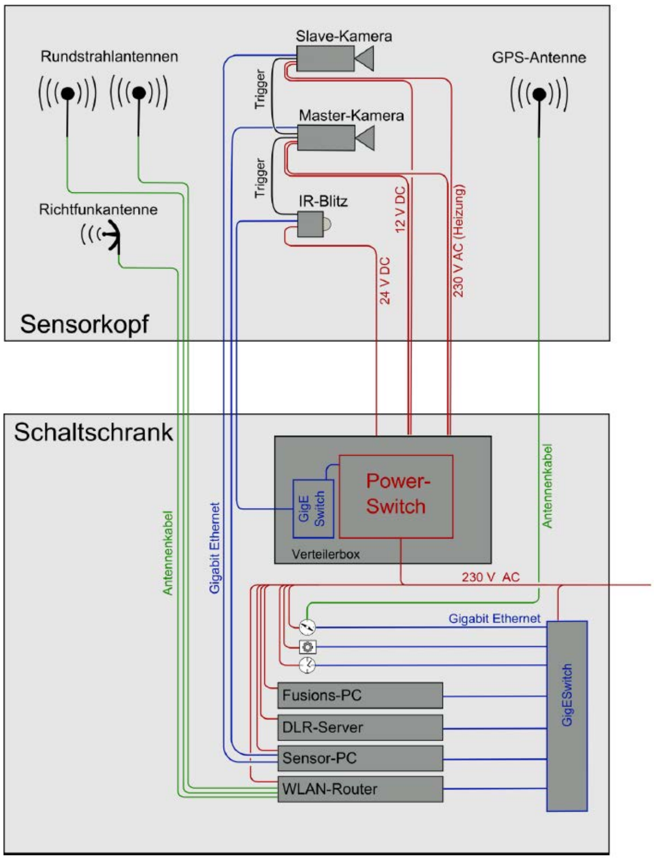

Figure 1: Technical architecture of a sensor pole (exemplary).

The field of vision of two associated sensor poles can be fused to get a better performance of the detection. The communication for data exchange between the poles is done via WLAN. The poles have a remote access because of a LTE-connection.
Figure 2 shows the different sensor poles. One out of two similar poles is shown in front of the main station in Braunschweig in the left part of the picture. It uses a stereo camera setup. In the right part of the picture a stand-alone pole is illustrated. In addition to a stereo camera system, mono-cameras, a 24 GHz multi-range radar system and a laser scanner can be found. All the poles possess an active infrared lighting for artificial scene illumination, so that the system has the ability to be used day and night 24/7.

Figure 2: Mobile sensor poles at railway station and level crossing.

2.2 In- and outputs

The sensor data is fused and processed to obtain the main output of the Mobile Traffic Acquisition, which are trajectories of the detected traffic participants. These trajectories hold information about the classification and dimensions of the object as well as its location, velocity and other dynamic state variables. The closure state of the railway crossing can also be detected. Figure 3 and 4 show the corresponding scene videos with augmented object information in different traffic situations. The two angles of vision are shown in the left and the right side of the picture.

Figure 3: Visualization of a railway crossing traffic scene with augmented object information.

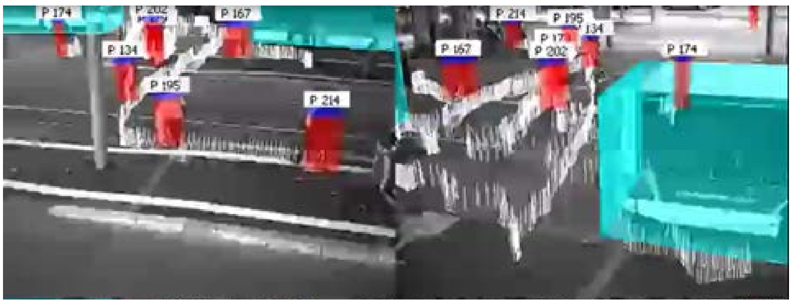

Figure 4: Visualization of a shared space traffic scene with augmented object information.

These trajectories are produced with a rate of 25Hz. They are automatically stored in a data base for offline analysis purposes with the respective scene videos for manual assessment and validation.

3 Project application examples

One pole was placed at a railway level crossing in Braunschweig-Bienrode. There the traffic behavior was investigated especially referring to red light violations. Details of this study can be seen in Grippenkoven et al. (2015) and Schnieder, Grippenkoven, Wang, & Lackhove (2015). In the future the system can be used to accompany the development of actions to increase the level crossing safety and evaluate specific measures.

The system consisting out of two poles has been mounted for a test campaign in the front of the railway main station in Braunschweig. There the behavior of different traffic participants like pedestrians, cyclists, taxis and buses and trams can be observed at shared traffic space. Prospectively the interaction between autonomous vehicles and vulnerable road users can be examined.

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