
Title: UAV for traffic surveillance and management using AI

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Abstract

Unmanned Aerial Vehicles (UAVs) are becoming increasingly popular for monitoring traffic on urban roads and highways. However, the large amount of generated data, is difficult for human operators to analyse and quantify on time in order to early detect traffic incidents and warn the affected road users. To address this challenge, we propose a traffic surveillance system for UAVs that leverages artificial intelligence (AI) to enhance safety and efficiency.

The system in development uses a combination of computer vision and machine learning algorithms to identify and track vehicles, detect traffic accidents and road hazards, and predict critical traffic situations employing trajectory prediction algorithms. The UAV system captures with the onboard calibrated camera video of the traffic, which is then used to extract the road and the lanes with image processing. On the next step deep learning for object detection is used for the detection of vehicles and other road users. The identified vehicles are then tracked during multiple frames and the vehicle speed is estimated across the frames. The vehicle trajectory prediction is performed taking into account the vehicle kinematics and the previous trajectory. Stationary vehicles can also be detected, this can signify a possible vehicle break-down or accident if the detection is on highway. Vulnerable Road Users as motorcyclists, cyclists and pedestrians can also be detected and become more conspicuous to the other road users through C-ITS (Cooperative Intelligent Transport System) communications.

The system in development is employed in two different projects in combination with a C-ITS RSU (Road Side Unit) and an Automatic Traffic Incident Detection (ATID) and warning system. The system will be tested both in urban and highway environments. In urban environments a lightweight quadcopter will be used with an onboard camera with the RSU and ATID system on the ground in close proximity. In the highway environment a fixed-wing UAV will be used with the RSU and ATID system on the payload of the aircraft. The proposed UAV traffic surveillance system represents a significant step towards safer and more efficient traffic

Keyword

UAV, traffic surveillance, object detection, trajectory prediction

Biography

Dr. Evangelos Bekiaris (male), PhD on Mechanical Engineering NTUA, has been elected as Researcher of the Hellenic Institute of Transport (HIT) of the Centre for Research and Technology Hellas (CERTH) in 2001; being its Director General as of 2016. Since 1992 he has participated in over 120 research projects, in 40 of which at the role of Overall or Technical Coordinator. He's the National representative of Greece in the H2020 Transport Committee since 2014 and President of the European Conference of Transport Research Institutes (ECTRI) and the European Rail Research Network of Excellence (EURNEX) since 2019. In the past he's also been the President of the European Associations FERSI (on road safety) and HUMANIST (on Human Factors in Transport). He is editor and/or author in 42 scientific book chapters, 71 publications in international scientific journals and 288 presentations in international conferences.