

Expression of interest for research cooperation in Horizon 2020

Description of institution

Interested institution:	AGH University of Science and Technology
Department carrying out the proposed research	Department of Measurement and Electronics "Traffic" Team
Adress and webpage	http://www.agh.edu.pl/ http://www.kmet.agh.edu.pl/
Contact person (name, e-mail address, phone)	Piotr Burnos, burnos@agh.edu.pl , +48501260604

Research offer

Brief description of the department (key research facilities, infrastructure, equipment)

The "Traffic" team is a part of the Department of Measurement and Electronics, within The Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering at the University of Science and Technology in Krakow, known as AGH-UST. The "Traffic" team exists for over 15 years now on and it's research field is related to the measurement of road traffic parameters, especially weighing vehicles in motion. The key infrastructure in the possession of the Department is the unique in European scale Multi-Sensor Weigh-in-Motion system installed in the national road in south of Poland. The other infrastructure and equipment using by "Traffic" team are: electrical engineering and mechanical engineering laboratories, climatic chamber with dynamic press, fast data acquisition systems and more. For simulation purposes licensed software is available: MSD Adams/Car, LabView, Matlab & Simuling, Ansys Maxwell.

Scientific area

<input type="checkbox"/> Chemistry	<input type="checkbox"/> Social Sciences and Humanities
<input type="checkbox"/> Economic Sciences	<input checked="" type="checkbox"/> Information Science and Engineering
<input type="checkbox"/> Environment and Geosciences	<input type="checkbox"/> Life Sciences
<input type="checkbox"/> Mathematics	<input type="checkbox"/> Physics

Research field

Main research field of the "Traffic" team are Weigh-in-Motion (WIM) systems which allow vehicles to be weighted in motion. This is emerging technology within Intelligent Transportation Systems, as direct enforcement of overloading is currently very expected solution. The benefits of such a solution are obvious because overloaded heavy goods vehicles pose a particular hazard in pavement deterioration, traffic safety and fair competition between transport operators.

For over 10 years, the "Traffic" team from Department of Measurement and Electronics has been carrying out research into developing WIM system with characteristics sufficiently good to be directly utilized for enforcement purposes. In particular the team work on:

- Design of WIM systems,
- Test of WIM systems,
- Data analysis from WIM's,
- Examined metrological properties of WIM systems.

The proposed research/project description

Project name: Weigh-in-Motion systems for direct enforcement of overloading vehicles

In many countries extensive research has been conducted over a number of years into WIM systems application for direct enforcement purposes but without success. The fundamental problems, which so far have not been solved, involve ensuring high and stable accuracy of WIM systems and the quantitative assessment of factors disturbing the weighing process. The "Traffic" team from AGH-UST have been working on WIM systems for direct enforcement for last few years. Since 2013 these actions are the objectives of the working group within the Intelligent Transportation Systems Cluster, which, beside AGH-UST (leader) includes: government agencies: Central Office of Measurements, General Inspectorate of Road Transport, and companies Kapsch Telematic Services Sp. z o.o., Kistler, CAT Traffic Sp. z o.o., TRAX Elektronik.

In project two main goals have been formulated:

1. Defining detailed procedures for legalization and metrological control of WIM systems (test conditions),
2. Defining technical requirements for such WIM systems.

The most important technical requirements for WIM systems applied for direct enforcement concern:

- the number of load sensors and their distances from one another,
- the interference quantities which affect the accuracy of the weighing result,
- determination of the allowed variability subspace of all known interfering quantities. If all these quantities are contained within the determined limits, then the uncertainty of the weighing result is acceptable.

To fulfill all project goals and give answer on formulated questions and issues new Weigh-in-Motion test site must be built within this project. Planning WIM site will allow also to perform test regarding defining detailed procedures for legalization and metrological control of WIM systems.

Additional information (key Persons and Expertise; additional trainings, research programme, other)

Electrical metrology will play the dominant role in solving the research problem. It is the native field of "Traffic" team members:

Prof. Janusz Gajda received his M.S., Ph.D. and D.Sc. degrees in electrical engineering at the AGH-UST in Krakow, Poland. He is a full Professor with the Department of Measurement and Electronics.

Prof. Ryszard Sroka received the M.Sc., Ph.D. and D.Sc. degrees in electrical engineering at the AGH - UST, Poland in 1989, 1995 and 2009 respectively. He is an author and co-author of 9 books and of over 130 scientific papers. He is currently an Associate Professor in Department of Metrology and Electronics, and Dean with the Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering at AGH-UST.

Piotr Burnos received M.S. and Ph.D. degrees in electrical engineering from the AGH-UST in Krakow, in 2005 and 2009 respectively. Since 2010, he has been an Assistant Professor. He is co-author of two books about road traffic parameters measurements and author or co-author of over 50 papers about vehicle Weigh-in-Motion system.

Last 3 high rank publications:

P. Burnos and J. Gajda, "Thermal Property Analysis of Axle Load Sensors for Weighing Vehicles in Weigh-in-Motion System," *Sensors*, vol. 16, no. 12, 2016.

P. Burnos and D. Rys, "The Effect of Flexible Pavement Mechanics on the Accuracy of Axle Load Sensors in Vehicle Weigh-in-Motion Systems," *Sensors*, vol. 17, no. 9, p. 2053, 2017.

J. Gajda, P. Burnos, and R. Sroka, "Accuracy Assessment of Weigh-in-Motion Systems for Vehicle's Direct Enforcement," *IEEE Intell. Transp. Syst. Mag.*, vol. Spring, pp. 88–94, 2018.

Patents:

PL 222602 B1: Method for accommodation of inductive detection system of mobile objects to the local environmental conditions

Most important international and Polish awards for research on WIM systems:

Silver Medal - Brussels Innova 2009,

Price of Ministry of Science and Education of Poland, 2010,

Silver Medal - Salon International des Inventions Geneve, 2010.