

## **VEGA 1/0453/12: Study of interactions between motor vehicle, traffic flow and roadway**

The project was focused on examination of new methods for measuring dynamic properties of motor vehicle and its interaction with roadway and its surrounding environment based on data fusion (data from 2D laser scanner(s), GPS, INS, cameras). A part of the project was focused on design of new and/or modification of existing measurement methods of chosen roadway parameters and its surrounding environment, design and implementation of new algorithms for experimental data processing, comparison of diverse approaches, identification of possible future applications.

The most important result of the project is proposed methodology of creating the 3D model of a traffic way (road, railway, water way) and its surrounding areas using the mobile measurement platform moving along the given trajectory. Primary data are obtained from a couple of 2D laser scanners. The methodology is based on an algorithm which pre-processes data from the laser scanners first and then, using fusion with data from GPS and INS receivers generates a cloud of points. If texture is required, calculation of metadata is also involved what makes easier to generate surfaces in the cloud of points. Only relevant parts are selected from visual information given by cameras and the texture generated in such a way is applied to the model. Thus the given approach integrates more types of data that are at present obtained separately and with a limited meaning. The application potential of such 3D models is high – their primary applicability is expected in relation to future intelligent transport systems.

Realization: 01/2012-12/2014

Coordinator: Ales JANOTA (DCIS)

Some of publications:

1. MRAVEC, T. - VESTENICKÝ, P.: Increasing Objects Localization Precision by Determination of Inertial Sensor Calibration Constants Using Differential Evolution Algorithm. In: 15th International Carpathian Control Conference ICCS 2014, Velké Karlovice, Czech Republic, May 28-30, 2014, p. 362-366, doi: 10.1109/CarpathianCC.2014.6843628  
[http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=6843628&abstractAccess=no&userType=inst](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6843628&abstractAccess=no&userType=inst)
2. HRUBOS, M. - JANOTA, A.: Road Surface Degradation – Measurement and Vizualization. J. Mikulski (Ed.): TST 2014, CCIS 471, Springer, Heidelberg, 2014, pp. 1-10, doi: 10.1007/978-3-662-45317-9\_1, [http://link.springer.com/chapter/10.1007/978-3-662-45317-9\\_1](http://link.springer.com/chapter/10.1007/978-3-662-45317-9_1)
3. MIKLUSCAK, T.-JANOTA, A.: How to Predict Location and for What to Use It? 15th International Carpathian Control Conference (ICCC), Velke Karlovice, Czech Republic: 28-30 May 2014, pp. 351-356, doi: 10.1109/CarpathianCC.2014.6843626,  
[http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=6843626&abstractAccess=no&userType=inst](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6843626&abstractAccess=no&userType=inst)
4. HRUBOS, M. - JANOTA, A.: Fusion of sensory data obtained by different equipment integrated in the mobile measurement platform. ANNALS of Faculty Engineering Hunedoara – International Journal on Engineering, Tome XIII [2015] – Fascicule 1 [February], pp. 65-68,  
<http://annals.fih.upt.ro/pdf-full/2015/ANNALS-2015-1-10.pdf>
5. HRUBOS, M.-JANOTA, A.: Fusion of Sensory Data Obtained by Different Equipment Integrated in the Mobile Measurement Platform. Proc. of the 10th International Conference ELEKTRO 2014, Rajecke Teplice, Slovakia: May 19-20, 2014, p. 446-450, doi: 10.1109/ELEKTRO.2014.6848935,  
[http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=6848935&abstractAccess=no&userType=inst](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6848935&abstractAccess=no&userType=inst)
6. HRUBOS, M. – JANOTA, P. – PIRNIK, R.: Road Surface Measurement and Visualization Based on Data from The Laser Scanner. 15th International Carpathian Control Conference (ICCC), Velke Karlovice, Czech Republic: 28-30 May 2014, pp. 168-173, doi: 10.1109/CarpathianCC.2014.6843591,  
[http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=6843591&abstractAccess=no&userType=inst](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6843591&abstractAccess=no&userType=inst)
7. SIMAK, V. – NEMEC, D. – HRBCEK, J. – JANOTA, A.: Inertial navigation: Improving precision and speed of Euler angles computing from MEMS gyroscope data. J. Mikulski (Ed.): TST 2013, CCIS 395, Springer, Heidelberg, 2013, pp. 163–170, doi: 10.1007/978-3-642-41647-7\_21  
[http://link.springer.com/content/pdf/10.1007%2F978-3-642-41647-7\\_21.pdf](http://link.springer.com/content/pdf/10.1007%2F978-3-642-41647-7_21.pdf)
8. HRUBOS, M.-JANOTA, A.: Algorithm for Surface Creation from a Cloud of Points. J. Mikulski (Ed.): TST 2013, CCIS 395, Springer, Heidelberg, 2013, pp. 42–49, DOI: 10.1007/978-3-642-41647-7\_6, [http://link.springer.com/content/pdf/10.1007%2F978-3-642-41647-7\\_6.pdf](http://link.springer.com/content/pdf/10.1007%2F978-3-642-41647-7_6.pdf)
9. KRŠÁK, E. - HRKÚT, P. - VESTENICKÝ, P.: Technical Infrastructure for Monitoring the Transportation of Oversized and Dangerous Goods. Federated Conference on Computer Science and Information Systems (FedCSIS) 2012, Wroclaw, Poland, September 9th - 12th, 2012, pp. 797

- 802 <https://fedcsis.org/proceedings/2012/pliks/298.pdf>
10. MIKLUSČAK, T. – GREGOR, M. - JANOTA, A.: Using Neural Networks for Route and Destination Prediction in Intelligent Transport Systems. Communications in Computer and Information Science 329, Springer-Verlag Berlin Heidelberg, Jerzy Mikulski (Ed.), 2012, pp. 380-387, doi: 10.1007/978-3-642-34050-5\_43, [http://link.springer.com/chapter/10.1007%2F978-3-642-34050-5\\_43](http://link.springer.com/chapter/10.1007%2F978-3-642-34050-5_43)
  11. SIMAK, V. – NEMEC, D. – HRBCEK, J.: Calculation of Robot Position Utilizing Accelerometers in Non-inertial Frame of Reference. Proc. of the 9th international conference ELEKTRO 2012, Rajecké Teplice, Slovakia: May 21-22, 2012, pp. 373-376, doi: 10.1109/ELEKTRO.2012.6225685, [http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=6225685&abstractAccess=no&userType=inst](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6225685&abstractAccess=no&userType=inst)
  12. HOLECKO, P. – BUBENIKOVA, E. – PIRNÍK R.: Communication Systems in Transport – Hybrid ITS Interface. Proc. of the 9th international conference ELEKTRO 2012, Rajecké Teplice, Slovakia: May 21-22, 2012, pp. 292-298, doi: 10.1109/ELEKTRO.2012.6225607, [http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=6225607&abstractAccess=no&userType=inst](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6225607&abstractAccess=no&userType=inst)
  13. JANOTA, A. – HALGAŠ, J.: A Methodology Applicable to Building a Classifier of Pavement Roughness Measurement Methods and Devices. Proc. of the 9th international conference ELEKTRO 2012, Rajecké Teplice, Slovakia: May 21-22, 2012, pp. 311-315, doi: 10.1109/ELEKTRO.2012.6225610, [http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=6225610&abstractAccess=no&userType=inst](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6225610&abstractAccess=no&userType=inst)
  14. HRBCEK, J. - SIMAK, V. - JANOTA, A.-PIRNIK, R.: Tunnel central control system enhanced with modern control approaches. Archives of Transport System Telematics, Vol. 7, Issue 3, 2014, pp. 3-7, [http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-401c9d18-afe7-46eaba1-2fe1a2255bd3/c/ATST2014\\_3\\_HRBCEK\\_SIMAK\\_JANOTA\\_PIRNIK.pdf](http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-401c9d18-afe7-46eaba1-2fe1a2255bd3/c/ATST2014_3_HRBCEK_SIMAK_JANOTA_PIRNIK.pdf)
  15. HOLECKO, P. - PIRNIK, R. - BUBENIKOVA, E.: Optimization of Channel Access in Wireless Sensor Networks. Archives of Transport System Telematics, Volume 5, Issue 3, 2012, pp. 31-34, [http://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-article-BSL3-0026-0126/c/httpwww\\_bq\\_utm\\_edu\\_plartatst3-42012holecko.pdf](http://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-article-BSL3-0026-0126/c/httpwww_bq_utm_edu_plartatst3-42012holecko.pdf)

Pending patents:

1. Systém zvyšovania bezpečnosti priechodnosti tunelov (System for increase of tunnel capacity). PP 28-2014, 14.04.2014 (authors: Bozek P. - Pivarciova E. - Trebuna P. - Halenar I. - Tothova M. - Hartansky R. - Pirnik R. – Simak V.)
2. Zariadenie na tvorbu virtuálneho 3D modelu jazdného profilu dopravnej cesty (Equipment for creation of a virtual 3D model of a driving road profile). PP 100-2014, 31.12.2014 (authors: Janota A. - Halgas J. - Hrubos M. - Pirnik R.)