

Modernizing laboratories for automotive industry related curricula

Mario Vranješ¹, Gordana Velikić², Ratko Grbić¹, Ivan Kaštelan³, Marijan Herceg¹, Denis Vranješ¹

¹ Faculty of electrical engineering, computer science and information technology Osijek, Croatia, mario.vranjes@ferit.hr, ratko.grbic@ferit.hr, marijan.herceg@ferit.hr, denis.vranjes@ferit.hr

² RT-RK Institute for Computer Based Systems, Narodnog Fronta 23a, Novi Sad, Serbia, gordana.velikic@rt-rk.com

³ Faculty of technical sciences, Trg Dositeja Obradovića 6, Novi Sad, Serbia, ivan.kastelan@uns.ac.rs

INTRODUCTION

- Autonomous vehicles are state-of-the art, while the level of vehicles autonomy has been rising on a daily basis.
- In the last few years, there has been a significant increase in the number of companies specialized for automotive software (SW) and hardware (HW) in Europe, which need engineers with adequate knowledge and skills.
- Faculty of Electrical Engineering, Computer Science and Information Technology (FERIT) Osijek, Croatia and the Faculty of Technical Sciences (FTN) Novi Sad, Serbia, have launched new study programs oriented towards education of engineers specialized for automotive SW and HW.
- FERIT and FTN have been performing a joint project named "Modernizing Laboratories for Innovative Technologies" (DRIVE), and using the funds of DRIVE project they have acquired the valuable equipment.

NEW AUTOMOTIVE COMPUTING AND COMMUNICATIONS (ACaC) STUDY PROGRAM AT FERIT

- Based on requirements stated from industry partners (RT-RK Institute Osijek, Rimac Automobili, Yazaki, GlobalLogic, Xylon, AVL-AST), in 2017 FERIT launched the graduate university study program in ACaC.
- FERIT ACaC study program provides students the opportunity to specialize in the field of designing, implementing and testing software and computer systems in the automotive industry and provides students specific knowledge related to:
 - general software development processes for automotive industry;
 - communication networks and protocols in automotive systems;
 - security of vehicle information systems;
 - artificial intelligence and deep learning in automotive software systems;
 - methodologies for testing and verification of software systems in automotive industry;
 - power supply and vehicle systems;
 - application of energy electronics in the vehicle;
 - etc.

- Upon completion of the mentioned study program, students will be able (among other things) to:
 - develop and test algorithms for effective message transmission in wireless ad-hoc vehicle networks;
 - design automotive software support: from risk analysis to a functionally safe concept;
 - develop one's own software solution to the given problem for the target architecture and correct the faults that occurred in its creation;
 - explain and apply automotive software diagnostics methods;
 - apply advanced image and video processing algorithms in real time;
 - choose and apply appropriate deep learning methods and models to solving specific problems in intelligent transport systems;
 - etc.

EQUIPMENT PROCURED FOR NEW STUDY PROGRAM

- In order to procure up to date equipment, which in the case of automotive industry is quite expensive, FERIT and FTN have applied for a joint project of cross-border cooperation between Croatia and Serbia (named DRIVE)), which is in implementation, starting in July 2017.
- The equipment worth 715.980,00 Euro (FERIT part is 273.092,00 Euro) is acquired and two automotive related laboratories at FERIT are formed (Fig. 1).



(a)



(b)

Fig. 1. Laboratory equipment procured by using DRIVE project funds (a) equipment that supports automotive application development in AUTOSAR for automotive ECUs (b) Advanced Driver-Assisted System (ADAS) development boards with appropriate periphery.

KEY NEW COURSES FOR ACaC STUDY PROGRAM

- Four new key courses that use the equipment procured by using funds from DRIVE project and are closely related to automotive SW and HW are developed.

1. Software Architecture in safety-Critical Control systems

- Students will be introduced in the basics of AUTOSAR: concepts, architecture, methodology, building elements (RTE-Runtime Environment, BSW-Basic Program Support, SWC-Programming Support Components, VFB-Virtual Functional Bus) and migration models.
- The general goal of this course is to provide students with insights into the concepts and architecture of safety-critical control systems software and train students in developing and managing software for automotive safety-critical systems.

2. Methods and Techniques for Automotive Software Testing

- The goal of this course is to introduce and explain the concepts and objectives of software testing and diagnostics.

3. Digital Image and Video Processing for Autonomous Vehicles

- Students will be introduced to image processing and manipulations techniques and also image segmentation methods, Motion analysis, object tracking techniques and 3D scene reconstruction will be discussed.
- The final goal of this course is to enable students to apply and develop advanced algorithms for processing of digital images and video signals, with an emphasis on real-time algorithms for usage in autonomous vehicles (Fig. 2).

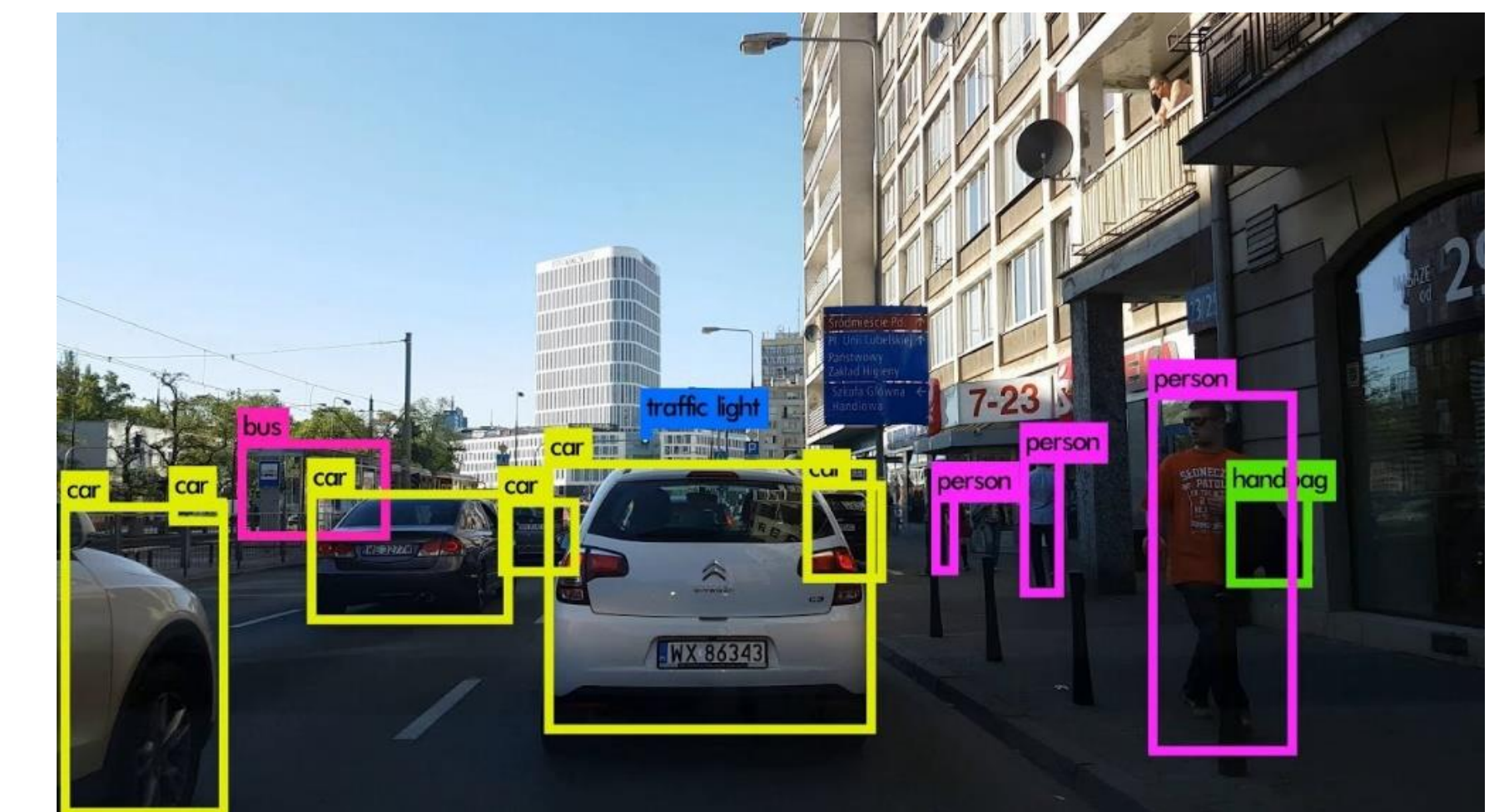


Fig. 2 Example of pedestrian and car detection system based on processing of image from car camera system

4. Machine Learning in Systems of Autonomous and Networked Vehicles

- Upon successful completion of the course, students will be able to develop their own software solution using appropriate libraries that contain implemented methods and machine learning algorithms and to choose and apply appropriate methods and deep learning models to solving specific problems in intelligent transport systems.

CONCLUSION

- Based on automotive related labor market requirements, FERIT Osijek launched new graduate study program in Automotive Computing and Communications.
- By performing the European Union co-founded DRIVE project, FERIT procured the valuable modern and state-of-the art laboratory equipment, which will be used for teaching students through modern courses in the field of automotive industry.
- FERIT will monitor the needs of the labor market and in the future it is likely to increase the number of enrollment places at the ACaC study.