

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Integrirani inteligentni senzori
Course title:	Integrated intelligent sensors

Študijski program Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Inženiring in avtomobilska industrija Engineering and Automotive Industry	Program nima smeri The program has no study fields	prvi first	drugi second

Vrsta predmeta / Course type Modul II-4 izbirni

Univerzitetna koda predmeta / University course code: DR_31010

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
60	-	-	30	-	180	10

Nosilec predmeta / Lecturer: Izr. prof. dr. Mario Žganec

Jeziki / Languages:	Predavanja / Lectures:	Slovenski /slovenian
	Vaje / Tutorial:	Slovenski / slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

<ul style="list-style-type: none"> - II stopnja naravoslovno-tehniške smeri - osnovna znanja iz področja računalništva, elektrotehnike in teorije obdelave signalov 	<p>Prerequisites:</p> <ul style="list-style-type: none"> - Second level degree from a natural sciences or engineering program, - Basic knowledge of computer science, electrical engineering and signal processing
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Vsebina:

Content (Syllabus outline):

<p><u>Predavanja:</u></p> <ul style="list-style-type: none"> - Definicija inteligentnih senzorjev, - prednosti in slabosti inteligentnih senzorjev, - vzorčenje analognih signalov, - osnove obdelave signalov in prepoznavanja vzorcev, - komunikacijski vmesniki in komunikacijski protokoli, - senzorska omrežja, - senzori za merjenje osnovnih fizikalnih veličin, - kompleksni senzori za detekcijo objektov, - tehnološki trendi. <p><u>Laboratorijske vaje in samostojno delo:</u></p> <ul style="list-style-type: none"> - Poglobitev teoretičnih znanj o inteligentnih 	<p><u>Lectures:</u></p> <ul style="list-style-type: none"> - Definition of intelligent sensors, - advantages and disadvantages of intelligent sensors, - sampling of analog signals, - basics of signal processing and pattern recognition, - communication interfaces and protocols, - sensor networks, - sensors for measuring basic physical quantities, - complex sensors for detection of objects, - trends in technology. <p><u>Laboratory work and individual work:</u></p> <p>Implementation of the theoretical knowledge in a specific</p>
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senzorjih na praktičnem primeru izbire, uporabe, evaluacije, ali načrtovanja inteligentnega senzorja	application comprising selection, use, evaluation or design of an intelligent sensor
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Temeljni literatura in viri / Readings:

<ul style="list-style-type: none"> – Sabrie Soloman , Sensors Handbook, McGraw-Hill, 2010, ISBN: 978-0-07-160571-7 (http://ailab.ijs.si/~blazf/kro/SL/Soloman%20-%20Sensors%20Handbook%202nd%20Edition%20-%202010.pdf) – Randy Frank, Understanding Smart Sensors, Artech House, Boston, 2000, ISBN 1-58053-398-1 (http://www.nomads.usp.br/pesquisas/design/dos/Capacitacao/arquivos/Understanding%20Smart%20Sensors,%202nd%20Ed.pdf)

Priporočljiva literatura / Recommended Textbooks

<ul style="list-style-type: none"> – Creed Huddleston, Intelligent Sensor Design Using the Microchip dsPIC®, Elsevier, 2007, ISBN-13: 978-0-7506-7755-4, (http://enggate.net/content/uploads/2015/07/intelligent-sensor-design-using-the-microchip-dspic-embedded-technology1.9780750677554.29008.pdf) – Robert H. Bishop, The Mechatronics Handbook, CRC Press, 2002, ISBN 0-8493-0066-5, (http://www.sze.hu/~szenasy/Szenzorok%20%E9s%20aktu%E1torok/Szenzakt%20jegyzetek/Mechatronics%2520handbook%5B1%5D.pdf) – Gierad Laput et al., Zensors: Adaptive, Rapidly Deployable, Human-Intelligent Sensor Feeds, 2015, (http://www.cs.cmu.edu/~jbigham/pubs/pdfs/2015/zensors.pdf) – Gary W. Hunter et al., Smart Sensor Systems, The Electrochemical Society Interface, 2010, (https://www.electrochem.org/dl/interface/wtr/wtr10/wtr10_p029-034.pdf)
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Cilji in kompetence:

<p>Cilji</p> <p>Predmet je namenjen pridobitvi osnovnih znanj in orodij, potrebnih za razvoj inteligentnih senzorjev in pridobitvi praktičnih znanj pri obdelavi podatkov.</p> <p>Študentje bodo seznanjeni z zgradbo in delovanjem inteligentnih senzorjev, programsko opremo inteligentnih senzorjev ter osnovami mikrotehnologije , z namenom realizacije senzorjev za potrebe avtomobilske in okoljevarstvene industrije. Predstavljene bodo arhitekture mikrosenzorjev za meritve osnovnih veličin kot so pospešek, pritisk, pozicija, hitrost, temperatura, magnetno polje, kot tudi kompleksni senzori za detekcijo objektov in dogodkov v okolju.</p> <p>Kompetence</p> <p><i>Učna enota prispeva k razvoju naslednjih splošnih in specifičnih kompetenc:</i></p> <ul style="list-style-type: none"> – sposobnost uporabe pridobljenega teoretičnega znanja v praksi, – sposobnost načrtovanja arhitekture inteligentnih senzorjev – sposobnost razvoja inteligentnih senzorjev – usposobljenost za implementacijo metod inteligence in računalniških tehnologij v
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Objectives and competences:

<p>Objectives</p> <p>The course provides basic knowledge and tools needed for the development of intelligent sensors and acquisition of practical skills in field of data processing.</p> <p>Students will become familiar with the structure and operation of intelligent sensors, intelligent sensor software and basics of microtechnology, used for sensors in automotive and environmental industry. Microsensor architectures for measurement of basic physical quantities such as acceleration, pressure, position, speed, temperature, magnetic field, as well as complex sensor architectures for detection of objects and events in the environment will be presented.</p> <p>Competences</p> <p><i>Learning Unit contributes to the development of generic and specific competences:</i></p> <ul style="list-style-type: none"> – ability to apply theoretical knowledge in practice, – ability to design intelligent sensor architecture, – ability to develop intelligent sensors – ability to implement intelligence methods and computer technologies in intelligent sensors for detecting signals, objects and common measured process parameters in industry, or in
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inteligentnih senzorjih za razpoznavanje signalov, objektov ter vsakdanjih merjenih parametrov procesov v industriji, ali v delovnem okolju .	the workplace.
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Predvideni študijski rezultati:

Intended learning outcomes:

<p>Znanje in razumevanje: Študent/študentka:</p> <ul style="list-style-type: none"> – pozna zgradbo in delovanje inteligentnih senzorjev, – učinkovito sodeluje pri načrtovanju senzorjev, – zna oceniti zmogljivosti, prednosti in omejitve, inteligentnih senzorjev ter izbrati ustrezen senzor za dano aplikacijo, – pozna osnovne postopke obdelave signalov, uporabljene v inteligentnih senzorjih, – pozna možnosti povezovanja senzorjev in izmenjevanja podatkov med senzorji in ostalimi procesnimi sistemi. 	<p>Knowledge and understanding: Student:</p> <ul style="list-style-type: none"> – is familiar with the structure and operation of intelligent sensors, – can effectively participate in the design of sensors, – is able to assess the capabilities, strengths and limitations of intelligent sensors and choose the appropriate sensor for a given application, – knows basic signal processing procedures used in intelligent sensors, – is familiar with communication interfaces and protocols for data exchange between sensors and other systems.
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Metode poučevanja in učenja:

Learning and teaching methods:

<ul style="list-style-type: none"> – predavanja z aktivno udeležbo študentov, ki vsebujejo razprave, diskusije, odgovore na vprašanja in prikaz praktičnih primerov, – laboratorijske vaje in/ali individualno in skupinsko delo s študenti v obliki konzultacij, – projektna naloga s praktičnim primerom implementacije inteligentnih senzorjev. 	<ul style="list-style-type: none"> – lectures with active participation of students, including discussions, debates, answers to questions and practical examples, – laboratory work and/or individual and group work with students in the form of consultations, – seminar with practical examples of the implementation of intelligent sensors.
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Načini ocenjevanja:

Delež (v %) / Assessment:

	Weight (in%)	
– projektna naloga	(50%)	– seminar project
– teoretični del izpita	(50%)	– theoretical examination

Reference nosilca / Lecturer's references:

Ključne reference nosilca:

- FERGUSON, Gary William, US-KRAŠOVEC, Marija, STROJAN FLEŽAR, Margareta, ŽGANEC, Mario, LAVRENČAK, Jaka, PALČIČ, Branko. Filter devices for depositing material and density gradients of material from sample suspension : US 7211225 (B2), 2007-05-01 : appl. no. 10/228,353, filed Aug. 26, 2002. Alexandria: United States Patent and Trademark Office, 2007.
- GOLOB, Žiga, ŽGANEC GROS, Jerneja, ŽGANEC, Mario, VESNICER, Boštjan, DOBRIŠEK, Simon. FST-based pronunciation lexicon compression for speech engines. International journal of advanced robotic systems, ISSN 1729-8814, 2012, vol. 9, no. 211, str. 1-9
- KOVAČIČ, Stanislav, PAVEŠIČ, Nikola, GYERGYÉK, Ludvik, ŽGANEC, Mario. Stereo-matching by deformation. V: PAVEŠIČ, Nikola (ur.), NIEMANN, Heinrich (ur.), PAULUS, Dietrich (ur.). Image processing and stereo analysis : proceedings of the Slovenian-German workshop, Erlangen, December 3, 1992, (Arbeitsberichte des Instituts für Mathematische Maschinen und Datenverarbeitung (Informatik), ISSN 0344-3515, Bd. 26, Nr. 1). Erlangen: Institut für Mathematische Maschinen und Datenverarbeitung (Informatik), 1993, str. 23-36
- KRAVANJA, Jaka, ŽGANEC, Mario, ŽGANEC GROS, Jerneja, DOBRIŠEK, Simon, ŠTRUC, Vitomir. Exploiting spatio-temporal information for light-plane labeling in depth-image sensors using probabilistic graphical models. Informatica, ISSN 0868-4952, 2016, vol. 27, no. 1, str. 67-84
- MACAULAY, Calum E., GARNER, David, US-KRAŠOVEC, Marija, STROJAN FLEŽAR, Margareta, ŽGANEC, Mario, LAVRENČAK, Jaka, PALČIČ, Branko, FERGUSON, Gary William. A method and a system for detection of malignancy-associated changes : EP 1532573 (B1), 2008-10-15. München: European Patent Office, 2008.
- PAVEŠIČ, Nikola, KOVAČIČ, Stanislav, ŽGANEC, Mario. Laboratory stereoscopic system : calibration, matching and error analysis. V: HORVAT, Bogomir (ur.), KAČIČ, Zdravko (ur.). Modern modes of man-machine communication : proceedings. Maribor: Univerza Maribor, 1994, str. 9-1 - 9-15
- VOLKOV, Alexey, ŽGANEC GROS, Jerneja, ŽGANEC, Mario, JAVORNIK, Tomaž, ŠVIGELJ, Aleš. Design of spreading-codes-assisted active imaging system. International journal of advanced robotic systems, ISSN 1729-8814, 2015, vol. 12, str. 80-1-80-8
- VOLKOV, Alexey, ŽGANEC GROS, Jerneja, ŽGANEC, Mario, JAVORNIK, Tomaž, ŠVIGELJ, Aleš. Modulated acquisition of spatial distortion maps. Sensors, ISSN 1424-8220, 2013, vol. 13, no. 8, str. 11069-11084,
- ŽGANEC, Mario, BABIČ, Ankica, US-KRAŠOVEC, Marija, PALČIČ, Branko. 3D presentation of the nuclear cell features in quantitative cytometry. V: CIMINO, James J. (ur.). Beyond the superhighway: exploiting the Internet with medical informatics : proceedings, 1996 AMIA Annual Fall Symposium, October 26-30, 1996, Washington, DC, (Journal of the American Medical Informatics Association, ISSN 1067-5027, Symposium supplement). Philadelphia: Hanley & Belfus, cop. 1996, str. 679-683
- ŽGANEC, Mario, ČERNE, Tomaž, ŽGANEC GROS, Jerneja. SmartPARK - sistem za samodejno prepoznavo vozil. V: MOHORČIČ, Mihael (ur.), ROBNIK, Ana (ur.), BAŠKOVČ, Dalibor (ur.). Delavnica Pametna mesta in skupnosti kot razvojna priložnost Slovenije : zbornik 18. mednarodne multikonference Informacijska družba - IS 2015, 12. oktober 2015, Ljubljana, Slovenia: Institut Jožef Stefan, 2015, str. 113-114,
- ŽGANEC, Mario, KRIŽAJ, Janez, ŽGANEC GROS, Jerneja, ŠTRUC, Vitomir. Method and device for depth imaging : SI24755 (A) - 2015-12-31. Ljubljana: Urad RS za intelektualno lastnino, 2015.
- ŽGANEC, Mario, LAVRENČAK, Jaka, BABIČ, Ankica, US-KRAŠOVEC, Marija. Detection of compact low-chromation areas in cell nuclei images. V: CESNIK, Branko (ur.), MCCRAY, Alexa (ur.), SCHERRER, Jean-Raoul (ur.). MEDINFO '98 : proceedings of the Ninth World Congress on Medical Informatics, (Studies in health technology and informatics, vol. 52). Amsterdam [etc.]: IOS Press, cop. 1998, part 2, str. 1017-1021
- ŽGANEC, Mario, PAVEŠIČ, Nikola, KOVAČIČ, Stanislav. Stereo-matching by dynamic programming. V: PAVEŠIČ, Nikola (ur.), NIEMANN, Heinrich (ur.), PAULUS, Dietrich (ur.). Image processing and stereo analysis : proceedings of the Slovenian-German workshop, Erlangen, December 3, 1992, (Arbeitsberichte des Instituts für Mathematische Maschinen und Datenverarbeitung (Informatik), ISSN 0344-3515, Bd. 26, Nr. 1). Erlangen: Institut für Mathematische Maschinen und Datenverarbeitung (Informatik), 1993, str. 37-51
- ŽGANEC, Mario, ŽGANEC GROS, Jerneja. Active 3D triangulation-based imaging method and device : patent : EP 1997322 (B1), 2011-12-28. München; Haag; Viena: European Patent Office, 2011.
- ŽGANEC, Mario, ŽGANEC GROS, Jerneja. Postopek in oprema za nadziranje ustreznosti geometrije cevastega predmeta : SI24725 (A) - 2015-11-30. Ljubljana: Urad RS za intelektualno lastnino, 2015. 14 str
- ŽGANEC, Mario, ŽGANEC GROS, Jerneja. Postopek komuniciranja v sistemu za telefonijo po internetnem protokolu (IP) z IP - telefoni in sistem za takšno telefonijo : patent : 20499 (A), 2001-08-31. Ljubljana: Urad RS za intelektualno lastnino, 2001

- ŽGANEC, Mario. Modul periferne enote večnivojskega procesnega sistema : delo je pripravljeno po razpisu odbora za Prešernove nagrade študentom za leto 1989, št. teme 25, pod mentorstvom prof. dr. Petra Šuhla dipl. ing. in komentorstvom asistenta Romana Blenkuša dipl. ing.. Ljubljana: [M. Žganec], 1989.