

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Ambientalna inteligenca
Course title:	Ambient Intelligence

Študijski program in stopnja Study programme and level	Modul Module	Letnik Academic year	Semester Semester
Informacijske in komunikacijske tehnologije, 3. stopnja	Inteligentni sistemi in robotika	1	1
Information and Communication Technologies, 3 rd cycle	Intelligent Systems and Robotics	1	1

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: IKT3-626

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Druge oblike	Samost. delo Individ. work	ECTS
15	15			15	105	5

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer: Prof. dr. Matjaž Gams

Jeziki / Predavanja / Lectures: slovenščina, angleščina / Slovenian, English
Languages: Vaje / Tutorial:

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

Zaključen študij druge stopnje s področja informacijskih ali komunikacijskih tehnologij ali zaključen študij druge stopnje na drugih področjih z znanjem osnov s področja predmeta. Potrebna so tudi osnovna znanja matematike, računalništva in informatike.

Prerequisites:

Completed second cycle studies in information or communication technologies or completed second cycle studies in other fields with knowledge of fundamentals in the field of this course. Basic knowledge of mathematics, computer science and informatics is also requested.

Vsebina:

Uvod:
 definicija, vizija in izzivi ambientalne inteligence; strojna in programska podlaga – pogoste vrste senzorjev in drugih naprav, vmesna programska oprema, vgrajeni sistemi
 Uporaba senzorjev na telesu:
 sinhronizacija, filtriranje in združevanje senzorskih podatkov; interpretacija z drsečim oknom in strojnimi učenjem ali pravili;

Content (Syllabus outline):

Introduction:
 definition, vision and challenges of ambient intelligence; hardware and software foundation – common sensors and other devices, middleware and embedded systems
 Use of wearable sensors:
 synchronisation, filtering and fusion of sensor data; interpretation with a sliding window and machine learning; using context and adapting to

upoštevanje konteksta in prilagajanje uporabnikom

Pametni prostori:
računalniški vid, sklepanje v času in verjetnostno sklepanje za potrebe ambientalne inteligence

Interakcija z uporabniki:
inovativne vhodno-izhodne naprave, uporaba metafor v uporabniških vmesnikih, načela snovanja interakcije z uporabniki v ambientalni inteligenci

Značilne aplikacije ambientalne inteligence:
prepoznavanje aktivnosti, zaznavanje padcev, analiza razpoloženja uporabnikov, zaznavanje nenavadnega obnašanja, spremljanje kroničnih bolnikov, udobje in varčevanje z energijo v pametnih stavbah

individual users

Smart environments:
computer vision, temporal and probabilistic reasoning for ambient intelligence

User interaction:
innovative input/output devices, the use of metaphors in user interfaces, the principles of designing user interaction in ambient intelligence

Representative applications of ambient intelligence:
activity recognition, fall detection, mood analysis, detection of unusual behaviour, monitoring of chronic patients, comfort and energy saving in smart buildings

Temeljna literatura in viri / Readings:

Izbrana poglavja iz naslednjih knjig: / Selected chapters from the following books:

- H. Nakashima, H. Aghajan, and J. C. Augusto, *Handbook of Ambient Intelligence and Smart Environments*. Springer, 2010. ISBN 978-0-387-93807-3
- M. Kuniavsky, *Smart Things: Ubiquitous Computing User Experience Design*. Morgan Kaufmann, 2010. ISBN 978-0-12-374899-7
- J. C. Augusto, M. Huch, A. Kameas, J. Maitland, P. J. McCullagh, J. Roberts, A. Sixsmith, and R. Wichert, *Handbook of Ambient Assisted Living: Technology for Healthcare, Rehabilitation and Well-being*. IOS Press, 2012. ISBN 978-1-60750-836-6

Cilji in kompetence:

Cilj predmeta je seznaniti študenta s področjem ambientalne inteligence in vseprisotnega računalništva. Poudarek bo na inteligentnih algoritmih za interpretacijo podatkov iz senzorjev in ukrepanju na podlagi take interpretacije. Bo pa predmet obravnaval vse glavne vidike ambientalne inteligence, od strojne in nizkonivojske programske opreme do interakcije z uporabniki.

Študenti, ki bodo uspešno končali ta predmet, bodo razumeli smoter ambientalne inteligence in bodo sposobni zasnovati in razviti aplikacije ambientalne inteligence.

Objectives and competences:

The objective of the course is to familiarize the student with the field of ambient intelligence and ubiquitous computing. The focus will be on intelligent algorithms for the interpretation of sensor data and acting upon such interpretation. However, the course will address all the key topics of ambient intelligence, from hardware and low-level software to user interaction.

The students who will successfully complete this course will grasp the purpose of ambient intelligence and will be able to design and develop ambient-intelligence applications.

Predvideni študijski rezultati:

Študenti bodo z uspešno opravljenimi obveznostmi tega predmeta pridobili:

- razumevanje pojma ambientalne inteligence, njenih zmožnosti in omejitev
- poznavanje temeljnih tehnologij ambientalne

Intended learning outcomes:

Students successfully completing this course will acquire:

- Understanding of the concept of ambient intelligence, its capabilities and limitations
- Knowledge of the fundamental technologies of

intelligence in njihove primernosti za različne aplikacije

- poznavanje širokega nabora algoritmov za interpretacijo senzorskih podatkov in ukrepanje na podlagi take interpretacije ter sposobnost izbire primernih algoritmov za dano aplikacijo
- spodobnost zasnove primerne uporabniškega vmesnika za aplikacije ambientalne inteligence

ambient intelligence and their suitability for various applications

- Knowledge of a wide range of intelligent algorithms for the interpretation of sensor data and acting upon such interpretations, and the ability to select algorithms suitable for a given application
- The ability to design an appropriate user interface for an ambient-intelligence application

Metode poučevanja in učenja:

Predavanja, seminar, konzultacije, individualno delo

Learning and teaching methods:

Lectures, seminar, consultancy, individual work

Delež (v %) /

Weight (in %)

Assessment:

Načini ocenjevanja:

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminarska naloga	50 %	Seminar work
Ustni zagovor seminarske naloge	50 %	Oral defense of seminar work

Reference nosilca / Lecturer's references:

- D. Zupančič, **M. Luštrek**, and **M. Gams**, "Multi-agent architecture for control of heating and cooling in a residential space," *The Computer Journal*, v tisku / in press, 2015.
- H. Gjoreski, S. Kozina, **M. Gams**, **M. Luštrek**, J. A. Álvarez-García, J.-H. Hong, J. Ramos, A. K. Dey, M. Bocca, and N. Patwari, "Competitive live evaluations of activity-recognition systems," *IEEE Pervasive Computing*, vol. 14, no. 1, pp. 70-77, 2015.
- H. Gjoreski, **M. Gams**, and **M. Luštrek**, "Context-based fall detection and activity recognition using inertial and location sensors," *Journal of Ambient Intelligence and Smart Environments*, vol. 6, no. 4, pp. 419-433, 2014.
- S. Kozina, H. Gjoreski, **M. Gams**, and **M. Luštrek**, "Three-layer activity recognition combining domain knowledge and meta-classification," *Journal of Medical and Biological Engineering*, vol. 33, no. 4, 2013.
- H. Gjoreski, B. Kaluža, **M. Gams**, R. Milić, and **M. Luštrek**, "Ensembles of multiple sensors for human energy expenditure estimation," *Proceedings of ACM International Joint Conference on Pervasive and Ubiquitous Computing*, 2013.