

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: ZGODNJE UČENJE ROBOTIKE
Course title: Early learning of robotics

Vrsta predmeta / Course type

D - Splošni izbirni predmet

Univerzitetna koda predmeta / University course code:

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Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	15	0	15	0	60	4

Nosilec predmeta / Lecturer:

prof. dr. Slavko Kocijančič

doc. dr. David Rihtaršič

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

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

Priporočene so spretnosti iz uporabe IKT.

Prerequisites:

Skills about using ICT are recommended.

Vsebina:

1. Kaj je robotika, področja v robotiki, vloga robotike za izobraževanje.
2. Odprta elektronska okolja primerna za učenje robotike (npr. Arduino, Raspberry Pie, itd).
3. Delovanje osnovnih vhodnih in izhodnih funkcij robotskega krmilnika s primeri uporabe.
4. Pregled različnih programskih okolij namenjenih šolskim projektom iz robotike.
5. Uporaba analogno digitalnega in digitalno analognega pretvornika.
6. Krmiljenje različnih motorjev in drugih močnostnih sistemov.
7. Pregled osnovnih elektronskih merilnikov (senzorjev) pomembnih za robotiko.
8. Programska zanka s povratnim delovanjem med merjenjem in krmiljenjem.
9. Komunikacijski protokoli med robotskimi sistemi.
10. Sestavljanje modelov programirljivih naprav (npr. mobilni robot, zapornica...) v povezavi s krmilnikom, programiranje delovanja.
11. Načrtovanje, izvedba in dokumentiranje projekta iz robotike.
12. Pomen robotike pri motivaciji mladih za naravoslovje in tehniko, tekmovanja iz robotike.

Content (Syllabus outline):

1. What is robotics, branches of robotics, the role of robotics in education.
2. Open electronic platforms suitable for learning robotics (eg Arduino, raspberry, etc.).
3. Operation of the basic input and output functions of the robot controller with examples of use.
4. An overview of the various programming environments for school projects on robotics.
5. Using analogue to digital in digital to analogue conversion.
6. Controlling various motors and other power systems.
7. A review of basic electronic sensors important for robotics.
8. S-R-A loop (sensing - reasoning - acting loop).
9. Communication protocols between robotic systems.
10. Assembly of programming devices (for example, mobile robot, lockable ...) in conjunction with the controller, programming of operation.
11. Planning, implementation and documentation of the project from robotics.
12. The importance of robotics in motivating

13. Robotika kot izhodišče integriranega pristopa k poučevanju naravoslovja, tehnike in matematike.

young people for science in technology, robotics competitions.

13. Robotics as the starting point for an integrated approach to teaching science, technology, engineering and math (STEM).

Temeljni literatura in viri / Readings:

1. KOCIJANČIČ, S. (2016), Robotika, e gradivo, <http://www.pef.uni-lj.si/slavkok/studgrad/Robotika2016.pdf>

2. RIHTARŠIČ, D. (2018), Robotika v tehniki, <https://sites.google.com/site/drtirobotika/izobrazevanje/arduino/robotika-v-tehniki/freewhellyarduino>

Prostodostopni opisi projektov iz robotike, na primer: /Freely accesible robot project descriptions, such as:

1. 155 robot projects, <https://create.arduino.cc/projecthub/projects/tags/robot>

2. Arduino robotics projects, <https://circuitdigest.com/arduino-robotics-projects>

Didaktični članki o robotiki, na primer: /Educational papers on robotics, for example:

1. Lai Poh Emily Toh et al, A Review on the Use of Robots in Education and Young Children, Journal of Educational Technology & Society, Vol. 19 (2016), No. 2, pp 148 – 163

2. ChanMin Kim et al, Studying the Usability of an Intervention to Promote Teachers' Use of Robotics in STEM Education, Journal of Educational Computing Research (2017)

Cilji in kompetence:

1. Sposobnost komuniciranja, sodelovalno/timsko delo.

2. Sintetično, analitično, ustvarjalno mišljenje ter reševanje problemov.

3. Fleksibilna uporaba znanja v praksi.

4. Uporaba informacijsko-komunikacijske tehnologije v vzgoji in izobraževanju.

5. Interdisciplinarno povezovanje vsebin.

6. Poznavanje, razumevanje in apliciranje osnovnih matematičnih konceptov in teorij.

7. Obravnavanje matematičnih problemov (abstrahiranje konkretne situacije, poznavanje strategij, kritičnost pri obravnavi ipd.) in povezovanje matematike z drugimi področji človekovega delovanja.

8. Poznavanje in razumevanje temeljnih naravoslovno - tehniških konceptov in njihova uporaba pri razlagi tehničnih pojavov in dogajanj v okolju.

9. Obvladanje različnih učnih metod in oblik dela s pomočjo multimedijske tehnologije ter uporaba IKT na različnih tehniških področjih.

10. Usposobljenost za načrtovanje, izvedbo in preskus elektronskih vezij ter razumevanje njihovega delovanja.

11. Razumevanje in razčlenitev strojnih elementov v strojih in napravah ter poznavanje delovnih principov in funkcij komponent ter izdelovalnih tehnologij.

Objectives and competences:

1. Communicative competence, collaborative/team work.

2. Synthetical, analytical, and creative thinking and problem solving

3. Flexible application of knowledge in the practice.

4. Application of information and communication technology in education.

5. Interdisciplinary subject matter linking.

6. To understand and apply basic mathematical concepts in theory.

7. To understand mathematical problems (abstracting a concrete situation, knowing strategies, critical assessment etc.) and relate Mathematics to other fields of human activities.

8. Knowing and understanding basic natural science - technology concepts and their using at explaining technical phenomena and events in the environment.

9. Knowing different teaching methods, teaching forms and strategies with the help of multimedia and information and communication technologies at different areas of technology education.

10. Ability to design, assemble and test electronic circuit and understanding of its operation.

11. Understanding and analyzing of machine elements in machines and devices and knowing operational principles and functions of their

12. Izdelava računalniških programov namenjenih podpori delovanja elektronskega vezja ali naprave.

components and constructing technologies.

12. Designing computer programmes to support the operation of the electronics circuit or a machine.

Predvideni študijski rezultati:

Znanje in razumevanje:

1. definira strokovni pomen termina "robotika" in utemelji pomen robotike za izobraževanje;
2. našteje in opredeli osnovne funkcije robotskega krmilnika;
3. razčleni izhodne funkcije krmilnika in navede primere uporabe;
4. razčleni vhodne funkcije krmilnika in navede primere uporabe;
5. primerja različna programska okolja primerna za šolske projekte iz robotike glede na in uporabniški vmesnik;
6. pozna možnosti robotike pri motiviranju mladih za tehniko.

Uporaba:

1. načrtuje, sestavi in preskusi modele robotov;
2. načrtuje, sestavi in preskusi elektronske merilnike in jih uporabi v povezavi s krmilnikom;
3. za rešitev projektne s področja robotike načrtuje ustrezno rešitev, jo izvede, preskusi in dokumentira.

Refleksija:

1. vrednoti projekt iz robotike glede na umestitev v projektno učno delo učencev v OŠ in SŠ;
2. primerja profesionalno robotiko z robotiko v šolskem laboratoriju.

Prenosljive spretnosti:

1. uporablja IKT, predstavitev projektne naloge na svetovnem spletu;
2. načrtuje, izvede, dokumentira in strokovno poroča o reševanju zastavljene projektne učne naloge;
3. je sposoben/na za sistematično izpeljavo projekta od operativne definicije naloge do končnega izdelka;
4. praktično izpelje projektno učno nalogo s prepletanjem sintetičnih in analitičnih metod dela;
5. je sposoben/na interdisciplinarnega pristopa do obravnavane teme oz. problematike.

Intended learning outcomes:

Knowledge and Understanding:

1. define the professional meaning of the term "robotics" and justifies the importance of robotics for education;
2. quote and determine the basic functions of the robot controller;
3. analyse the output functions of the controller and provides examples of use;
4. analyse the input functions of the controller and provides examples of use;
5. compare the different programme environments suitable for school robotics projects by and on the user interface;
6. know the possibilities of robotics in motivating young people for the technique.

Application:

1. design, assembles and tests robot models;
2. design, assembles and tests electronic meters and uses them in conjunction with the controller;
3. plans a suitable solution to solve the robotic design project, perform it, test it and document it.

Reflection:

1. evaluates the project based on robotics with respect of implementation in primary and secondary education;
2. compares the professional robotics with the robotics in the school laboratory.

Transferable skills:

1. use of ICT to present the project task on-line;
2. design, perform, document and report about given learning tasks related to robotics;
3. being capable for systematic implementation of the project operational definition to the finished technical model;
4. carry out practical project learning task combining synthetic and analytical working methods;
5. capable to implement interdisciplinary approach to given topics or issues.

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Metode poučevanja in učenja:

1. Predavanja, laboratorijske vaje, problemsko učenje, projektno delo.
2. Laboratorijske vaje se izvajajo v učilnici z računalniki in ustreznimi zbirkami za izpeljavo projektov iz robotike primernih za učence osnovnih in srednjih šol.

Learning and teaching methods:

1. Lectures, lab work, problem learning, project work.
2. Laboratory exercises are carried out in a classroom with computers and appropriate kits for carrying out robotics projects suitable for elementary and secondary schools.

Načini ocenjevanja:

**Delež (v %) /
Weight (in %)**

Assessment:

Ustni zagovor.	50	Oral interview.
Izvedba projekta s predstavitvijo.	30	Performing and presenting a project.
Samostojna izvedba laboratorijskih vaj v obsegu najmanj 80 %.	20	Autonomous execution of at least 80 % of laboratory exercises.
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Reference nosilca / Lecturer's references:

prof. dr. Slavko Kocijančič:

1. RIHTARŠIČ, David, AVSEC, Stanislav, KOCIJANČIČ, Slavko. Experiential learning of electronics subject matter in middle school robotics courses. International journal of technology and design education, ISSN 1573-1804, 2016, vol. 26, no. 2, str. 205-224
2. AVSEC, Stanislav, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. A predictive study of learner attitudes toward open learning in a robotics class. Journal of science education and technology, ISSN 1573-1839, 2014, vol. 23, no. 5, str. 692-704.
3. RIHTARŠIČ, David, KOCIJANČIČ, Slavko. The role of equipment and accessories in the early teaching of robotics. World transactions on engineering and technology education, ISSN 1446-2257, 2012, vol. 10, no. 1, str. 29-34
4. AVSEC, Stanislav, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. The impact of robotics-enhanced approach on students' satisfaction in open learning environment. International journal of engineering education, ISSN 0949-149X, 2016, vol. 32, no. 2(A), str. 804-817
5. AVSEC, Stanislav, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. Students' satisfaction with an INFIRO robotic direct manipulation learning environment. World transactions on engineering and technology education
6. ŠANTEJ, Gorazd, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. School activity days : electronics workshop. Journal of Technology and Information Education, ISSN 1803-6805, 2013, vol 5, no. 2, str. 206-209.
7. SUSMAN, Katarina, RIHTARŠIČ, David. How to observe electric current and resistance?. V: ZIHERL, Saša (ur.). Book of abstracts. Ljubljana: Faculty of Education, 2015. Str. 50. ISBN 978-961-253-168-3.
8. RIHTARŠIČ, David, AVSEC, Stanislav, KOCIJANČIČ, Slavko. Experiential learning of electronics subject matter in middle school robotics courses. International journal of technology and design education. 2016, vol. 26, no. 2, str. 205-224.
9. AVSEC, Stanislav, RIHTARŠIČ, David, KOCIJANČIČ, Slavko. The impact of robotics-enhanced approach on students' satisfaction in open learning environment. International journal of engineering education. 2016, vol. 32, no. 2(a), str. 804-817
10. RIHTARŠIČ, David. Model poučevanja elektronike, programiranja in mehanike v robotiki za mladostnike : doktorska disertacija. Ljubljana: [D. Rihtaršič], 2017. XII, 218 str.
11. RIHTARŠIČ, David. Using an Arduino-based low-cost DAQ in science teacher training. World transactions on engineering and technology education. 2018, vol. 16, no. 4, str. 380-385.

doc. dr. David Rihtaršič:

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