GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical basis of microcontroller measurement systems, PG_00051072		
Field of study	Technical Physics		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Optional subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Fizyki Teoretycznej i Informatyki Kwantowej -> Instytut Fizyki i Informatyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Syty	
	Teachers	dr inż. Paweł Syty	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	30.0	0.0	45

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	5.0	25.0	75

Subject objectives

The aim of the course is to familiarize students with the structure and basic methods of designing and programming simple embedded systems based on microcontrollers, i.e. specialized IT systems responsible for performing strictly defined tasks - mainly related to monitoring and control. The physical basis of the functioning of sensors (receptors) and actuators (effectors / actuators) as the basic components of this type of systems will be discussed.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U05	The student is able to design, build and program simple, specialized embedded systems based on selected microcontrollers.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
K6_U06	The student is able to estimate the technical and economic feasibility of building an embedded system.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
K6_W06	The student is able to describe the functioning of an embedded system on the basis of electronics.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K6_W02	The student is able to explain the physics of the functioning of selected electronic components (receptors and effectors) used in embedded systems.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

<table>
<tr><td>Subject contents</td><td>1. Rodzina płytek Arduino. Części składowe Arduino Uno. Wejścia/wyjścia cyfrowe. Wejścia analogowe.
2. Modelowanie systemów czasu rzeczywistego.
3. Arduino Software / IDE. Pierwszy program (szkic).
4. Omówienie języka Arduino jako podzbioru języka C++.
5. Prezentacja sprzętu (różne układy Arduino, różne wersje Raspberry Pi, ESP8266 i jego odmiany, STM32).
6. Sensory - receptory, efektory, programatory, wyświetlacze itp.). Podstawy fizyczne funkcjonowania.
7. Rezystor PULL UP. Interfejsy: szeregowy (Serial; TX/RX), SPI (Serial Peripheral Interface; MOSI / MISO / SCK / SS), I2C (SDA / SCL).
8. Transmisja NFC/RFID. System przerwań. Sterowniki silników.
9. Metody oszczędzania energii.
10. Internet rzeczy. Mikrokontrolery z obsługą WiFi - ESP8266 oraz WiFi/Bluetooth - ESP32.
11. Płytki deweloperskie. Programowanie klienta / serwera WiFi.
12. Komputer jednoukładowy Raspberry Pi. Modele, systemy operacyjne, kamera.
13. Raspberry Pi - obsługa GPIO (w tym remote GPIO).
14. Język MicroPython.
15. Systemy automatyki domowej.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of programming
Basic knowledge of electronics</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Completion of the project</td><td>50.0%</td><td>80.0%</td></tr>
<tr><td>Passing the theoretical part</td><td>50.0%</td><td>20.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Michael J. McGrathCliodhna Ní Scanaill, Sensor Technologies. Healthcare, Wellness, and Environmental Applications. Apress, 2013
Andy King, Programming the Internet of Things. O'Reilly Media, 2021
Vedat Ozan Oner, Developing IoT Projects with ESP32. Packt Publishing, 2021</td></tr>
<tr><td>Supplementary literature</td><td>Husan Mahey, Robotic Process Automation with Automation Anywhere. Packt Publishing, 2020</td></tr>
<tr><td>eResources addresses</td><td>Uzupełniające
Adresy na platformie eNauczanie:
Fizyczne podstawy mikrokontrolerowych układów pomiarowych (2023/2023) - Moodle ID: 29167
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29167</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>- Internet radio with remote control (Raspberry Pi + WiFi + remote control / infrared sensor / Python)
- room access control system (Arduino + RFID / C ++) weather station with reporting on the website (Arduino + selected sensors + ESP8266 / C ++)
- room monitoring with reporting on the website (Arduino + selected sensors + ESP8266 / C ++)
- wheeled self-propelled robot (Arduino + distance and obstacle sensors + robot platform with motors and wheels / C ++)
- home automation (Arduino or Raspberry Pi + sensors + effectors / C ++ or Python)
- webcam with object recognition (Raspberry Pi + camera / Python + OpenCV library)</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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