#### card of course

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| Subject name | Internet of Things |

1. The placement of the subject in the study system

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| 1.1. Field of study | Computer science |
| 1.2. Form and path of study | Full-time/Part-time |
| 1.3. Level of education | First-cycle studies |
| 1.4. Study profile | Practical |

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| --- | --- |
| 1. 5. Specialty | Cybersecurity and computer forensics |
| 1.6. Subject Coordinator | Dr inż. Tomasz Giżewski, Dr inż. Mateusz Górka |

2. General characteristics of the subject

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| --- | --- |
| 2.1. Belonging to a subject group | Optional/practical |
| 2.2. Number of ECTS | 5 |
| 2.3. Language of lectures | English |
| 2.4. Semesters in which the subject is taught | V |
| 2.5.Criteria for selecting course participants | For specializations: Cybersecurity and computer forensics |

1. Learning outcomes and course delivery
   1. Subject Objectives

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| --- | --- |
| No. | Subject Objectives |
|
| C1 | Introduction to key concepts and main issues of the Internet of Things. |
| C2 | Familiarization with the methods of functioning of the Internet of Things. |
| C3 | Discussing basic aspects of the functioning of the Internet of Things. |

* 1. Subject-specific learning outcomes, divided into knowledge , skills and competences , with reference to the directional learning outcomes

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| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Description of subject  learning outcomes** | **Reference to  directional effects**  **learning (symbols)** | **Method of implementation (mark "X")** | | | |
| **ST** | | **NST** | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| After passing the course, the student knows and understands **the knowledge** | | | | | | |
| W1 | Architecture of the Internet of Things. | INF\_W05  INF\_W14 |  | X |  | X |
| W2 | Technologies used in the Internet of Things. |  | X |  | X |
| W3 | Practical examples of Internet of Things implementation. |  | X |  | X |
| After passing the course, the student is **able** to: | | | | | | |
| U1 | Characterize the architecture of the Internet of Things. | INF\_U03 INF\_U05 INF\_U08 INF\_U22 INF\_U23 INF\_U27 | X |  | X |  |
| U2 | Describe, critically analyze, and evaluate specific Internet of Things technology solutions. | X |  | X |  |
| U3 | Design and create solutions in the field of the Internet of Things. | X |  | X |  |
| After completing the course, the student is ready to take part in **social competences.** | | | | | | |
| K1 | Understanding the need for continuous improvement of knowledge in the field of computer science. | INF\_K01 | X |  | X |  |

3.3. Forms of teaching and their number of hours - Full-time studies (ST), Part-time studies (NST), Part-time PUW studies (NST PUW)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Path | Lecture | Exercises | Design | Workshop | Laboratory | Seminar | Lecturer | Classes conducted using distance learning methods and techniques in the form of a lecture | Other | **ECTS points** |
| **ST** |  |  |  |  | 30 |  |  | 20 |  | 5 |
| **NST** |  |  |  |  | 15 |  |  | 10 |  | 5 |

3.4. Content of education (separately for each form of classes: (W, ĆW, PROJ, WAR, LAB, LEK, OTHER). It should be marked (X) how the given content will be implemented (classes at the university or classes on the e-learning platform conducted using distance learning methods and techniques)

TYPE OF CLASS: LECTURE

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | The concept of the Internet of Things | W1 |  | X |  | X |
| 2. | Elements of the Internet of Things | W1 |  | X |  | X |
| 3. | Miniaturization of things: nanotechnology. | W1, W3 |  | X |  | X |
| 4. | Smart Things: Appliances, Cars. Wearable Technology. | W2, W3 |  | X |  | X |
| 5. | Smart homes, offices, cities. | W3 |  | X |  | X |
| 6. | Applications. | W3 |  | X |  | X |
| 7. | Communication between person and thing, thing and person, thing and thing, communication between objects and people in motion. | W2 |  | X |  | X |
| 8. | Internet of Things Infrastructure. | W2 |  | X |  | X |
| 9. | IoT wireless technologies. | W2 |  | X |  | X |
| 10. | Use of wireless networks in the Internet of Things: personal, radio, sensor, individual. Ad-hoc networks. | W3 |  | X |  | X |
| 11. | IoT Threats. | W3 |  | X |  | X |
| 12. | Ethical aspects. | W3 |  | X |  | X |
| 13. | Summary of classes and discussion of grades. |  |  | X |  | X |

TYPE OF CLASS: LABORATORY

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Learning and using elements of the Internet of Things. | U1, | X |  | X |  |
| 2. | Practical use of smart things. | U1, | X |  | X |  |
| 3 | Designing intelligent systems. | U1, | X |  | X |  |
| 4. | Conducting human-thing, thing-human, thing-thing communication, communication of objects and people in motion. | U2 | X |  | X |  |
| 5. | Designing solutions for IoT wireless technologies | U3 | X |  | X |  |
| 6. | Handling IoT threats and how to prevent them | U2, K1 | X |  | X |  |
| 7. | Use of IoT security elements. | U2, K1 | X |  | X |  |
| 8. | Summary of classes and discussion of grades. |  | X |  | X |  |

3.5. Methods of verifying learning outcomes (indication and description of methods of conducting classes and verification of achievement of learning outcomes and method of documentation)

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| --- | --- | --- | --- |
| Subject Effects | Teaching methods | Methods of verifying learning outcomes | Documentation methods |
| KNOWLEDGE | | | |
| W1-W3 | informative lecture with the use of multimedia conversational lecture | Lecture credit: Exam - test containing a set of 20 questions  Score 3: 11 – 12 points  Rating 3.5: 13 – 14 points  Score 4: 15 – 16 points  Rating 4.5: 17 – 18 points  Score 5: 19 – 20 points | graded test sheet |
| SKILLS | | | |
| U1-U3 | situation simulations, project work, analysis of materials/articles/films/documents, performing exercises, group work | Execution of the task - project together with the characteristics of the solution in the field of the Internet of Things | assessed work |
| SOCIAL COMPETENCES | | | |
| K1 | working on a team project, doing exercises, working in a group | Execution of the task - project together with the characteristics of the solution in the field of the Internet of Things | assessed work |

3.6. Assessment criteria for the achieved learning outcomes

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| --- | --- | --- | --- | --- | --- |
| Learning effect | For a grade of 3 or "pass."  the student knows and understands/is able to/is ready to | For a grade of 3.5, the student knows and understands/is able to/is ready to | For a grade of 4, the student knows and understands/is able to/is ready to | For a grade of 4.5, the student knows and understands/is able to/is ready to | For a grade of 5, the student knows and understands/is able to/is ready to |
| W | 51-60% of knowledge indicated in learning outcomes | 61-70% of knowledge indicated in learning outcomes | 71-80% of knowledge indicated in learning outcomes | 81-90% of knowledge indicated in learning outcomes | 91-100% of knowledge indicated in learning outcomes |
| U | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |
| K | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |

3.7. Literature

**Basic**

1. S. Greengard, "The Internet of Things," MIT Press, Cambridge, MA, USA, 2015. https://direct.mit.edu/books/book/4051/The-Internet-of-Things

2. Marcin Sikorski, Internet rzeczy, Warszawa, Polska: Wydawnictwo Naukowe PWN, 2020.

**Supplementary**

1. Mariusz Duka, Internet rzeczy. Podstawy programowania aplikacji i serwerów sieciowych w językach C/C++, MicroPython i Lua na urządzeniach IoT ESP8266, ESP32 i Arduino, Gliwice, Polska: Wydawnictwo Helion.

4. Student workload - ECTS points balance

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| --- | --- | --- |
| **Types of student activity** | **Student Load** | |
| **ST** | **NST** |
| **Classes requiring direct contact between the student and the academic teacher at the university premises** | **50** | **25** |
| Classes included in the study plan | 50 | 25 |
| **Student's own work** | **75** | **100** |
| Ongoing preparation for classes, preparation of project work/presentations/etc. | 35 | 50 |
| Preparation for passing classes | 40 | 50 |
| **TOTAL STUDENT HOURLY LOAD** | **125** | **125** |
| **Number of ECTS points** | **5** | **5** |

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| Last change date | 30/09/2024 |
| The changes were introduced | INF Education Quality Team |
| The changes were approved | Arkadiusz Gwarda, M.A. |