**EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION**

**STUDY GUIDE**

*INTERNET OF THINGS*

Organised by

*Karlstad University*

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| **1. IDENTIFYING DATA.** | |
| **· Course Name.** | Internet of things |
| **· Coordinating University.** | Karlstad University |
| **· Partner University(ies) Involved.** | N/A |
| **· Course Field(s).** | Computer Science |
| **· Related Study Programme.** | [Master of Science in Industrial Engineering and Management](https://www.kau.se/en/education/programmes-and-courses/programmes/TACIE) |
| **· Course Code.** | DVAD70 |
| **· ISCED Code.** | 0610: Information and Communication Technologies |
| **· SDG.** |  |
| **· Study Level.** | M |

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| **· Number of ECTS credits allocated.** | 7,5 ECTS |
| **· Mode of Delivery.** | Online synchronous |
| **· Language of Instruction.** | English |
| **· Delivery Period.** | Spring semester 2024 |
| **· Course Dates.** | 15 January 2024 to 2 June 2024 |
| **· Precise Schedule of the Lectures.** | TBA (CET) |
| **· Key Words.** | Computer Science, Internet of things |
| **· Catchy Phrase.** | The course covers the Internet of Things, where communication occurs between connected free-standing devices, rather than between humans and machines. |
| **· Link to Course Guide.** | [Internet of Things | Karlstad University (kau.se)](https://www.kau.se/en/education/programmes-and-courses/courses/DVAD70) |

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| **· Prerequisites and co-requisites.** | Upper secondary level English 6 or B, or equivalent. Computer Science 30 ECTS cr, or three years of work experience in the IT sector, or equivalent. |
| **· Number of EUNICE students that can attend the Course.** | *2* |
| **· Course inscription procedure(s).** | Upper secondary level English 6 or B, or equivalent. Computer Science 30 ECTS cr, or three years of work experience in the IT sector, or equivalent. |

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| **2. CONTACT DETAILS.** | |
| **· Department.** | Computer Science |
| **· Name of Lecturer.** | Mohammad Rajiullah |
| **· E-mail.** | mohammad.rajiullah@kau.se |
| **· Office.** | Computer Science |
| **· Other Lecturers.** |  |

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| **3. COURSE CONTENT.** |
| The course covers the Internet of Things, where communication occurs between connected free-standing devices, rather than between humans and machines. The focus of the course is small, resource-saving devices such as sensors for measuring, steering of regulators, and communication between them.  The course begins with an introduction to the field and presents current areas of application. The Internet of Things comprises many different technologies, and the course covers a number of building blocks such as architectures, radio interfaces, and communication protocols. When several devices are connected, a large amount of data is produced and must be handled, and the flow of data is treated from collection to the steering of another device based on collected and analysed data.  An important aspect of connected systems is integrity and security. It is a challenge, especially for resource-constrained devices, to keep software updated and prevent unauthorised use or wiretapping.  For sensors, energy consumption is a significant factor, both in relation to long battery life and in relation to environmental concerns. The course therefore treats the influence of communication interfaces and communication protocols on energy consumption. |

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| **4. LEARNING OUTCOMES.** |
| Upon completion of the course, students should be able to:  1. explain and discuss the Internet of Things as a concept and its typical areas of use,  2. describe the characteristics of different technology alternatives, and based on those characteristics, suitable areas of use,  3. use tools to analyse a data set from sensors,  4. explain how privacy and security can be achieved in the Internet of Things,  5. identify factors that influence energy consumption and discuss how a low level of energy consumption can be achieved, and  6. create a system solution for an IoT application scenario, and justify choices of architecture, components, and other aspects treated in the course. |

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| **5. OBJECTIVES.** |
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| **6. COURSE ORGANISATION.** | |
| **UNITS** | |
| 1. | Areas of application: Health, smart homes, smart cities, industry 4.0 |
| 2. | Infrastructures. Online sensors, gateway connections, mesh networks. Technologies such as NB-IoT, ZigBee, 433MHz, Z-Wave, LoRa, WiFi, Bluetooth, CoAP, MQTT |
| 3. | Data management (collection, storage, processing, analysis, automation, presentation) |
| 4. | Privacy and security (surveillance, behavioural patterns, encryption, firmware updates, attack vectors) |
| 5. | Energy optimisation (10 years of battery life - how can we achieve this? What can influence energy consumption?) |
| **LEARNING RESOURCES AND TOOLS.** | |
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| **PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.** | |
| The course includes practical/laboratory components. Students purchase and pay for the equipment they need. | |

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| **7. ASSESSMENT METHODS AND CRITERIA.** |
| Assessment is based on individual hand-in assignments and an oral exam. |
| **OBSERVATIONS.** |
| One of the grades Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. Engineering students are awarded one of the grades Pass with Distinction (5), Pass with Some Distinction (4), Pass (3) or Fail (U). |

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| **8. BIBLIOGRAPHY AND TEACHING MATERIALS.** |
| The course literature consists of scientific articles and literature made accessible online. |