



Pre-requisites:

 Which year of study is appropriate for your topic?

Year 2 and above


 What background and programming languages are required for your topic?

Python and JavaScript

 What do you think is attractive/unique about your topic?

This topic provides students with a unique opportunity to learn and integrate three important skills of the future economy, namely software engineering, IoT development and machine learning.

Learning content and Teaching

 What will be covered during “trial” lectures?

Topic 1 – Introduction to Artificial Intelligence of Things

- Introduction to Internet of Things (IoT).
- Introduction to Artificial Intelligence (AI).
- Overview of implementing AI with machine learning.
- Artificial Intelligence of Things (AIoT) – The whole is greater than the sum of the parts.

Topic 2 – Single-board Microcontroller (I)

- Overview of single-board microcontrollers.
- Overview of the micro:bit.
- Technical characteristics and features of micro:bit.
- Programming micro:bit with JavaScript.
- Working with micro:bit onboard sensors.
- Working with micro:bit computational and communication capabilities.



What will be covered during the “advanced” seminars?

Topic 3 – Single-board Microcontroller (II)

- Basic electronic component concepts.
- How to work with external peripherals via the micro:bit’s edge connector.
- What is an Analogue to Digital Converter.
- How to write and read analogue and digital values to/from the micro:bit.
- Programming peripherals directly with micro:bit’s pins, and indirectly with edge connector breakout board.

Topic 4 – Single-board Computer (I)

- Overview of the Raspberry Pi single-board computer.
- General purpose programming with Python on Raspberry Pi.
- Basic Raspberry Pi GPIO programming using digital signal (I).

Topic 5 – Single-board Computer (II)

- Basic Raspberry Pi GPIO programming using digital signal (II).
- Basic Raspberry Pi GPIO programming using analogue signal.
- Working with other external devices.
- BLE communication with Raspberry Pi.
- Using Raspberry Pi to control micro:bit devices with BLE and radio.
- Working with Raspberry Pi’s advanced interfaces.

Topic 6 – IoT Backend Integration

- What is Service-Oriented Architecture.
- What is RESTful web service.
- How to create RESTful web service in Python with Flask and Connexion.

Course Information

- How to test RESTful web service in Postman.
- How to consume RESTful web service in Python.
- Persisting the data to a relational database.
- What is Publish-Subscribe messaging architecture.
- What is Message Queuing Telemetry Transport (MQTT).
- What is MQTT broker.
- How to create MQTT publisher and subscriber clients in Python with Eclipse Paho.

Topic 7 – IoT Data Preprocessing

- More about machine learning.
- How to perform basic scientific computing with NumPy.
- How to perform data preparation with Pandas.
- How to perform data visualisation with Matplotlib.

Topic 8 – Machine Learning for IoT Data (I)

- How to perform prediction with regression analysis.
- How to perform prediction with regression that involves categorical independent variables.
- Overview of classification.
- How to perform prediction with heuristic classification.
- How to apply supervised learning to IoT sensor data.

Topic 9 – Machine Learning for IoT Data (II)

- How to perform prediction with probabilistic classification.
- How to perform prediction with separation classification.
- How to perform segmentation with clustering.
- How to apply unsupervised learning to IoT sensor data.

Topic 10 – Machine Learning for IoT Data (III) - Computer Vision

- Introduction to Computer Vision.
- Introduction to Object Detection.
- Object Detection with YOLO and other models.

🐱 What will students be doing for the project work? How do you intend to split students into project groups?

The project involves the conceptualization, design and implementation of a smart AIoT system. The deliverable must demonstrate both elements of IoT and AI.

The group size of the project is 4 students. The project involves IoT hardware development and thus students working on the hardware development will need to meet up physically. The recommended group configuration is 2 students on hardware development, and 2 students on software development and AI.

🐱 Do you have any recommendations for references (books) where students can study to prepare for this topic beforehand?

Students are encouraged to self-learn the Python programming language if they are not familiar with it. Please refer to the official Python tutorial on this website – <https://docs.python.org/3/tutorial/>.

🐱 Apart from a laptop/computer, is there any other equipment/software required for this topic?

The course requires a set of IoT equipment based on micro:bit and Raspberry Pi. This would be issued to each group of students during the workshop. As this course focuses on IoT, it is important for students to hands-on with the IoT hardware. The hardware is also required for the group project.