

81683 - INTERNET OF THINGS (6 cfu)+

91286 - PROJECT WORK IN INTERNET OF THINGS (3 cfu)

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Period: 2° Semester (Feb 2026 – June 2026)



81683 - Internet of Things

- Main objective: to introduce enabling **technologies, protocols, software architectures** and **applications** for the development of the Internet of Things (IoT) paradigm and its **synergy** with AI, BigData, Digital Twin, Web of Things, etc.
- **Introduction to IoT systems:** definitions, applications, enabling technologies
- IoT components: **from sensors to gateway**
 - Embedded Systems Architectures (Arduino, ESP32, ESP8266) and Programming (C/C++/MicroPython) and communications (BLE, IEEE 802.15.4, Z-Wave, etc.), (LoRA, Dash7, Spirit, etc.), (6LoWPAN, RPL), etc.
- IoT components: **from gateway to cloud.**
 - XMPP, CoAP, MQTT, AMQP, WebSocket, cloud/fog/edge computing, IoT Platforms, IoT and BigData (cloud)
- IoT components: **from cloud to applications.**
 - Web of Things and Semantic Web 3.0, Machine learning principles, sensor data analysis, AllJoyn, Google Thing, Apple HomeKit, IoT Platforms (e.g. AWS IoT)
- IoT and **Artificial Intelligence**
 - IoT Data Management and Analytics, Forecasting
 - Edge AI and TinyML
- IoT Open **Issues and bottlenecks.**
 - privacy, security, energy efficiency, scalability, etc.



What will I be able to do at the end of the course?

- to understand the **architectures and methodologies** at the basis of the Internet of Things (IoT) and IoT Platforms
- to **program applications on embedded systems' architectures**, and to exploit **IoT communications**
- to understand **network protocols**, integration of mobile and pervasive **end-devices, middleware** platforms for M2M-based **IoT systems, edge/distributed/gateway** computing principles, new services, **service platforms** and **innovative application** scenarios
- create/exploit **synergy** with Web Of Things, Artificial Intelligence, Machine learning, Big/Open Data, Digital Twin, Mobile Apps, etc.
- Final Exam: Seminar + Project



IoT Prism Lab

Research Lab at University of Bologna

More details here:

<http://iot-prism-lab.nws.cs.unibo.it/>

<https://site.unibo.it/iot/en/teaching-1/the-iot-course>



What will I be able to do at the end of the course?

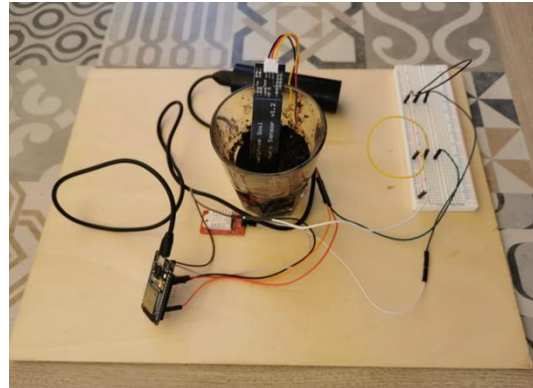
- **Projects** (some more examples in next slides)
 - **Multiprotocol IoT Bridge** Platform (data visualization, storage, bridging)
 - SenSquare: **IoT service middleware**
 - Arrowhead: **toolchain for Industrial IoT** and Service Oriented Architectures
 - **Web of Things** and **Digital Twin**
 - **Mobile Crowdsensing** and Crowdsourcing platforms
 - **Activity recognition** and **context awareness**
 - **Drones** and autonomous systems (e.g. drone swarms)
- **Systems' Design** and frameworks **development and adoption**
- **Thesis** in international Projects and Collaborations
 - e.g. <http://iot-prism-lab.nws.cs.unibo.it/proposals/>
- **PhD programs**, e.g. Computer Science (CS), Data Science (DS), or Structural and Environmental Health Monitoring and Management (SEHM2)



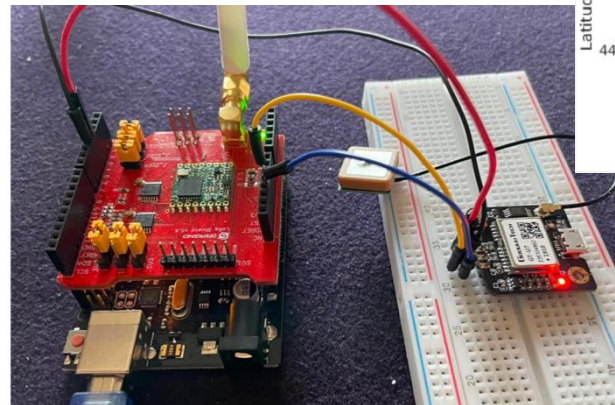
What will I be able to do at the end of the course?



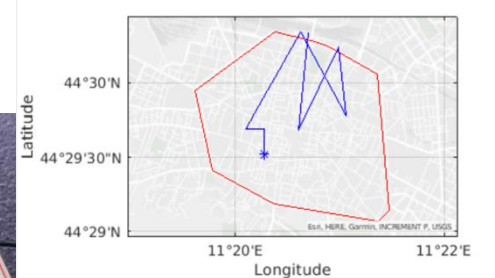
Human Activity Recognition
Edge AI + embedded systems
Author: Alessandro Ghibellini



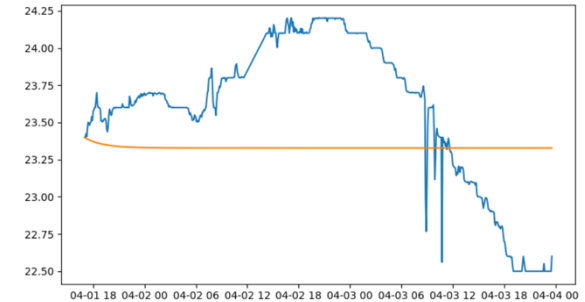
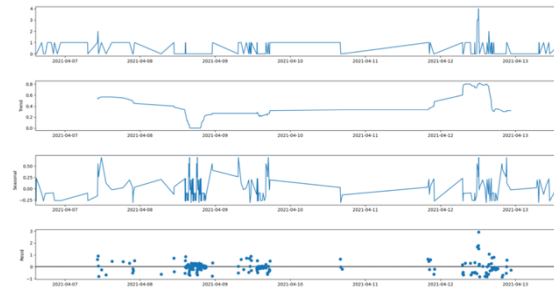
Smart Pot System
Remote monitoring of indoor gardens
Author: Damiano Bellucci



Low-power tracking of bicycles
LoraWAN stack



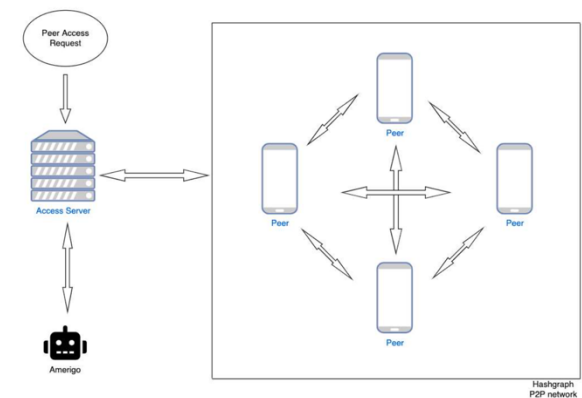
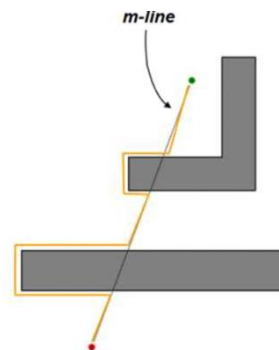
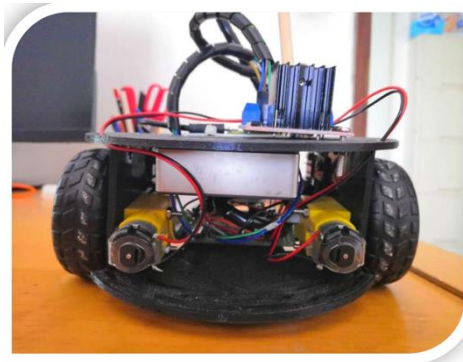
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SafeLab

Access Control and People counter with proximity sensors and the Web of Things

Author: Christian Castiglione



Amerigo

Self—steering, autonomous robot, Block-chain enabled (Hedera Hashgraph)

Author: Bruno Quintero Panaro, Nunzio Maccarrone

What will I be able to do at the end of the course?

Contribution to Research Projects, e.g. MAC4PRO (monitoring of critical infrastructures)



What will I be able to do at the end of the course?

Contribution to Research Projects, e.g. TRACE (monitoring of smart agriculture systems)



Data gathering + AI-based machine learning and predictive analysis

Thank you

Questions?