



ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA

# ***International Summer School on “Smart Objects and Applications”***

***Silvia Mirri** – School Director*

Department of Computer Science and Engineering  
University of Bologna

## How to apply

- Here you can find the call for application:  
[https://www.unibo.it/en/teaching/summer-and-winter-schools/2021/attachments/bando-smart-object\\_en](https://www.unibo.it/en/teaching/summer-and-winter-schools/2021/attachments/bando-smart-object_en)
- Application Deadline: **June 1<sup>th</sup>, 2021, 1:00 p.m.** (Italian Time)
- In order to apply you have to prepare and submit:
  - Your **CV**
  - A ***motivation letter***, explaining why you are interested in attending the summer school and what you are expecting from this experience



## Admitted Students

- From June 07<sup>th</sup>, 2021, the list of admitted students will be available on the Summer School Web page
- Min: 6 students
- Max: 15 students



## How to enroll

- The enrollment procedure is detailed in the Call for application ([https://www.unibo.it/en/teaching/summer-and-winter-schools/2021/attachments/bando-smart-object\\_en](https://www.unibo.it/en/teaching/summer-and-winter-schools/2021/attachments/bando-smart-object_en))
- Enrollment period:  
from June 07<sup>th</sup> to June 11<sup>th</sup>, 2021



## Where

- Online
- The University of Bologna will provide official accounts to all the students, to exploit all the needed tools
- We will use Microsoft Teams, Zoom, to arrange online lectures, labs and remote synchronous support (from tutors) to the project works.



## What

- 6 CFUs (in Computer Science and Engineering)
- 45 hours:
  - Lectures
  - Labs (accessing University of Bologna servers, services, and platforms)
  - Online visit to Fondazione Marconi (seminar, online videos and remote activities)
- Language: English



## Agenda

- Lectures and activities in lab will be scheduled in June 2021, from 15<sup>th</sup> to 28<sup>th</sup>
- Totally: 45 hours



# Agenda

Date	Time	Subject	Prof and Tutor
Tue, June 15th 2021	15:00 – 18:00	Introduction to the Summer School. Smart Environments and Smart Objects	Silvia Mirri
Wed, June 16th 2021	15:00 – 18:00	Smart Sensing and HCI	Silvia Mirri
Wed, June 16th 2021	19:00 – 22:00	Project Works	Silvia Mirri, Roberto Girau
Thu, June 17th 2021	15:00 – 18:00	Data Visualization	Catia Prandi
Thu, June 17th 2021	19:00 – 22:00	Virtual visit to Fondazione Guglielmo Marconi	Silvia Mirri, Roberto Girau
Fri, June 18th 2021	15:00 – 18:00	Data Prediction	Vittorio Maniezzo





# Agenda

Date	Time	Subject	Prof and Tutor
Mon, June 21st 2021	15:00 – 18:00	Security for Smart Objects	Gabriele D'Angelo
Tue, June 22nd 2021	15:00 – 18:00	Project Works	Silvia Mirri, Roberto Girau
Tue, June 22nd 2021	19:00 – 22:00	Project Works	Silvia Mirri, Roberto Girau
Wed, June 23rd 2021	15:00 – 18:00	Project Works	Silvia Mirri, Roberto Girau
Wed, June 23rd 2021	19:00 – 22:00	Project Works	Silvia Mirri, Roberto Girau
Thu, June 24th 2021	15:00 – 18:00	Social connected objects: an overview	Roberto Girau
Thu, June 24th 2021	19:00 – 22:00	Project Works	Silvia Mirri, Roberto Girau
Fri, June 25th 2021	15:00 – 18:00	Project Works	Silvia Mirri, Roberto Girau

# Agenda

Monday 28<sup>th</sup> June 2021

## ***Final exam:***

presentation and discussion of the project works



## Project Work Proposals

Since the School is only online, we will focus the projectworks on the **Smart Applications**

- 10 project proposals
- 3 macro-topics
- 1 project per group
- 2 (or 3) students per group
- Students can provide suggestions (regarding technologies, design issue) that can be agreed with the tutors and professors
- The final examination of the Summer School will be based on the presentation and discussion of the project works



# Project Work Proposals

- Macro-topics:
  - Smart Objects and Applications within a **Smart Campus**
  - Smart Objects and Applications within a **Smart City**
  - Smart Objects and Applications for **Sustainability**



## 1° proposal – Main topic: Smart Campus

- **Title:** Classrooms Manager
- **Areas:** Data visualization, Sensors, HCI
- **Description:** designing/developing a user interface tool, exploiting data visualization strategies, to provide information about the classrooms usage, both for detailed uses (e.g. defining the lectures timetable) and for decision making (classrooms and resource allocation)
- **Technologies:**
  - Map of the Cesena Campus (SVG based)
  - Rgb-d camera to count students (already installed in the Cesena Campus)
  - Current time table in open format



## 2° proposal – Main topic: Smart Campus

- **Title:** Talking Campus
- **Areas:** Sensors, HCI, data visualization
- **Description:** designing/developing a mobile application that interact with ebeacons installed outside classrooms and other public rooms and services (restrooms, reception, canteen) within a smart campus. The app will show details about the lectures within a classroom, the number of students attending a lecture, the office hours for each professor, etc.
- **Technologies:**
  - eBeacons: simulated
  - Current time table in open format
  - Map of the Cesena Campus (SVG based)
  - You can choose between a native app or a hybrid one



### 3° proposal – Main topic: Sustainability

- **Title:** Canarin II Dashboard
- **Areas:** Sensors, data visualization, HCI
- **Description:** designing/developing an app, letting the users interact with a dashboard showing data collected by the Canarin II sensors and the different data it can sense: temperature, relative humidity, PMs, etc. The dashboard should show data of a single Canarin II or of a set of many Canarins II. Data visualization strategies should be adopted.
- **Technologies:**
  - Sensors (already installed): Canarin II sensor
  - Map of the Cesena Campus (SVG based)
  - You can choose between web (responsive for mobile), native or hybrid app



## 4° proposal – Main topic: Sustainability + Smart Campus

- **Title:** Crowdsourcing Garden
- **Areas:** Sensors, data visualization, HCI
- **Description:** designing/developing an app, letting the users interact with a map of the outdoor areas of the Cesena Campus. The app will let the user interact with the environmental data collected by some Canarin II sensors outdoor installed and will show the presence of plants in the Campus garden. The user can share pictures of the plants (including trees) reporting plant diseases and can get information about them, by means of augmented and mixed reality, using repositories. It is possible to simulate the use of QR-codes (or similar labels) on the plants.
- **Technologies:**
  - Sensors (already installed): Canarin II sensor
  - Map of the Cesena Campus (SVG based)
  - You can choose between web (responsive for mobile), native or hybrid app





## 5° proposal – Main topic: Smart Campus + Covid-19 era

- **Title:** Detecting Users' Position Using AR
- **Areas:** HCI, mobile devices, AR
- **Description:** designing/developing an app so as to detect users' position within a lab or a classroom, by using augmented reality. It is necessary to map the laboratory (or the classroom) by using ARKit and ARWorldMap. Then, it is necessary to understand the users' position by using Augmented Reality. Students who choose this project work have to evaluate the system precision.
- **Technologies:**
  - ARKit and ARWorldMap
  - Smart phones
- **Reference:** Chang, Yaohua, Jin Chen, Tyler Franklin, Lei Zhang, Arber Ruci, Hao Tang, and Zhigang Zhu. "Multimodal Information Integration for Indoor Navigation Using a Smartphone." In *2020 IEEE 21st International Conference on Information Reuse and Integration for Data Science (IRI)*, pp. 59-66. IEEE, 2020.



## 6° proposal – Main topic: Smart Campus + Covid-19 era

- **Title:** Detecting Users' Position Using DL
- **Areas:** Mobile devices, deep learning
- **Description:** 1) Students have to create a dataset taking picture of the lab and associating them to the smartphone gyroscope and the x,y position of the lab (they should move in a grid and collect different pictures of all the sides, it would be great to duplicate the dataset using two different smartphones); 2) Using the collected data to train a deep learning model that takes as input the images and the gyroscope data and predicts x and y; 3) Evaluate the MAE (or RMSE)
- **Technologies:**
  - Smart phones
- **Reference:** Section 5.1.2 of Chen, Changhao, Bing Wang, Chris Xiaoxuan Lu, Niki Trigoni, and Andrew Markham. "A survey on deep learning for localization and mapping: Towards the age of spatial machine intelligence." *arXiv preprint arXiv:2006.12567* (2020).



## 7° proposal – Main topic: Smart City

- **Title:** Smart Parking
- **Areas:** Sensors, HCI, data visualization
- **Description:** Designing and developing a mobile app that shows on a map the available parking slots. Managing users and their vehicles. Managing parking slots and their costs. Assuming that the vehicle can recognize BLE ebeacons, corresponding to the parking area and the specific parking slot and that can send information about arriving and leaving the parking slot and the parking area (by means of Rest APIs). Data visualization strategies can be exploited to let the user interact with statistic charts.
- **Technologies:**
  - eBeacons: simulated
  - Map of a city
  - You can choose between a native app or a hybrid one



## 8° proposal – Main topic: Smart City

- **Title:** Smart Urban Gardening
- **Areas:** Sensors, HCI, data visualization
- **Description:** Designing and developing a mobile app that shows on a map the urban gardens. Managing users (citizens and municipal maintainers) and their urban gardens. Linked weather forecast external services. Simulating sensors (sensing environmental data from the soil and external), acquiring data from REST APIs. Data visualization strategies can be exploited to let the user interact with statistic charts.
- **Technologies:**
  - Environmental Sensors: simulated
  - Map of a city
  - You can choose between a native app or a hybrid one



## 9° proposal – Main topic: Smart City

- **Title:** Smart Harbor
- **Areas:** Sensors, HCI, data visualization
- **Description:** Designing and developing a mobile app that lets manage sailors and related boats, manage nautical operators, showing a map of boats and operators (simulating sensors on board and within the harbor) and linking weather forecast external services. Data visualization strategies can be exploited to let the user interact with statistic charts.
- **Technologies:**
  - Environmental Sensors: simulated
  - Map of a harbor
  - You can choose between a native app or a hybrid one



## 10° proposal – Main topic: Smart City

- **Title:** Smart Beach
- **Areas:** Sensors, HCI, data visualization

**Description:** Designing and developing a mobile app that lets the users book a position on the beach, choosing a beach umbrella, cots and chairs, ordering food and beverage at the bathhouse café, linking forecast weather external services (providing information and warning about wind, sun, swimming in the sea, sunscreen, etc.). Environmental data and sensors can be simulated. Data visualization strategies can be exploited to let the user interact with statistic charts.

- **Technologies:**
  - Environmental Sensors: simulated
  - Map of a bathhouse
  - You can choose between a native app or a hybrid one



## Environmental data, sensors and smart objects

- In order to simulate sensors and environmental data collected from sensors and smart objects, it is possible to exploit services like this one:

<https://thingspeak.com/>





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**Silvia Mirri**

[silvia.mirri@unibo.it](mailto:silvia.mirri@unibo.it)

[www.unibo.it](http://www.unibo.it)