Co-funded by the
Erasmus+ Programme
of the European Union

Project:	Network of Competence on Internet of Things [NEON]
Project ID:	618942-EPP-1-2020-1-AT-EPPKA2-CBHE-JP
Work Package 3:	Teaching methodologies, material and modernization of study programmes
Title:	D3.1 Web repository for class and lab sessions material
Lead Organization:	UNC
Participating Organizations:	UNI-KLU, UC3M, UNC, UNS, UNMDP, UdelaR, UCU, INCUTEX, ALASSIO, ALENET
Editors:	Jorge M. Finochietto
Contributors:	Daniel Carrica, Favio Masson

Deliverable data	Work Package and Outcome ref.nr	WP3 D3.1
	Title	Web repository for class and lab sessions material
	Type	☐ Teaching material ☐ Event ☐ Learning material ☐ Report ☐ Training material ☐ Service / Product
	Description	A web repository to collect digital materials will be available by MS3.3. The web repository will be available for professors and students, partners of the NoC.
	Date	01.04.2022
	Language	English
Target groups	☒ Teaching staff ☐ Students ☐ Trainees ☐ Administrative staff ☒ Technical staff ☐ Librarians ☐ Industry partners, Higher education authorities	
Dissemination level	☐ Department / Faculty ☐ Local ☐ National ☐ Institution ☐ Regional ☐ International	
WP Lead Organization	UNC	
Participating Organizations	UNI-KLU, UC3M, UNC, UNS, UNMDP, UdelaR, UCU, INCUTEX, ALASSIO, ALENET	
Task	T3.1 Adoption of new learning/teaching methods, tools, ICT best practices in teaching	

Revision History				
Version	Date	Author(s)	Organization(s)	Brief description of change
1	01.04.2022	Jorge M. Finochietto	UNC	Initial draft
2	23.05.2022	Jorge M. Finochietto	UNC	Final version with minor changes, including some clarifications.

Table of Contents

1. Introduction

The main objective of the NEON project is to improve and diversify the training of human resources, both in the academic field and in the public-private sphere, motivating innovative technologies in the Information and Communications Technologies (ICT) field, in particular the Internet of Things (IoT). The main goal of the institutions that make up the consortium is the creation of a Network of Competence (NoC) for IoT. The project will offer the framework and support to foster the industry collaboration at each country of interest, namely, Argentina and Uruguay, and, at the same time, it offers the possibility of exchange and advice from two European countries: Austria and Spain (through the corresponding partner of the project), that have demonstrated a good amount of development and innovation in the IoT field. The project's goals will be achieved by updating and improving the curricula at the different university degrees, the creation of at least 5 laboratories on IoT, the training of their academic staff and the collaboration between the local and regional industry.

Latin America (LA) is a region of the world that still does not offer a sufficient level of equal opportunities. One of the reasons for this disparity can be identified in a constantly growing population and an increasing urbanization into big and densely populated metropolises. The southern regions, especially Argentina and Uruguay, operate mostly in the primary sector of agricultural goods, mainly food. Most advanced economy sectors including high-tech industry are not well developed. Furthermore, unemployment is a constant and worrying issue in LA. Argentina and Uruguay are among the top riders of LA with the highest unemployment rates[1] as a result of a great deterioration of the economy and a general decrease of the average Gross Domestic Product (GDP) due to scarce diversity in industry, lack of innovation, lack of qualified personnel especially in technology. Engineers are scarce in all areas, especially ICT. The demand is higher than the offer. Among the high tech market sectors, Internet of Things is extremely relevant since it spans several application domains, from quality and environmentally friendly agriculture, to cattle rising, to smart energy and renewables, to health applications, to the holistic vision of smart cities.

The European Union (EU) character of the project will ensure modernization of the engineering profile with the inclusion of IoT skills and knowledge by having EU Higher Education Institutions (HEI)s bring their experience and help to enhance the quality of the study programmes. Value will be attained by creating more skilled and competent graduates, which will reflect in better-qualified engineers that work in ICT companies, with specialization in IoT, and contribute to the innovation process of such companies at EU levels. Study programme improvements, innovative teaching and training methodologies, new labs, and internships will result in students being better prepared for a flexible international job market, recognized by employers at EU level, which enhances mobility opportunities. NEON focus is on IoT, which is aligned with the EU strategy of stimulating the wider application of ICT in society and economy. The objectives will be attained only if HEIs in LA and EU countries work together to exchange good practices, enhance curricula and their contents, and facilitate mutual studies and degrees recognition as well as cooperation with industry. LA companies will also benefit by rendering themselves more visible at EU level, potentially diminish the drain of experts and attract employees from the EU.

In this context, the development of teaching material that can contribute to the training of human resources, both in the academic field (students, professors, technicians) and in the public - private sphere, in the field of the Internet of Things is a necessary step towards achieving the ultimate goal of the NEON project. In order to develop this material, a web repository is required to enable collaboration among the NEON partners and facilitate the delivery of the material in the short term.

[1] NEON project proposal, 2020

2. Objectives of this deliverable

The aim of Work Package 3 (WP3) is to adopt novel learning/teaching methods and develop classes to modernize teaching on IoT subjects. From the HEI partners' perspective, there are considered discussion panels and mutual visits, that will provide Latin American teaching staff with opportunity to master novel and innovative teaching methods, advanced lab solutions, development of joint academic/industrial teaching methodologies, usage of e-tools, online courses, social media, cloud-based platforms, etc. Considering industrial partners that aim to stimulate creativity, innovation and entrepreneurship, it will be followed by an unconventional teaching practice (lecturing and examination through project tasks, implementation / development challenges, hackathons, etc.). To this end, teaching modules and classes will be prepared and shared among all partners by means of a web repository that provides internal visibility of the material and fosters collaboration in both the development stage as well as the delivery one.

Hence, the following requirements were identified for this web repository :

- Teaching material development shall be organized as a collaborative project proposed by one or more teachers (authors) of a partner,
- Each proposed project shall have its own repository where material (slides, worksheets, quizzes, etc.) can be uploaded and online text be added to describe and organize the material
- Each repository shall track changes and provide statistics to supervise progress and facilitate collaboration among teachers / partners
- Each partner shall have write access to the repositories of those projects proposed by their teachers
- All partners shall have at least read access to the all repositories

3. Implementation of the web repository

In order to fulfill these requirements, a collaborative platform was implemented using GitHub that can serve as a web repository for all class material that will be developed. Even if GitHub is a code hosting platform for version control and collaboration, it can be also used to develop and share any document. Besides its capability to upload and version files in repositories, it supports markdown syntax that lets users create and edit online documents that can be used for describing the material and organization of the repository.

The first step to implement this web repository was to create a GitHub "organization" for the neon project, which was named as "neon-iot" [2] and described as a "Working repositories for modernized and new classes on IoT". Under this organization a collection of repositories were created, one for each of the projects that will develop teaching material. To facilitate the organization of each project and the collaboration among partners, a project template known as demo-material[3] was proposed and agreed as the general structure for all projects.

A total of **23 different projects** were proposed by all partners and a repository was created for each project as shown in Figure 1. All teachers indicated by partners were invited to join the platform as members and update their project's main page with introductory information.

[2] Neon-IoT GitHub site: https://github.com/neon-iot
[3] Project template: https://github.com/neon-iot/demo-material

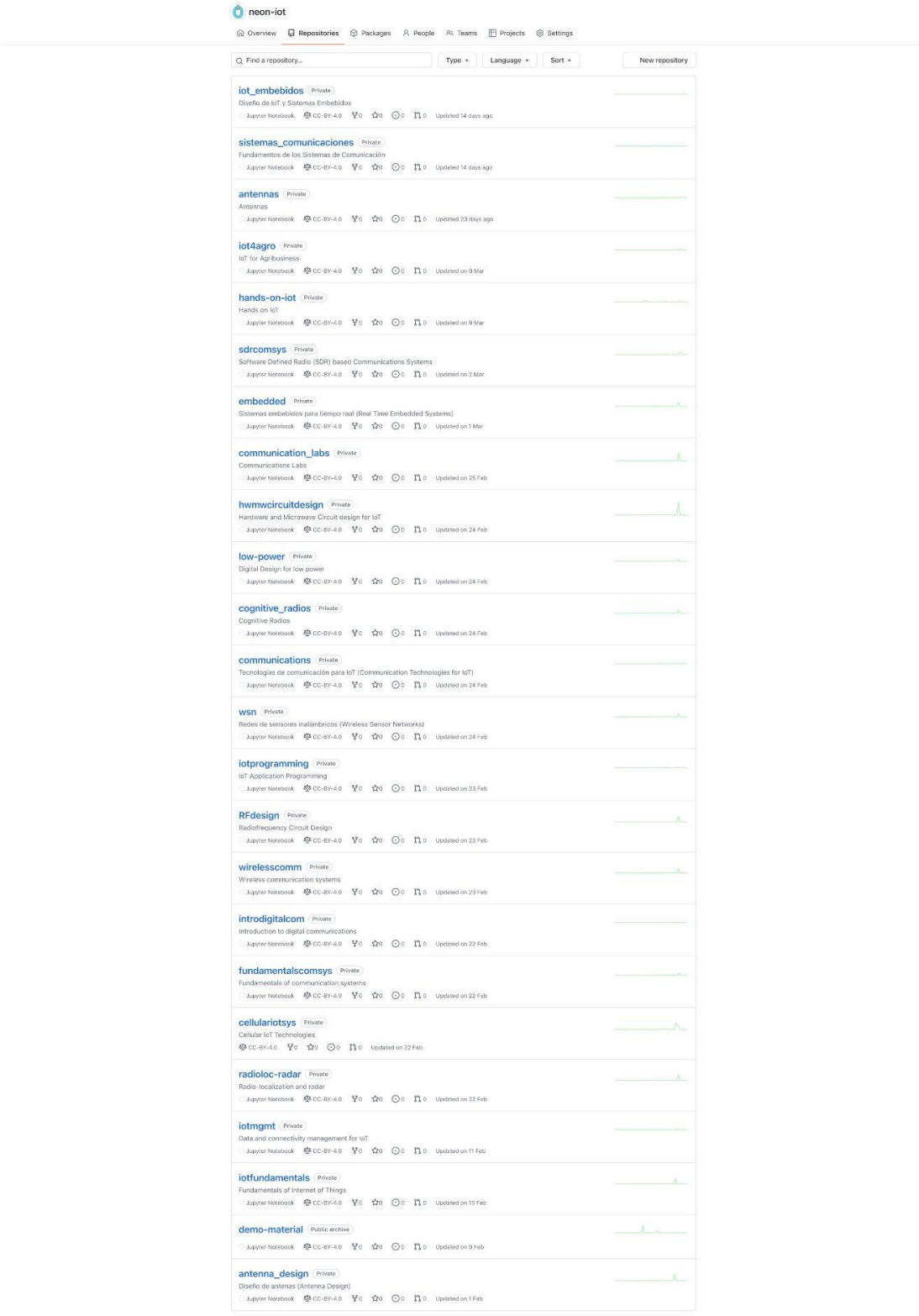


Figure 1: Screenshot of web repository with all created projects

The names of each project correspond to either a full course or modules of an existing course that will be updated with IoT related topics and activities. The names of the 23 projects and the partner that has proposed it are the following

- Hands on IoT (UNMDP)

- Software Defined Radio (SDR) based Communications Systems (UNDMP)
- Hardware and Microwave Circuit design for IoT (UNMDP)
- IoT in Agribusiness (UCU)
- Antenna Design (UdelaR)
- Real-time Embedded Systems (UdelaR)
- Wireless Sensor Networks (UdelaR)
- Digital Design for Low Power (UdelaR)
- Communication Technologies for IoT (UdelaR)
- Fundamentals of Internet of Things (UNC)
- Cognitive Radio (UNC)
- Data and connectivity management for IoT (UNC)
- Communications Labs (UNC)
- IoT Programming (UNC)
- Fundamentals of communication systems (UNS)
- Radiofrequency circuits design (UNS)
- Introduction to digital communications (UNS)
- Antennas (UNS)
- Radio-localization and radar (UNS)
- Cellular IoT Systems (UNS)
- Wireless Communications Systems (UNS)

A total of **35 members** joined the platform and were assigned to one of the **10 teams available**, one for each partner as shown in Figure 2. Each project was assigned a team, whose members can update (i.e., write access) all projects assigned to the team and can access (read-only) projects from other teams (i.e. partners). Even if the partners that will develop the teaching material are only 5 (UNMDP, UCU, UdelaR, UNC, UNS) the other 5 partners would participate in the revision of the material.

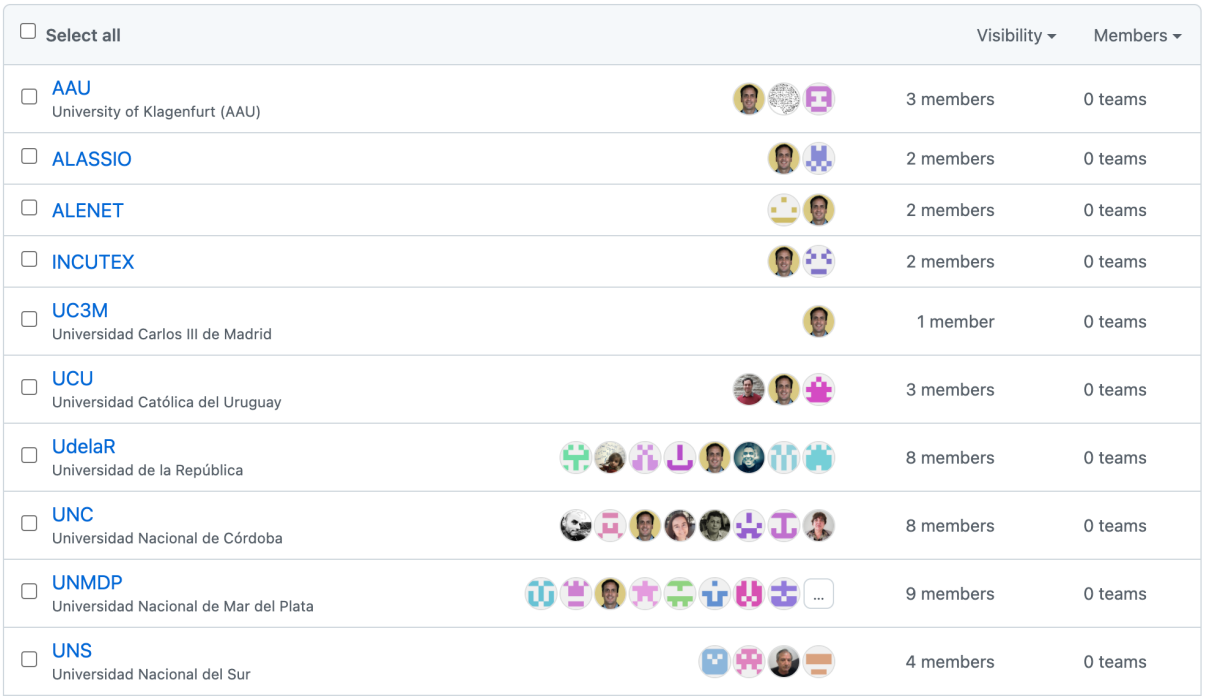
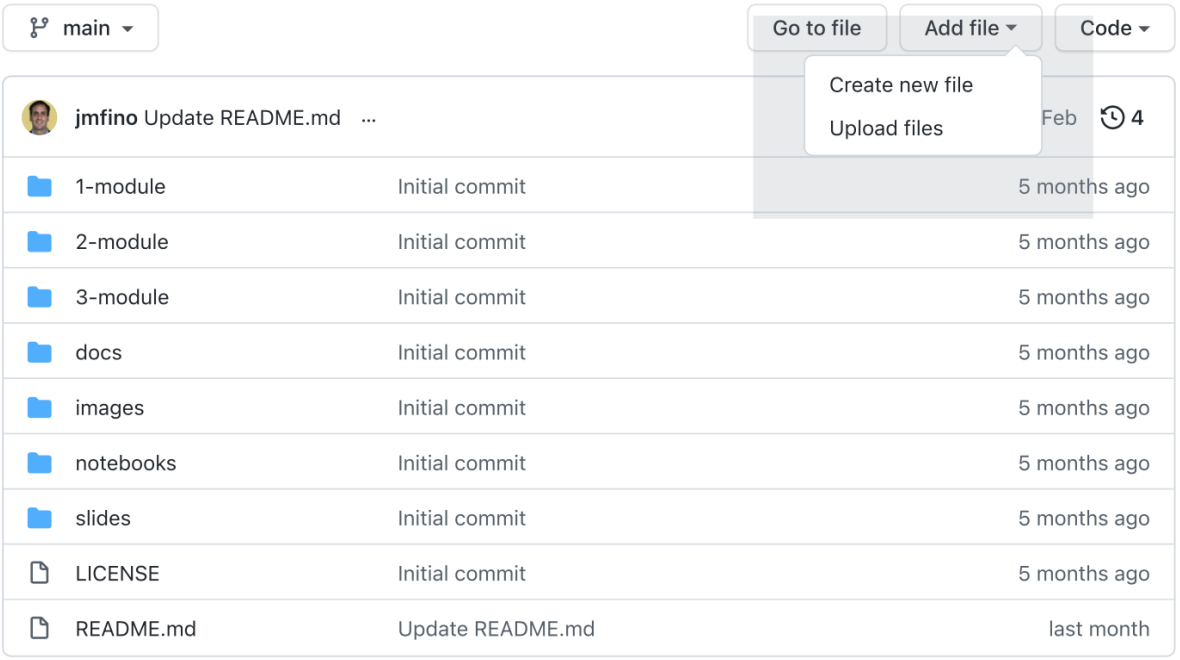


Figure 2: Screenshot of the teams and their members

A meeting to introduce each project to all partners was held on February 24th, 11:30 (AR/UR) - 15:30 (CET), and its recording is available here[4].

4. Use of the web repository

The use of the web repository by teachers is simple and straightforward. As shown in Figure 3 the project is organized by default using folders (in blue). These folders can be used to either represent teaching units (modules) and/or type of content or activities. Inside each folder corresponding files can be uploaded (by means of the Add file >> Upload files button) or new folders created. It is also possible to create text files and edit them using markdown[5] syntax.



5. Conclusion

As stated throughout this document, partners have collaborated together in an effort to identify and adopt innovative teaching methodologies for modernizing educational/training courses on IoT to students and professionals. The delivery of a web repository (M3.3) has been carried out by the creation of a collaborative platform in GitHub.

Next steps will be the adoption of tools and equipment to enable innovative teaching methodologies (M3.4), and the development of class material (M3.5) aiming to fulfill the ultimate goal of NEON project that is, to improve and diversify the training of human resources, both in the academic field and in the public-private sphere, motivating innovative technologies in the Information and Communications Technologies (ICT) field, in particular the Internet of Things (IoT).

[4] Recording of the meeting to present all projects: https://www.youtube.com/watch?v=bCP04FCHHMQ

[5] Markdown syntax: https://docs.github.com/es/get-started/writing-on-github/getting-started-with-writing-and-formatting-on-github/basic-writing-and-formatting-syntax