DELIVERABLE3.2

Identification of general equipment of laboratories

Written by	Responsibility
Andreas Kazantzidis (UPAT)	WP3 Leader
Edited by	
Athanassios Argyriou (UPAT)	Participant
Moath Safasfeh (AHU)	Participant
Ahmad Al-Jaafreh (TTU)	Participant
Yaseen Alhusban (IU)	Participant
Mohammad Siam (IU)	Participant
Khaled Alawasa (MUTAH)	Participant
Ziyad Altarawneh (MUTAH)	Participant
Omar Daoud (PU)	Participant
Stelios Ioannou (UCLAN)	Participant
Marios Raspopoulos (UCLAN)	Participant
Nearchos Paspallis(UCLAN)	Participant
Josephina Antoniou(UCLAN)	Participant
Eliana Stavrou(UCLAN)	Participant
Fabrizio Granelli (UNITN)	Participant
Jonathan Rodriguez (IT)	Participant
Georgios Mantas (IT)	Participant
Felipe Gil-Castiñeira (UVIGO)	Participant
Approved by	
Saud Althunibat (AHU)	Project Coordinator

LIST OF CHANGES

Version	Date	Change Records	Author
1.0	June 02, 2020	Whole document	Andreas Kazantzidis (UPAT)
1.1	June 07, 2020	Small changes, proposed by participants	Andreas Kazantzidis (UPAT)
1.2	June 12, 2020	Finalization of participant list	Andreas Kazantzidis (UPAT)
1.3	Jun2 14, 2020	Edititng and Adding the Other Equipment Section	Saud Althunibat (AHU)

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1. INTRODUCTION

1.1   Scope and Objectives

IREEDER (Introducing Recent Electrical Engineering Developments into undErgraduate curriculum) objective to develop, integrate, accredit and evaluate a quality bachelor degree program in Renewable Energies (RE), Internet of Things (IoT) and Cyber Security (CS) in Jordan with an appropriate laboratory component jointly taught by universities in Jordan, in accordance with the Bologna process. This ensured that universities in Jordan are placed in a position to offer quality education compatible with European standards and meets socio-economic needs of the emerging knowledge-based society by strengthening teaching in those fields in order to graduate professional leaders who can meet market needs of the country. IREEDER's direct aim is to enhance the capacity and enable Jordanian partner universities to develop sustainable bachelor programmes with state-of-of-the-art educational technologies.

In this frame, **WP3** aims to develop a capacity building and staff development program in these fields (IoT, CS, RE). Three labs will be established in three Jordanian universities as follow:

- IoT laboratory will be established at Al-Hussein Bin Talal University (AHU).

- CS laboratory will be established at Tafila Technical University (TTU).

- RE laboratory will be established at Mutah University (MU).

Moreover, the installed labs must have remote access feature, where students from all Jordanian partners can remotely access them and perform their experiments. . Jordanian partners will disseminate a tender (with the help of all partners and under the supervision of the coordinator) to announce the need to construct the required equipment to purchase and deliver the components of the laboratories

Deliverable 3.2 (Identification of general equipment of laboratories) follows the teaching objectives and materials (as determined in WP2), identifies the needs for practical training and defines the equipment of laboratories to be designed at Jordanian partners. In the next pages, the types of hardware and software needed for IoT, CS and RE fields are presented. It has to be mentioned that the proposed laboratory equipment has been designed to give the ability to implement real life projects. It is accompanied by the flexibility given to students to mount components and apply changes themselves in order to develop and conduct appropriate

experimentation, analyze/process/interpret data and use engineering judgment to draw conclusions.

The presented lists were prepared with the help of the associated partners in Jordan, taking into account the results of the training needs survey conducted in WP1, the partner facilities survey conducted in WP1, and the proposed course outline accomplished in WP2.

1.2   Structure of the Document

The present document is organized as follows:

- The current section describes the scope, objectives and structure of the document
- Sections 2, 3, and 4 provides the IOT, CS and RE laboratory specifications. Some necessary general conditions and requirements are included below each list
- Section 5 provides a list of the equipment to be installed at the Jordanian partners to facilitate the remote access of the labs.
- Section 6 concludes the document and provides some comments on the results

2. THE IOT LABORATORY EQUIPMENT LIST

No	Item	Specifications	Quantity
1.	IoT educational Platform	• IoT platform should able to train students on the following topics: sensors and actuators, IoT data acquisition &applications, IoT data communication, IoT data storage & retrieval, IoT data analysis. • The platform must be accompanied with a software that allows for a remote access (via Internet) of all provided platform functions. • The platform should be flexible to accommodate more experiments.	20
2.	Temperature Sensor	• Operating Voltage 3-5v • Analogue Output • Temperature Range 0 to 100°C	20
3.	3 Axis Accelerometer	• Operating Voltage 3-5v • Analogue Output	20
4.	Ultrasonic Sensor	• Operating Voltage 3-5V • Digital Output	20
5.	Inertial Measurement Unit	• Operating Voltage 3-5v • 9 Degrees of Freedom (DOF) • Digital Output, Serial or I2C	20
6.	Digital magnetometer	• Operating Voltage 3-5v • Digital Output Serial or I2C	20
7.	Digital Gyroscope	• Operating Voltage 3-5v • Digital Output, Serial or I2C	20
8.	LiDAR	• Operating Voltage 3-5v • Digital Output	10
9.	Light Dependent Resistors (LDR)	• Positive Coefficient	100

10.	Switches		100
11.	Resistors (1k-10k)		300
12.	Servos	• Operating Voltage 3-5v • Rotation 180°	100
13.	Servos	• Operating Voltage 3-5v • Continuous Rotation	100
14.	RF Serial Transceiver Modules wireless	• Operating Voltage 3-5v • Transmit Power 2-5mW or Transmit Distance 70-120m	20
15.	GPS Module with Antenna	• Operating Voltage 3-5v	20
16.	ARM Microcontrollers (MCU)	• ARM CORTEX M3 and M4. • 32-bit processors • Analogue Inputs • Analogue Outputs • Digital Input/Output	20
17.	MCU Wifi	• WiFi Development Tools	10
18.	SD Cards	• SD Card with Card Reader-32GB	20
19.	SD Card adapter for microcontroller		20
20.	LCD Display	• Operating Voltage 3-5v • Connectivity I2C	10
21.	Color Display	• Operating Voltage 3-5v • Connectivity Serial	10
22.	Inventor's Kits		10
23.	Connecting Wires (Large Jumper Wire Kit)		300

24.	Connecting Wires (JUMPER MALE TO MALE 15CM 10PK)		300
25.	Educational Robotic Kits		10

Necessary Conditions:

- The item 1 must have a remote access feature, where student can control the whole items remotely.
- It is preferred that the items 2-25 are all included in one set.
- All bidders should provide complete equipment datasheet and experiments manual sheets.
- The bidder should offer a complete onsite and offsite training.
- The quantity of the different items can be reduced according to the available budget.

3. The CS LABORATORY EQUIPMENT LIST

No	Hardware / Software	Quantity	Notes
1	Personal Computer / Workstation with minimum 8 GB RAM, , SSD(256GB)+HDD 1TB , latest i7 processor	20 PC	- Windows 10 Professional Edition licensed for each PC. - VM Ware Software with licenses for each PC. - Open Source RedHat Linux, Kali Linux (can be installed on VM Ware).
2	Physical Server Intel Xeon 10 cores, 64GB RAM	1 (ideally 2)	- Windows Server 2016 or more licensed for Server. Provides Virtualization for Creating Several –on demand- Virtual Servers.
3	Core Switch (Layer3)	1 (ideally 2)	- Provides SDN**(not essential functionality) Video / Audio Conferencing
4	Management Switch(Layer3)	4	- Should be manageable, configurableSwitching, VLANs, and all Switching features.
5	Network Firewall	2	- Can be Hardware (Appliance) - Can be Software (VM) - Provides firewall features Can provide Routing Services
6	Network Router (CISCO routers recommended)	1 (ideally 2)	- Can be Hardware (Appliance) - Can be Software (VM) If it is VM, Can be embedded with firewall in one entity
7	Load Balancer	1	Can be installed on VM (Software)
8	Security Information & Event Management (SIEM) Solution	1	Can be installed on VM** (any of Monitoring Software)
9	Wireless Access Point	2	Should be standalone / without controller
10	USB Wi-Fi Dongle Adapter	20 pcs.	To provide PC's with wireless connections

11	Network cables and cabling tools (cutters + RJ connectors + testers)		
12	Network Interface Cards	20	Extra internal network cards (some machines need 2 network interfaces inside to be able to run as a physical firewall or load balancer)
13	Flash drives (USB flash drive):	10	will be needed to test encryption and locking
14	Console cables and WAN cables	20	dd-wrt WAN ports
15	Swithch for PC conecction	4	

Necessary Conditions:

- Hardware & Software (including Virtualization)
- Installation: all of above infrastructure and components should be installed accurately and tested for best practice.
- Official Training: should be carried out by certified or specialist.
- All needed security tools can be provided later / after finishing infrastructure.
- The bidder should provide complete equipment datasheet and experiments manual sheets.
- The bidder should offer a complete onsite and offsite training.
- The quantity of the different items can be reduced according to the available budget.

4. THE RE LABORATORY EQUIPMENT LIST

The offered Trainer system comprises at least of:

No	Item	Specifications	Quantity
1	Renewable Energy generation technologies Bases	PV solar system, Wind Turbine system, Fuel Cells, storage devices (battery bank), Power Conditioners/Inverters,…etc),	One set
2	Renewable energy sensors	Wind Speed Sensor, Solar Radiation Sensors, Temperature Sensors (Ambient, and Module)	One set
3	System devices	• Measurement device: Current, voltage, • operation and monitoring system, • control and protection system, • data Acquisition System, • interconnecting wires / cables, • Remote lab hardware interfacing and software • Other necessary components.	One set
4	licensed software and associated platform	• Computer based training setup for the use in laboratory training for entry-level students of engineering and/or technical schools. • A system-design platform, development environment and with full devices computability. • Software should support the remote labs technology and has complete functionality including a user-friendly graphical interface where instructors and students should be able to access and perform the required experiments remote online. • Unlimited users	A license for unlimited users
5	Educational Software	• Educational software for simulation, modelling, analysis of solar, wind, battery storage systems and hybrid energy resources optimization. • The software should allow for students to simulate their own systems and evaluate their performance.	50 seats in five universities

| | | The licence of the software should be able to be used in five universities with 50 seats. Preferred Softwares are PSIM and/or HOMER. | |

Necessary Conditions:

- The items 1,2,3 ,4 and 5 must be all compatible with each other and from the same manufacture.
- It is preferred that items 1,2,3,4 and 5 are all included in one training set.
- The 1,2,3 and 4 must have a remote access feature, where student can control the whole items remotely.
- The bidder should provide complete equipment datasheet and experiments manual sheets. The bidder should offer a complete onsite and offsite training.
- The quantities can be changed according the availabe budget.

5. Other Equipment

The list below includes a set of equipment that are necessary to facilitate the remote access for the students/staff in all Jordanian partners to the installed laboratories at AHU, MU and TTU.

No	Item	Quantity	Location
1	Physical Server Intel Xeon 6 cores,12GB RAM	2*	One at AHU and one at MU
2	Personal Computer with 4 GB RAM, SSD (256GB) + HDD I TB, i7 processor	80*	20 PCs at AHU 20 PCs at MU 20 PCs at PU 20 PCs at IU
3	Portable data show	5*	1 at AHU 1 at MU 1 at TTU 1 at PU 1 at IU
4	Portable computers (Labtops)	5*	1 at AHU 1 at MU 1 at TTU 1 at PU 1 at IU

*The qunatities can be changed according to the available budget.

6. CONCLUSIONS

Deliverable 3.2 identified the needs for practical training and defined the equipment of laboratories to be designed at Jordanian partners.

There was coherent work from all partners to propose the best available equipment as well as to define its appropriateness and necessity in the frame of the project.

For both hardware and software equipment, effort has been made to provide specifications that will make the laboratories sustainable in the long term.

The proposed list of equipment aims to develop flexible experiments in terms of giving the initiative to students to follow the proposed experimental work as well as to develop new/different projects and analyze/interpret data.

Based on Deliverable 3.2, all partners will have the chance to develop the practical trainings in IoT, CS and RE courses. Moreover, it gives the essential information to Jordanian Universities to start the tendering process.