

# Intellectual Output 3 (O3)

## Online Platform for Joint Distant Courses



*This document accompanies the platform deployed at “<https://jaunty.cs.ihu.gr>”*

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In the reporting period of the JAUNTY project, the tasks that were completed in the context of Intellectual Output 3 (O3) for the design and implementation of the “Online Platform for Joint Distant Courses” are categorized into three phases: 1) Requirements of the Platform, 2) Installation and configuration of the system server, and 3) Deployment and configuration of the Online Platform. Each phase is described below. It is noted that the current version of the platform is publicly available at: <https://jaunty.cs.ihu.gr/>

## **1. ONLINE PLATFORM REQUIREMENTS**

For the needs of the JAUNTY project, the following basic functionalities were defined:

### **1.1 Open-source online platform**

The platform will be publicly accessible over the Internet and will be provided free of charge.

### **1.2 Remote Training/Asynchronous education by storing and providing educational material**

The platform will allow remote training (transnational open collaboration), mainly in an asynchronous manner. It will allow storing and accessing educational material. The ability to allow synchronous educational processes is also examined (through the use of suitable tools, such as the Big Blue Button “BBB”).

### **1.3 Multiple user roles (Administrator, Student, Teacher, guest access) with different permissions on each role**

The platform will have the ability to create user accounts with different roles. Trainers and trainees will co-exist in the platform. The trainers will be able to configure the training material, the assignments, and the assessment items, while the trainees will be only permitted to read the material, as well as to submit papers and responses. Free access will be also provided when required.

### **1.4 User self-registration and auto enrollment on each course**

The users will be able to self-register on the platform. The trainees will also have the ability to self-enrol on a course. The assignment of courses to trainers will be conducted by the platform administrator.

### **1.5 Multiple Courses**

The platform will be able to support numerous courses.

### **1.6 Uploading Course Learning Material & supplementing Resources**

The training material will be possible to be uploaded in multiple formats and be organized within a folder.

### **1.7 Divide material into sections**

Each course will be able to be structured into different topics, in order to ensure efficient organization of its content.

### **1.8 Material with different media formats such as text, audio, and video**

Several file types will be supported for the training material, such as pdf, mp3, mp4, and YouTube content.

### **1.9 Adequate online storage space for ppts, docs, worksheets**

The platform will be hosted on a server with adequate capacity for storing all of the courses' material.

### **1.10 Material can be either secure or shared with students**

The courses' material can be accessible, hidden, and unmodifiable by the trainees. This feature will be applicable to any specific part of the material.

### **1.11 Links to outside sources**

There will be weblinks (URLs) that will allow trainees to access sources outside the platform, possibly acting as supplementary learning material.

### **1.12 User Feedback/Comments for evaluation purposes**

Users will be able to provide feedback and comments that can be exploited for facilitating the evaluation process.

### **1.13 User Interactivity, system e.g., taking self-tests, uploading assignments, learner-learner, and/or learner-teacher collaboration, chat, forum, blogs, etc**

The platform will support quizzes, allocation of assignments, and interaction between peers (trainees), as well as among trainers and trainees. The related supporting tools will include chat rooms, forum, and blogs.

### **1.14 Tracking of progress and achievement**

The trainees' progress will be tracked through the monitoring of their access to the material, under specific conditions, as well as with assessment methods through quizzes.

### **1.15 Appealing and pleasant user interface**

The platform will have an attractive design, by offering satisfactory user experience.

### **1.16 Automated Email communication**

Whenever necessary, the platform will send email messages, either for communicational reasons or for task execution.



### **1.17 Security of the platform**

The platform will include security features, for its protection against malicious users. The hosting server also needs to be secured. A security certificate (https support) needs to be installed.

### **1.18 Maintenance of the platform**

The platform needs to be upgradable in time.

### **1.19 Backup**

An external backup server will be utilized to keep copies of the platform. This is necessary due to possible hardware or data failures.

## 2. INSTALLATION AND CONFIGURATION OF THE SYSTEM SERVER

The platform that hosts the courses requires the installation of a server. Due to cost, performance, and security, the Linux distribution Ubuntu 20.04 LTS was selected as the operating system. The effective installation of the server needs a series of configuration steps, namely: Basic Installation, Firewall installation, Installation of packages for activating security certificates, installation of prerequired packages on which the VLE depends on (such as, MySQL Database Server, PHP, Apache2, ...), and installation of a remote server for hosting backups and writing backup scripts.

### 2.1 Basic Installation

The online platform will be hosted on a Virtual Private Server (VPS) located on the following Physical (Bare Metal) Machine.

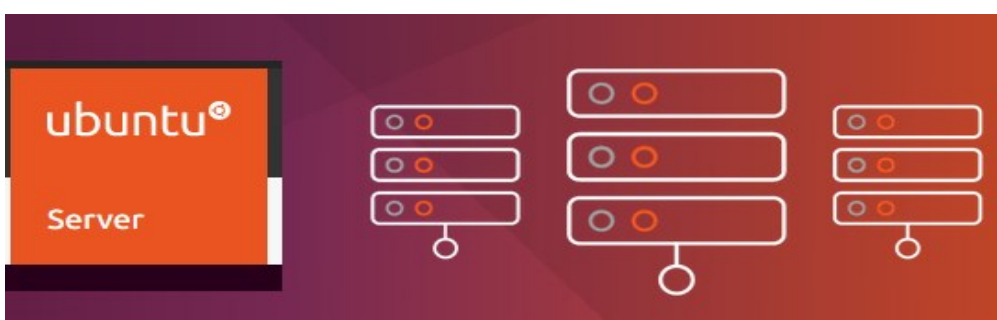
#### Bare Metal/Rack Server synthesis

- **Dell PowerEdge R640 Server**
- **CPU: 2xIntel Xeon Silver 4214 2.2G, 40 Cores**
- **Memory: 128GB RAM**
- **Hard Drives: 2xSAS Drives 300GB**
- **Network Interface Cards: 2x10Gb**

#### Virtual Private Server (VPS) - Host

- **Ubuntu Linux LTS 20.4 LTS +**
- **4 CPU Cores**
- **16GB Ram**
- **100GB Drive**
- **The VM specs can be extended.**

We downloaded and installed Ubuntu 20.04 LTS (ubuntu-20.04.2-live-server-amd64.iso), from the following website:  
<https://ubuntu.com/download/server>





## 2.2 Installation and Configuration of the Firewall

Using Ubuntu – apt-get, the firm firewall 2.5 was installed and configured.

```
chain INPUT {
  policy DROP;
  # allow SSH connections
  proto tcp dport ssh ACCEPT;
  proto tcp dport http ACCEPT;
  proto tcp dport https ACCEPT;
}
chain OUTPUT {
```

*(Part of a configuration file that allows ssh/http/https access)*

## 2.3 Installation of Packages for Activating Security Certificates

Using Ubuntu – apt-get, certbot (<https://certbot.eff.org>) was installed for publishing free certificates from “Lets Encrypt” (<https://letsencrypt.org>).

```
root@fusegi:/etc/letsencrypt/archive/jaunty.cs.ihu.gr# ls -l
total 20
-rw-r--r-- 1 root root 1769 Jun 28 07:03 cert1.pem
-rw-r--r-- 1 root root 3750 Jun 28 07:03 chain1.pem
-rw-r--r-- 1 root root 5519 Jun 28 07:03 fullchain1.pem
-rw----- 1 root root 1704 Jun 28 07:03 privkey1.pem
root@fusegi:/etc/letsencrypt/archive/jaunty.cs.ihu.gr#
```

*(Location of security certificates)*

## 2.4 Installation of Prerequisite Packages

This task is described in the next section (Deployment and configuration of the online platform).

## 2.5 Installation of Remote Server for Hosting Backups

To ensure protection against unpredictable hardware failures of the server, an additional server is installed to host backup copies of the online platform. On that server, the NFS service was installed and configured (package nfs-kernel-server), so that it can accept backup files.



## 2.6 Installation of the backup scripts

To ensure protection against unpredictable hardware failures of the server, a number of scripts have been developed, which automate the duplication of the online platform files, as well as the platform's database files, to the remote server. The Remote Server access (NFS Service) is achieved through the NFS Client (nfs-common).

```
echo "Copying: $SITEPATH directory..."
cp -r "$SITEPATH" .
echo "Compressing: $SITENAME directory..."
tar cvfz "$SITENAME.tar.gz" "$SITEPATH" > core
#gzip "$SITENAME.tar"
echo "-->Copy: $SITENAME.tar.gz to a numbered file name..."
cp --backup=t "$SITENAME.tar.gz" "$SITENAME.tar.gz_bak"
echo "Clear temporary: $SITENAME folder.."
rm -r "$SITEPATH"
rm "$SITENAME.tar.gz"
```

*(Part of backup script)*

```
# /etc/exports: the access control list for filesystems
#               to NFS clients.  See exports(5).
#
# Example for NFSv2 and NFSv3:
# /srv/homes      hostname1(rw,sync,no_subtree_check)
ree_check)
#
# Example for NFSv4:
# /srv/nfs4      gss/krb5i(rw,sync,fsid=0,crossmnt,no
# /srv/nfs4/homes gss/krb5i(rw,sync,no_subtree_check)
#
/backups      1 .1 .9 .1 2 (rw,sync,no_subtree_check)
/backups      1 .1 .9 .1 (rw,sync,no_subtree_check)
/backups      1 .1 .9 .3 (rw,sync,no_subtree_check)
/backups      1 .1 .9 .4 (rw,sync,no_subtree_check)
~
~
```

*(NFS Service Configuration that enables VPS access )*

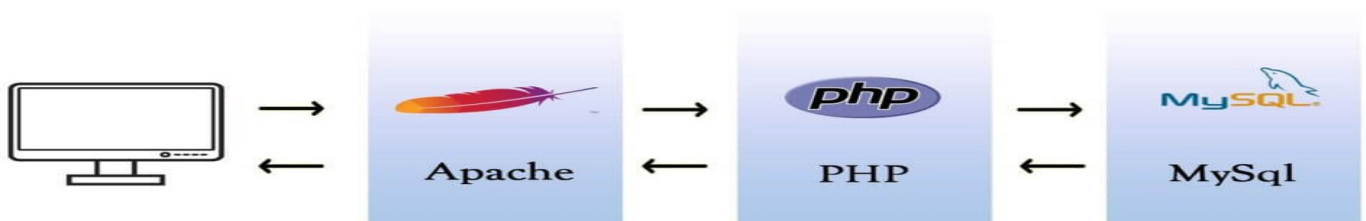
### 3. DEPLOYMENT AND CONFIGURATION OF THE ONLINE PLATFORM

The platform hosting the courses requires a series of configuration steps to function effectively, such as: installation of the database, installation of the special packages for the platform operation, installation of the basic platform files, installation of the platform software, configuration of the platform to meet the project’s special requirements.



#### 3.1 Online platform system requirements

- **Web server.** Moodle requires a web server: Apache will be installed.
- **PHP.** Moodle is written in PHP ( PHP 7.3 + will be installed).
- **Database server.** Moodle uses a database: MySQL will be installed to store information about courses, users, and other data.
- **Operating System.** Moodle is compatible with a variety of operating systems: Ubuntu Linux will be installed.
- **Memory.** A minimum of 2GB RAM is recommended, but the specific memory requirements may vary depending on the number of users and courses: 16GB will be used.
- **Storage.** The storage requirements will depend on the size of the courses and the number of files and resources that will be stored on the server. A minimum of 5GB storage is recommended: 100GB will be used.
- **Bandwidth.** Moodle requires a fast and reliable internet connection, with sufficient bandwidth to support the number of users accessing the platform: 1 up to 10Gb will be used.



#### 3.2 Database Installation and Configuration

After Moodle version 4.0.1 (moodle-4.0.1.tgz), the Ubuntu – apt-get tool was used to install the MySQL Database Server (package mysql-server). Next, a user was created on the Moodle database schema.

### 3.3 Installation of the Special Packages for the Platform Operation

Using Ubuntu – apt-get, the following software packages were installed, since they are required for the operation of the platform:

```
graphviz      aspell  ghostscript  clamav  php7.4-pspell  php7.4-curl  php7.4-gd  php7.4-intl  php7.4-  
mysql  php7.4-xml  php7.4-xmlrpc  php7.4-ldap  php7.4-zip  php7.4-soap  php7.4-mbstring  git
```

### 3.4 Installation of the Platform Software

The file moodle-4.0.1.tgz was decompressed and all installation steps were followed successfully.

### 3.5 Configuration of the Platform to Meet the Project's special requirements

The extra features of the JAUNTY project were added and several configurations were made on the platform, so that the VLE is ready to host the developed educational material and support remote training.

## Joint undergraduate courses for smart energy management systems (JAUNTY)

### Available courses

#### VLE Demonstration Course

**Teacher:** Admin Jaunty

**Teacher:** Vassilis Tsoukalas

#### Energy consumption monitoring with energy meters and security aspects (Lab)

Energy consumption monitoring with energy meters and security aspects (Lab)

**Teacher:** Charalampos Anastasiou

**Teacher:** Admin Jaunty

**Teacher:** Thomas Lagkas

#### IoT sensors and devices (Lab)

IoT sensors and devices (Lab)

**Teacher:** Charalampos Anastasiou

**Teacher:** Christos Dalamagkas

**Teacher:** Admin Jaunty

**Teacher:** Thomas Lagkas

**Teacher:** Marios Siganos

#### Introduction to IoT and smart devices (Theory)

Introduction to IoT and smart devices (Theory)

**Teacher:** Charalampos Anastasiou

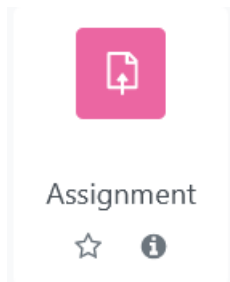
**Teacher:** Admin Jaunty

**Teacher:** Thomas Lagkas

For the needs of the JAUNTY project, the following plugins are supported by the Moodle platform. We can also add more plugins.

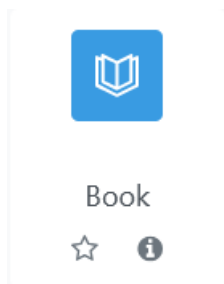
## 4.1 Assignment module

Enables Instructors(teachers) to create and manage online assignments, including the submission of digital files.



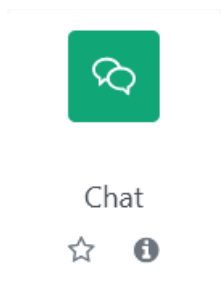
## 4.2 Book module

Enables the creation and publishing of electronic books, with each chapter or section displayed as a separate page.



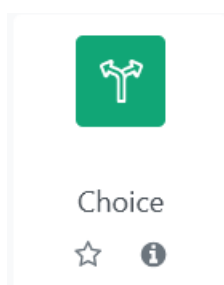
## 4.3 Chat module

The Chat activity allows course participants to have a real-time synchronous discussion in a Moodle course .



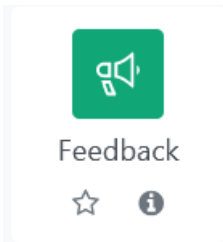
## 4.4 Choice

Choice enables asking a question and configuring radio buttons that the learners can click on to make a selection from a number of possible responses. Choices can be useful as a quick poll to stimulate thinking about a topic.



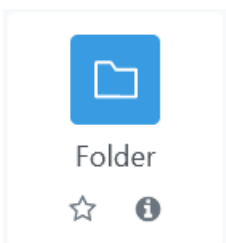
#### 4.5 Feedback

The Feedback activity enables the creation and conduction of surveys for the collection of feedback.



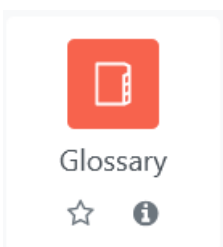
#### 4.6 Folder

The folder allows an instructor to display several course files together. The files may be of different types and they may be uploaded all at once, as a zipped folder that can be later unzipped, or they can be added individually to an empty folder on the course page.



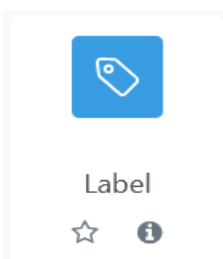
#### 4.7 Glossary module

Creates an online glossary that can be used to define terms and concepts related to a course.



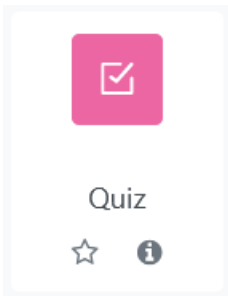
#### 4.8 Label/Text and Media Area

A Text and media area serves as a spacer on a Moodle course page. It can be used to add text, images, multimedia or code in between other resources in the different sections. It is a very versatile resource and can help to improve the appearance of a course if used thoughtfully.



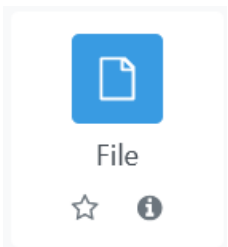
## 4.9 Quiz module

Allows the creation and management of quizzes, surveys, and exams.



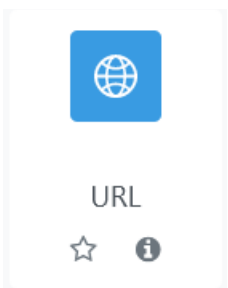
### 4.10 File

Files are not just materials such as word-processed documents or slideshow presentations. All types of files can be uploaded and accessed through Moodle, if the student has the appropriate type of software to access them.



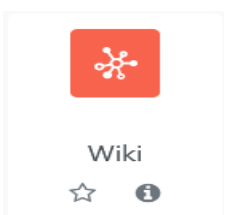
### 4.11 URL

A URL (*Uniform or Universal Resource Locator*) is an Internet link leading to a website or online file. Instructors can use URL module to provide the trainees with web links for research, saving the student time and effort in manually typing out the address.



### 4.12 Wiki

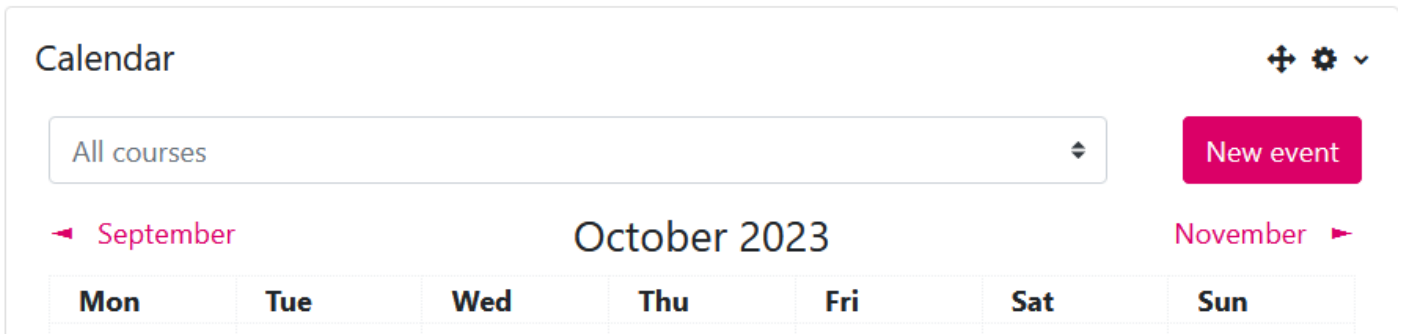
The Wiki activity allows trainees to create a collaborative document by building pages together, similar to Wikipedia.





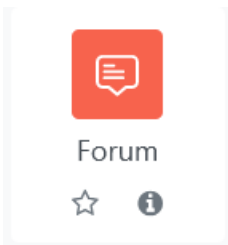
#### 4.13 Calendar module

Adds a calendar to the Moodle site, which can be used to display upcoming events, deadlines, and other important dates.



#### 4.14 Forum module

Adds a discussion forum to the Moodle site, allowing trainees and instructors to participate in online discussions.



## Contacts

### Project Coordinator:

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1000, Sofia, Bulgaria

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