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# BRIDGING THE — GAP

An AI-enabled versatile skill matching  
tool to assist the less privileged

## BRIDGING THE GAP DELIVERABLE 4.1

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## BRIDGING THE GAP Project Profile

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### Partners

 INTERNATIONAL HELLENIC UNIVERSITY	DIETHNES PANEPISTIMIO ELLADOS (IHU)	Greece
 MYCOMPANY	MY COMPANY PROJECTS O.E.	Greece
	UNIVERSITATEA DIN CRAIOVA	Romania
	Regional center for vocational training and education to CCI-Blagoevgrad	Bulgaria

## Document History

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1.0	13/04/2024	Periklis Chatzimisios (IHU)	FINAL VERSION TO BE SUBMITTED

## Abbreviations and acronyms

Deliverable	D
Expected Outcomes	EO
International Hellenic University	IHU
Non-governmental organization	NGO
Labour Force Survey	LFS
Neither in employment nor in education or training	NEET
Human Resources	HR
URI	Uniform Resource Identifier
CV	Curriculum Vitae
JV	Job Vacancy
UoL	Unit of Learning

## **Executive Summary**

BRIDGING THE GAP is a 24 month duration project funding from the European Union's Erasmus+: KA220-YOU under Grant Agreement 2021-1-EL02-KA220-YOU-000028780.

The overarching objective of the BRIDGING THE GAP project is to provide a holistic approach beyond a classical skill-matching system to a system that will bridge the gap as to who are the underprivileged and why are they underprivileged and how education and skill improvement will benefit them.

The main purpose of this document is to report the progress of the BRIDGING THE GAP project during the deliverable 4.1. More specifically, this deliverable reports on Project Results 4 findings that analyze and approve the platform's requirements and design.

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# **1 Introduction**

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## **1.1 Purpose of the document**

The purpose of this document is to present the progress of the project during the final implementation phase regarding the implemented research activities as they are reported in Project Results 4 (deliverable 4.1).

## **1.2 Intended audience**

The intended audience of this document consists of the following target groups:

- BRIDGING THE GAP project partners and the Project Officer at the National Agency
- Young people, especially on the Balkan area, that are interested in skill building/matching
- Labour market actors
- Universities, course providers

## **1.3 Work Package Objective**

The results included in this deliverable are part of O4 result type representing the “Bringing the Gap Web Platform”. The objective of the O4 is the creation of a web platform host all the tools, services and related audiovisual material produced during the O1, O2, O3 and O5. The platform will be used for dissemination purposes, but will also provide to all the relevant stakeholders to use the tools and/ or integrate them into their systems. The development of this output was achieved through the next activities:

4.1 Analysis of platform requirements and design

4.2 Development of e-platform

4.3 Development of material that will be uploaded to the website

4.4 Translation of web platform

Results obtained in T4.1 are included in this deliverable that addresses sub objective O4.1 “Analysis of platform requirements and design”.

## **1.4 Structure of the document**

In chapter 2, this report provides an overview of the requirements analysis.

In chapter 3, this report introduces our proposed platform architecture and design.

In chapter 4, this report concludes the findings.



## 2 Requirements Analysis

### 2.1 Use Cases

The aim of the application we built, is to give the opportunity to all EU citizens to seek a job within EU and improve their skills, by providing the available tools stemming by the action to better describe with specific, known and agreed semantics his/her skills and qualifications. On the other hand, EU companies will be supported in describing occupations and specific jobs under an agreed semantic context. Finally, EU educational institutions (and even companies offering on-the-job training) are to adapt their courses and learning outcomes to EU job and citizens requirements.

The project involves three participant pillars without exclusion criteria:

- ⑩ EU citizens seeking a job within EU
- ⑩ EU companies
- ⑩ EU educational institutions (and even companies offering on-the-job training)

Based on the goals mentioned above, we came up with a few use-cases involving the stakeholders, and are presented in the tables below.

*Table 1: Use-case example 1*

<b>Title:</b>	Recommend JVs or a few occupations to a job seeker
<b>Actors:</b>	Job seeker
<b>Precondition:</b>	A number of JVs uploaded in the database
<b>Story:</b>	An individual enters the web-app in order to search for some jobs. He uploads his CV which passes through the Annotator module. The module extracts his skills and previous work experience which are then matched to ESCO skills and occupations. Then, based on the percentage the extracted CV skills match the required JV skills, the system proposes him the top job vacancies. Additionally, based on the ESCO info extracted from the CV, the system proposes a few occupations to him.

*Table 2: Use-case example 2*

<b>Title:</b>	Recommend a few courses to a job seeker
<b>Actors:</b>	Job seeker
<b>Precondition:</b>	A number of courses uploaded in the database

<b>Story:</b>	An individual enters the web-app in order to search for jobs and he clicks on a specific job vacancy. He has already uploaded his CV, meaning it has been processed by the Annotator module which has extract his ESCO matching skills and occupations. The system finds which skills required by that specific JV are missing from the individual's CV. It then proposes him a number of courses that provide those skills.
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Table 3: Use-case example 3

<b>Title:</b>	Help a company improve a JV's description
<b>Actors:</b>	Company/Employer
<b>Precondition:</b>	None extra
<b>Story:</b>	A company enters the web-app and uploads a few JVs. These JVs go through the Annotator module and the ESCO skills and occupations are extracted. Then the system, based on the ESCO info extracted proposes some changes the company can make to the job description in order to make it more compatible with the ESCO format/ontology.

Table 4: Use-case example 4

<b>Title:</b>	Help an educator improve a course's description
<b>Actors:</b>	Educator
<b>Precondition:</b>	None extra
<b>Story:</b>	A course-provider enters the web-app and uploads a new course. The course goes through the Annotator module and the ESCO skills and occupations are extracted. Then the system, based on the ESCO info extracted, proposes some changes the course-provider can make to the course's description in order to make it more compatible with the ESCO format/ontology.

Table 5: Use-case example 5

<b>Title:</b>	Provide recommendations for adding new courses or update existing courses' contents
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<b>Actors:</b>	Educator
<b>Precondition:</b>	A number of JVs uploaded in the database
<b>Story:</b>	Taking into account the gap between the currently provided courses and the new requirements from JVs, the application recommends to the course-provider some new courses he can add to his course list or some updates he can make to the already existing ones in order to cover that gap.

*Table 6: Use-case example 6*

<b>Title:</b>	Inform job seeker about skill shortages in the job market and probably propose some courses to him
<b>Actors:</b>	Job seeker
<b>Precondition:</b>	A number of JVs and CVs uploaded in the database
<b>Story:</b>	Based on the skills required by the JVs and on the skills extracted from the CVs in the database, we can find the skill shortages in the job market and inform the user about them.

## 2.2 Application features

Based on the use-cases presented in the previous section, we decided that our application should meet up with some standard requirements and features. In the following tables, the essential features of web application are presented.

*Table 7: Web platform's Feature 1*

<b>Feature:</b>	Give the citizen, the ability to upload his CV on the platform
<b>User:</b>	EU Citizen
<b>Comments:</b>	This feature is necessary because the whole system is based on the extraction of ESCO Skills and Occupations from the citizen's CV.

*Table 8: Web platform's Feature 2*

<b>Feature:</b>	Provide to the Citizen some job recommendations based on his CV
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<b>User:</b>	EU Citizen
<b>Comments:</b>	This feature is an important part of our platform as it makes direct use of the modules we built for it. Using this feature the user will be able to get some job recommendations (from the jobs already available in our database), based on the Skills and Occupations extracted from his CV.

Table 9: Web platform's Feature 3

<b>Feature:</b>	Provide to the Citizen some Occupation recommendations based on his CV
<b>User:</b>	EU Citizen
<b>Comments:</b>	This feature is an other important part of our platform as it also makes direct use of the modules we built for it. Using this feature the user will be able to get some Occupation recommendations (from the Occupations available in the ESCO vocabulary), based on the Skills extracted from his CV.

Table 10: Web platform's Feature 4

<b>Feature:</b>	Provide to the Citizen some inside info about the market's needs in Skills and Occupations (most popular Skills at the current time, Occupation categories most popular at the current time, etc.)
<b>User:</b>	EU Citizen
<b>Comments:</b>	This feature will be based on the data analysis performed on the resources (CVs, JVs, UoLs) collected by us. Through this data analysis we can extract some useful information and statistical indices that can give to the user an image of the current Skill and Occupation trends in the job market.

Table 11: Web platform's Feature 5

<b>Feature:</b>	Recommend to the Citizen some courses based on the market's needs and on his CV
<b>User:</b>	EU Citizen

<b>Comments:</b>	This feature is an important part of our platform as it makes direct use of the modules we built for it but it also makes use of the information extracted through the data analysis of the resources (CV, JV, UoL). Using this feature the user will be able to get some UoL recommendations (from the UoLs already available in our database), based on the Skills and Occupations extracted from his CV and based on the Skills he needs to apply for a currently trending job in the market.
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Table 12: Web platform's Feature 6

<b>Feature:</b>	Give the company the ability to upload job positions (JVs) on the platform
<b>User:</b>	EU Company
<b>Comments:</b>	This feature is necessary because one of the system's goals is to bridge the gap between the job seekers (citizens) and the job providers (companies). So there must be job positions available in the platform for the citizen to be able to see them or for the system to be able to recommend some of them to the citizen.

Table 13: Web platform's Feature 7

<b>Feature:</b>	Provide to the Company some recommendations on how to improve its JV's description.
<b>User:</b>	EU Company
<b>Comments:</b>	This feature is necessary because, using this, the Company will be able to make the JV more compatible with the ESCO vocabulary, such making it more easy to be matched with job seekers.

Table 14: Web platform's Feature 8

<b>Feature:</b>	Give the Institute the ability to upload courses or seminars (UoLs) on the platform
<b>User:</b>	EU Educational Institutions

<b>Comments:</b>	This feature is necessary because one of the system's goals, is to bridge the gap between the job seekers (citizens) and the UoL providers (institutes). So there must be courses and seminars available in the platform for the citizen to be able to view them or for the system to be able to recommend some of them to the citizen.
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*Table 15: Web platform's Feature 9*

<b>Feature:</b>	Provide to the Institute some recommendations on how to improve its UoL's description.
<b>User:</b>	EU Educational Institutions
<b>Comments:</b>	This feature is necessary because, using this, the Institution will be able to make the UoL more compatible with the ESCO vocabulary, such making it more easy to be recommended to job seekers.

## 3 Platform Architecture and Design

### 3.1 High-level Architecture

In this section we present the overall architecture of the web application. A high level representation of it can be seen in the figure below. According to this figure, the reader can see that it is built up from three basic modules, each one providing a different type of information to the respective user. The overall system communicates with each user in a different way, having as input a different kind of information and returning different ones to each user. In the following paragraphs, we give a thorough description of what each modules does, how it works and how it interacts with the user.

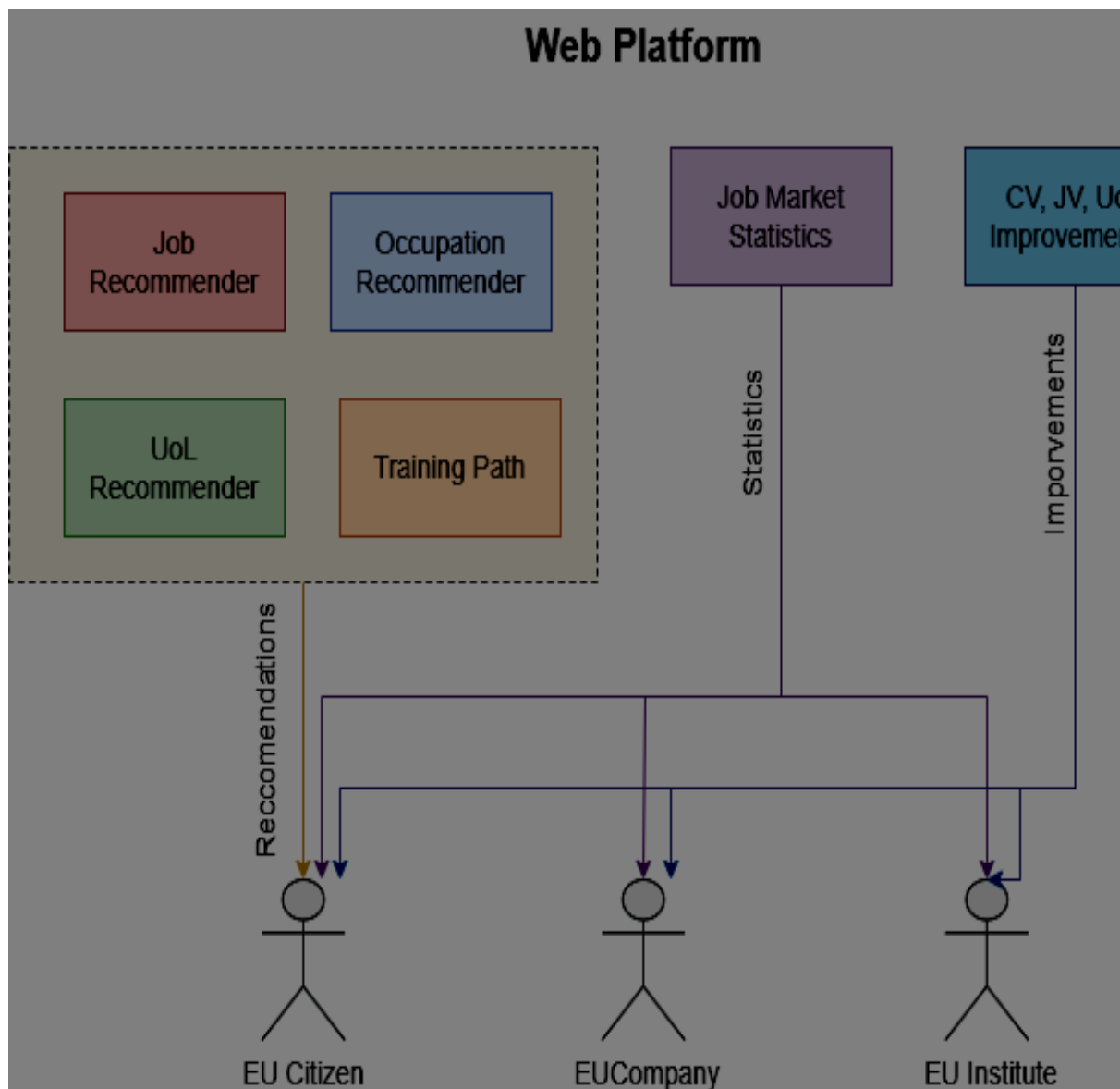


Figure 1: Platform's high-level architecture.

**Job Recommender:** This module is considered to be one of the basic modules of our system because each job platform's primary goal is to allow people to search for some job positions, but in our case we try to do the searching for them and recommend some jobs to them based on their CV. This module takes as input the Skills and Occupations extracted from the candidate's CV and also takes the Skills and Occupations extracted for each JV in our database during the pre-processing of our data. It then tries to match the CV with the JVs available through the common Skills and Occupations of each pair and returns the ones with the highest matching score based on a weighted average type of equation.

**Occupation Recommender:** This module's functionality is similar to the previous one where basically we try to search for Occupations for the Job Seeker and recommend them to him/her based on his/her CV. This module takes as input the Skills and Occupations extracted from the candidate's CV and also takes the Essential and Optional Skills of each Occupation available in the ESCO vocabulary. It then tries to match the CV with the Occupations through the common Skills of each pair and then returns the ones with the highest matching score based on a weighted average type of equation.

**UoL Recommender:** This module is a bit different from the other two in that it doesn't only depend on the Skills and Occupations extracted from the candidate's CV and the UoL's description but also depends on the statistical analysis performed on all the resources available in our database (CVs, JVs, UoLs) in order to recommend to the candidate the courses that will help him/her to acquire the Skills he/she needs to apply for the most popular JVs or for the JVs that fall into a specific job sector. In an example scenario, this module takes as input the Skills extracted from the candidate's CV as well as the most popular JVs according to the statistical analysis performed on the data available in our database. It then recommends to the candidate the courses he/she needs to take so that he can acquire the Skills he/she misses so that he improves his chances of being selected for this most popular position.

**Job Market Statistics:** This module provides the user with statistical information about the offer and demand of the skills in the job market. It is useful both to the job candidate and to the company as it helps them get an idea of the state of the job market (as extracted from the data in our database), and it can also help them make any adjustments to the CVs and the JVs respectively. An example of the information it provides are the overall skill demand, the overall skill offer and the overall skill offer from the UoLs.

**Training Path:** This module is a more sophisticated one as it combines two types of resources in our database (Jobs and Courses), in order to generate a training-carrer path for the job seeker. Specifically, what this module does is, it takes some of the jobs recommended to the user and it finds the courses he/she needs to take in order to acquire the skills he/she is missing. So in a possible scenario, the



candidate can enroll in some of this courses in order to acquire the missing skills and become a more suitable candidate for the respective job position.

### 3.2 Integration with APIs

The web application communicates with the back-end of our system with the two separate APIs that were described in previous deliverables. In the following table we present the basic interaction between each module of the web platform and the endpoints of the APIs mentioned.

*Table 16: Modules and APIs interactions*

Module	API Endpoints	Interaction
Job Recommender	94.23.0.7:80/extract_from_pdf?pdf_url= 94.23.0.7:80/jobs_suitable_for_cv?top_K=10 65.21.193.155:8787/job_recommender	This module takes as input a candidate's CV in PDF format. It then transfers this PDF to the first endpoint in the list that extracts the Skills & Occupations from it. Those info, are then given as input to the next two endpoints in the list in order to get the job recommendations, which are then returned to the user. Each job recommender endpoint has a different algorithm running from behind and that is the reason why there are two of them. This way, the user takes two lists of job recommendations such having a larger set of options to choose from.
Occupation Recommender	94.23.0.7:80/extract_from_pdf?pdf_url= 94.23.0.7:80/occupations_suitable_for_cv?top_K=10	This module takes as input a candidate's CV in PDF format. It then transfers this PDF to the first endpoint in the list that extracts the Skills & Occupations from it. Those info, are then given to the next endpoint in the list in order to get the occupation recommendations from it, which are then returned to the user.
UoL Recommender	94.23.0.7:80/extract_from_pdf?pdf_url= 65.21.193.155:8787/skill_set_uol_recommender	This module takes as input a candidate's CV in PDF format. It then transfers this PDF to the first endpoint in the list that extracts the Skills & Occupations from it. Those info, are then given to the next endpoint in the list in order to get

		the UoL recommendations from it, which are then returned to the user.
Job Market Statistics	<p>65.21.193.155:8787/get_overall_skill_gap</p> <p>65.21.193.155:8787/overall_skill_offer</p> <p>65.21.193.155:8787/overall_skill_training_offer</p> <p>65.21.193.155:8787/overall_skill_demand</p>	This module works without input as it works with statistical information extracted from the data in our CV, JV, UoL, ESCO database. The way this module works is, it calls each endpoint in the list sequentially to get the statistics it provides and it then returns those information to the user in an organized manner through diagrams.
Training Path	<p>94.23.0.7:80/extract_from_pdf?pdf_url=</p> <p>65.21.193.155:8787/training_path</p>	This module takes as input a candidate's CV in PDF format. It then transfers this PDF to the first endpoint in the list that extracts the Skills & Occupations from it. Those info, are then given as input to the next endpoint in the list which, as described in a previous section, recommends to the user a few training paths base on the job recommendations given to him from the previous models. Those training paths are presented to the user in an organized manner through a table.

## 4 Conclusion

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In this deliverable, we presented the analysis of the platform's requirements and design. In order to do that, we presented the use-cases and we defined based on the platform's requirements, and we also presented the basic features of our web application. We continued by describing the overall architecture of the web application we built along with its high level representation. Finally, we described in detail the modules that build apart the web application along with their workings and interactions both with the user, but also with the back-end APIs.

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