UniCareers Project Proposal

Keeron Huang, Libin Wang, Mingyan Gao, Yanzi Li[1]

[1]University of Illinois Urbana-Champaign

Keywords: Job Exploration, College Career, Education

1 | Summary

Our goal is to create a web app called UniCareers, designed to help university students find suitable jobs based on their personal skills and plan their study paths according to their ideal careers. The project consists of two main parts: Tree Diagram Visualization & Presentation and Course Matching Job Demo. The first part classifies career options into different levels, allowing users to explore suitable job opportunities in specific fields. We will use a tree structure for clearer data presentation, which is one of our key innovations. The second part connects courses to skills, and skills to relevant jobs, allowing for bidirectional querying—another major innovation. Students can explore potential career options based on their current courses or plan their study paths according to their desired career.

We aim to develop four core functionalities: Dashboard, Profile, Exploring, and Matching. For the Tree Diagram Visualization section, we will use real databases, including data from O*NET online[2], Kaggle[3], and user-submitted information. In the Matching part, we will utilize course information from the Course Explorer[1], specifically focusing on CS/ECE courses. Regular data review and cleaning will ensure the database remains functional and up to date.

2 | Description

Nowadays, there are many apps or websites powered by AI that allow people to search for jobs and contact employers, such as LinkedIn and Handshake. However, most college students still lack tailored guidance and need to explore research interests and career possibilities based on their personal majors and experience. Therefore, UniCareers is specially designed for college students to fill this gap. It provides a personalized platform where college students can discover potential career paths and related academic recommendations based on their personal interests and course selections.

The **Career Tree Path** enables students to explore potential jobs based on their interests and skills by organizing options into a structured hierarchy. This feature helps users identify relevant fields and job opportunities, allowing them to better plan their career trajectory. On the other hand, the **Course Matching Job Demo** enables students to explore the relationship between their core courses and corresponding job experience. By providing both forward and backward exploration, students can make informed decisions about their future academic and career paths.

2.1 Tree Diagram Visualization & Presentation

Before conducting personal **Tree Diagram**, users have to update their profile to include degrees and interests as tags/labels. Then, the system would pop up options from general industries to concrete job titles. Furthermore, links are provided for each specific job, including importance, salary, role, etc.

The tree diagram consists of four basic layers, using the international job code SOC to compute the initial filter. Then, we connect another dataset consisting of specific jobs to relevant SOC categories. Other than following a certain path, users can directly compare certain jobs, which will provide them with a deep insight and detailed descriptions of both jobs.

Besides, we would make a **Knowledge Graph** to mark the connections between specific jobs, showing different levels of certain jobs in specific fields. With the help of this graph, users could explore potential cooperation within a project group containing various jobs.

2.2 Course Matching Job Demo

Since there not exists dataset that directly connects courses to jobs, we chose UIUC Course Explorer as our dataset for our demo, specifically designed for ECE and CS students.

We will try to relate personal selections of core courses to various job options via the transformation with second-layer skills. That is to say, we connect courses along with prerequisite information with certain engineering skills. Then we combine certain skills with the requirements of specific jobs to make a match. Besides, we have decided to give suggestions for future MS or PHD advanced courses for Undergraduate students to achieve more advanced jobs. For example, suggesting to select CS588 Autonomous Vehicle Systems Engineering for CompE and CS students who are interested in AV Engineers.

3 | Functionality and UI

In our project, we propose to develop four core functionalities: **Dashboard**, **Profile**, **Exploring**, and **Matching**. Each function will correspond to a distinct page within our web platform. The **Dashboard** will serve as an overarching guide, assisting users in navigating our tools and accessing relevant information. The **Profile** feature is designed to enable the creation, updating, and deletion of users' basic information. The **Exploring** page will offer an interactive experience, guiding users in discovering their interests. Finally, the **Matching** function will connect courses, skills, and jobs, providing users with a reliable perspective on how their educational background aligns with potential career paths.

3.1 Dashboard

Once logging into the website, users would see the dashboard page. The **Dashboard** will serve as the central hub for users, providing an intuitive and comprehensive overview of all available features. It will include:

- **Navigation Menu:** Easy access to all main functions, such as **Profile**, **Exploring**, and **Matching**, ensuring seamless transitions between pages.
- **Quick Links:** Shortcuts to frequently used resources, such as Linkedin Page or Handshake Student Page.
- **Favorites:** A section that records users' favorite working areas and jobs, helping them keep track of their interests and preferences.
- **Help Section:** Access to demo tutorials and support options to assist users in making the most of the platform.

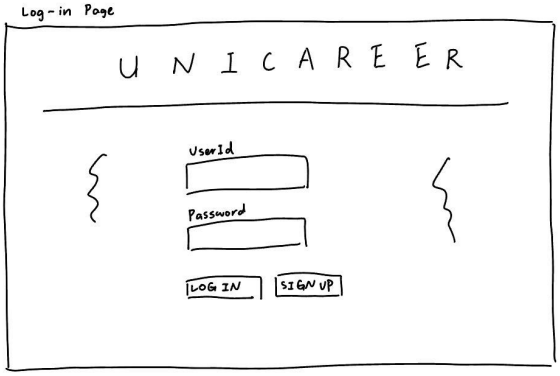

Figure 1: Log-In Page

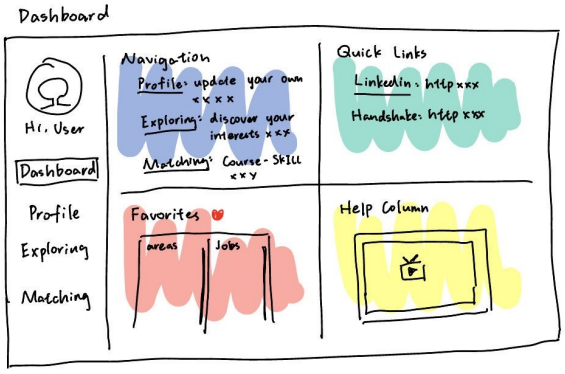

Figure 2: Dashboard Page

This design ensures the **Dashboard** remains user-friendly while providing a comprehensive overview of the platform's capabilities.

3.2 Profile

Upon clicking the **Profile** icon, users will be directed to their personal profiles. These profiles will contain essential information such as age, school year, GPA, education, skills, and experience. Users will have the right to create, update and delete these basic informations. Using this data, the system will generate a rating that enables users to gauge their level of competitiveness.

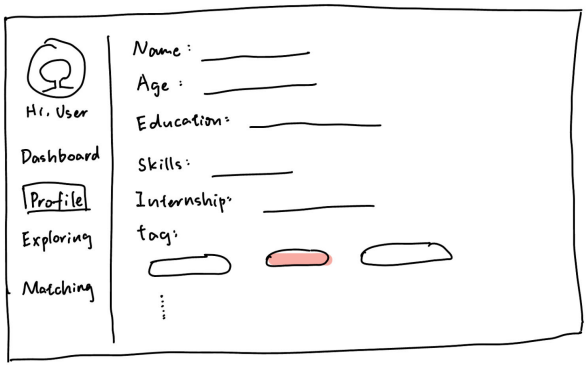

Figure 3: Profile Page

3.3 Exploring

By clicking the **Exploring** icon on the left, users are directed to a page featuring a variety of major career options. After selecting their preferred choices, additional branches will expand from these main topics. Through several rounds of selection, users will ultimately discover their ideal careers along with specific job details, such as salaries and work styles. Besides the relation tree, there is also a search bar enabling users to search for a specific work type, which also will be matched to a node in tree branches.

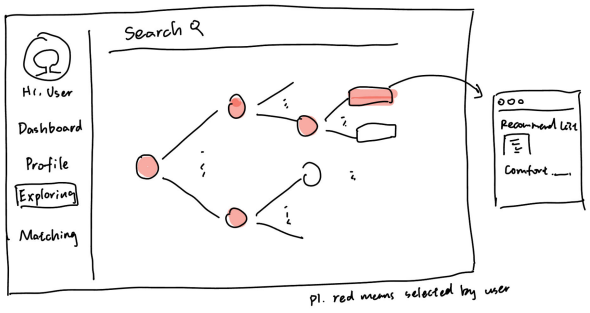

Figure 4: Exploring Page

3.4 Matching

Our goal is to guide college students in their career journeys by linking them to their foundational experiences in education. In this feature, users can input the names and IDs of courses they have completed to receive job suggestions that align with the skills acquired in those courses. Additionally, students can provide feedback to help us refine the connections between courses, skills, and jobs. Considering that there might exist some freshmen who intend to pursue a job but don't know how to plan the courses, the system will also provide learning route recommendation for users.

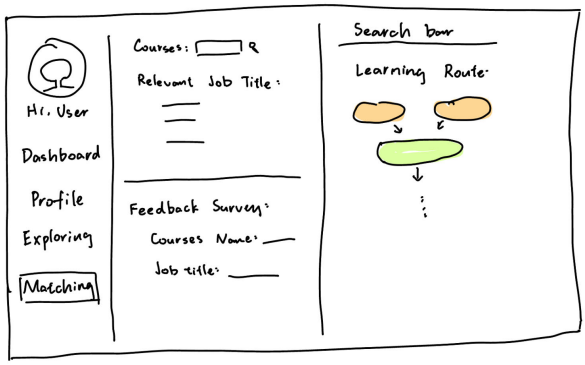

Figure 5: Matching Page

4 | Usefulness

Although job-seeking websites like LinkedIn and Handshake offer recruiting information for a broad audience, they do not specifically address the unique needs of college students who often face uncertainty about their future career paths. Our platform is designed to fill this gap by focusing exclusively on college students. Unlike traditional job sites, we emphasize career exploration rather than direct recruitment. Our project includes features such as creating and updating profiles, identifying areas of interest from general to specific and attaining recommended job list, as well as mapping courses to jobs that require similar skills. In summary, our web project is a valuable tool for helping university students navigate their career options and identify suitable job opportunities.

5 | Dataset Details

In order to build a job introduction and recommendation app for users, we decided to obtain some real datasets from the Internet as a way to provide the necessary information and functional support for our app.
We plan to categorize our datasets into the following categories:

5.1 Job Information Dataset

Source: Our group plans to obtain these databases from the Occupational Statistics and Analysis website. The databases we currently plan to use are O*NET online and Kaggle. The former one is an occupational database developed and maintained by the U.S. Department of Labor, providing comprehensive occupational information. While the second one is an online platform for data science and machine learning, which offers massive open datasets across multiple fields.

Content: Includes basic information about the occupation (Job title, Job description, Skill requirements, etc.), salary range and employment outlook.

Format: Data is provided in XLSX/CSV format for easy import and processing.

- **O*NET Online**
  This dataset contains very detailed descriptions for various jobs. For each job, the website can provide detailed information relating to the job, like Tasks, Tools Used, Work Activity, etc.

  Taking computer programmer as example, there are corresponding hyperlinks: ***Task Tools Used***, ***Work Activity***

  Also, jobs are categorized with **SOC (Standard Occupational Classification)** in this website. It categorizes all occupations into multiple layers, ranging from broad occupational classifications to very specific occupations. There four layers in SOC, from large to small, are 'Major Group', 'Minor Group', 'Broad Occupation' and 'Detailed Occupation'. These categories are verified by a 6-bit SOC Code. This can be a blueprint for our 'Tree presenting' design, which means we can categorize occupations based on SOC and maybe improve the standard more detailed.

SOC	Major Group
11-0000	Management Occupations
13-0000	Business and Financial Operations Occupations
15-0000	Computer and Mathematical Occupations
17-0000	Architecture and Engineering Occupations
19-0000	Life, Physical, and Social Science Occupations
21-0000	Community and Social Service Occupations
23-0000	Legal Occupations
25-0000	Educational Instruction and Library Occupations
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations
29-0000	Healthcare Practitioners and Technical Occupations

Figure 6: SOC Code(part)

- **Kaggle**
  This website is a very detailed database having many occupations in real-life. We are going to use this database as "real-life example list" for the categorized jobs above. For each job, the attributes are various and comprehensive(shown below), such as Job title, Company size, Role, etc. However, some of the attributes aren't very useful for our app, such as the latitude and longitude of the work place. We may need to delete or modify them in later stages.

  We have selected the jobs in USA right now, and the current database from Kaggle contains **7432 tuples** and **17 attributes**.

Salary Range	location	Work Type	Company Size	Job Posting Date	Preference	Job Title	Role
$59K-$117K	Washington, D.C.	Temporary	126334	2023/6/7	Male	Network Engineer	Wireless Network Engineer
$57K-$117K	Washington, D.C.	Intern	35869	2021/9/23	Both	Landscape Architect	Urban Planner
$63K-$90K	Washington, D.C.	Intern	80163	2023/5/20	Both	UX Researcher	UX Strategist
$55K-$124K	Washington, D.C.	Intern	79017	2023/3/19	Both	HR Coordinator	Benefits Coordinator
$65K-$91K	Washington, D.C.	Intern	65144	2022/11/2	Female	Landscape Architect	Environmental Designer
$56K-$87K	Washington, D.C.	Part-Time	49989	2022/6/21	Female	UX/UI Designer	User Experience Designer
$55K-$110K	Washington, D.C.	Contract	131825	2023/5/23	Female	UI Developer	Front-End Developer
$56K-$99K	Washington, D.C.	Full-Time	127065	2022/4/10	Female	Event Planner	Wedding Planner
$62K-$90K	Washington, D.C.	Part-Time	21532	2023/6/17	Male	Interior Designer	Residential Interior Designer
$55K-$126K	Washington, D.C.	Intern	40540	2022/11/12	Male	Art Teacher	Fine Arts Instructor
$63K-$101K	Washington, D.C.	Full-Time	39614	2022/5/30	Both	Systems Administrator	Database Administrator
$58K-$112K	Washington, D.C.	Contract	47942	2022/7/21	Female	Psychologist	Research Psychologist
$55K-$116K	Washington, D.C.	Temporary	48548	2022/3/27	Both	Account Executive	Sales Account Executive
$61K-$93K	Washington, D.C.	Full-Time	14317	2022/9/18	Both	Environmental Consultant	Environmental Impact Analyst
$58K-$114K	Washington, D.C.	Contract	120875	2021/10/28	Both	Graphic Designer	Print Graphic Designer

Figure 7: Datasets from Kaggle(part)

To combine our two databases together, we need to link the SOC occupations with the real-life jobs. This means we need to get the 6-bit SOC Code for each 'Job Title' in Kaggle. Fortunately, we have found an online 'Code Connector' to achieve this functionality.

5.2 User Data

This part of the data will be generated through our application during user registration and usage. For example, when a new user registers for the app, we will collect basic information about the user (e.g. Age, Education degree, Interests, etc.). Therefore, we can automatically provide users with more precise careers based on the 'Profile'.

5.3 Course Data

As mentioned in Section 3.2, our app tries to explore the relation between courses and jobs for UIUC students. We plan to link UIUC courses to jobs through a logical relationship like "course-to-skill, skill-to-job". While 'Job Information Data' help us deal with the "skill-to-job" link, the rest of the dataset need to be focused on relations between courses and skills. So, we choose the **Course Explorer** website of our college.

One difficulty is how to find skills behind each course. Our group decide to use the titles of courses to represent the corresponding skills. While for some high-level courses, we noticed that most of them had prerequisite courses for the corresponding requirements. Taking Course CS411 as an example, the prerequisite course is CS225. Therefore, we currently consider that for courses with 300+ level, we need to traverse and include their prerequisite to determine the relating skills. What's more, if the job requires M.S. or PHD degree, we will consider 500+ level courses.

6 | Data Management Strategy

To keep the amount of data in our app at a reasonable level, our group also plans to regularly review the app's data and clean up some of the data that has remained unchanged for a long time.

At the same time, since the app involves user registration, it is important to protect basic user information: On the one hand, the user data collected by the app should be "minimized" and only necessary user information should be obtained. On the other hand, we can also encrypt the user information on a technical level: for example, in the case of data transmitted over the Internet, both incoming and outgoing data are encrypted using TLS to prevent the data from being intercepted during transmission. In addition, there are international standards for information security such as **ISO/IEC:27001**, which can also provide guidance for our data protection.

By using the above datasets and data management strategies, our app aims to provide a personalized service to each user, helping them discover suitable career paths and plan for the future.

7 | Creative Component

Our project has two main innovations: Tree Diagram Visualization and Bidirectional Linking between Jobs and Courses.

7.1 Tree Diagram Visualization

The tree diagram visualization allows users to clearly see the relationships between different fields and jobs, giving them a clearer understanding of the content of their target careers. We will integrate databases with different classification standards, forming a multi-level hierarchical structure. Users can continue to filter by selecting specific branches of the tree, and in the final layer, we will provide all relevant job listings that meet their criteria.

7.2 Bidirectional Linking between Jobs and Courses

For the bidirectional linking, we will first summarize the skills required for specific jobs. We will then extract course descriptions from advanced courses (e.g. starting with '3') in the Course Explorer and connect them to specific skills, creating a bidirectional link. This enables users to search for job opportunities based on the courses they have taken or plan to take. Correspondingly, they can find the desired course list by inputting their ideal future career. We will return all necessary courses, including prerequisites based on Course Explorer's prerequisites restrictions, allowing students to easily plan their study path while acquiring the skills needed for their future careers. This will improve their competitiveness by equipping them with the essential skills for their desired job.

8 | Project Work Distribution

Generally, we have divided the project into three parts based on functionality and workload: the first part includes Dashboard and Profile, the second part is the Exploring, and the third part is Matching. Two team members will complete the Exploring section, while the other sections will be handled by one team member each. This work distribution is not strictly fixed, and we will make adjustments based on the actual complexity and workload as the project progresses. Flexible arrangements and some overlap in tasks may occur.

Dashboard and Profile: Mingyan Gao
Frontend testing, creating pages involving user profiles and Dashboard, Tree Diagram Visualization, Web Page Design

Exploring: Keeron Huang, Libin Wang
Backend, User Tracking and Database Management, Dataset Integration, Multi-level Hierarchical Structure Design, Unit Testing

Matching: Yanzi Li
Middleware, API Management, Ensuring that front End matches with Backend, Bidirectional Linking Design

References

[1] University of Illinois. Course explorer. `https://courses.illinois.edu/`. Accessed: 2024-09-17.

[2] O*NET Online. O*net online. `https://www.onetonline.org/`. Accessed: 2024-09-17.

[3] Ravindra Singh Rana. Job description dataset. `https://www.kaggle.com/datasets/ravindrasinghrana/job-description-dataset`. Accessed: 2024-09-17.