COMP4801 Final Year Project

FYP19063

AI Student Advisor

Project Plan

MO HAO RAN (3035366403)
CHAU WING YU (3035377660)

Supervised by Dr. T. W. Chim

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Abbreviation

AI	Artificial Intelligence
BEng	Bachelor of Engineering
CS	Computer Science
HKU	The University of Hong Kong
IT	Information Technology

1 Background

This project aims to create an online platform that contains an AI student advisor which can give tailor-made feedbacks and suggestions to Computer Science students in the University of Hong Kong. In relation to this, this section will briefly discuss the problems faced by most CS students in HKU and some existing solutions with respect to these problems.

1.1 Problem Statement

In the age of rapid technological advancement, CS spans a range of topics from theoretical studies of algorithms and the limits of computation to the practical issues of implementing computing systems in hardware and software [1]. For CS undergraduate students yet to choose a particular field for further study and future career, they should do so after knowing what are the options open for them. With respect to the subject-matter, the BEng in Computer Science programme offered by HKU aims to expose students to a wide range of topics within CS.

However, according to the syllabus, students are only required to complete 6 disciplinary elective courses (equivalent to 36 credits) to fulfill the graduation requirement. Given that the CS department at HKU is offering around 30 disciplinary elective courses in 2019-2020, only enrolling into 6 of the courses is obviously insufficient for students to have an all-round understanding of each CS sub-fields.

In addition, the current methods for CS students to get advice in the university, namely referencing statistics from unofficial websites and listening to seniors student's advice, cannot effectively help students make correct decisions. The reason behind is that those online statistics are not useful enough and the seniors' advice are not universally applicable.

As a result, there are 2 questions being asked frequently by CS students:

1) ***"What courses should I take to stand out when applying for a particular job?"***

2) ***"What jobs should I apply if I am interested or got good grades in some particular courses?"***

In light of this situation, this project aims to build a platform that utilizes artificial intelligence technologies to give course and career suggestions to students according to their own career paths, interests and academic results.

1.2 Previous Work

There are existing projects with similar ideas of producing an online academic advisor, but the technologies used and the main areas of concern are different. These projects include GPA.AI and UM-IBM SAPPHIRE PROJECT.
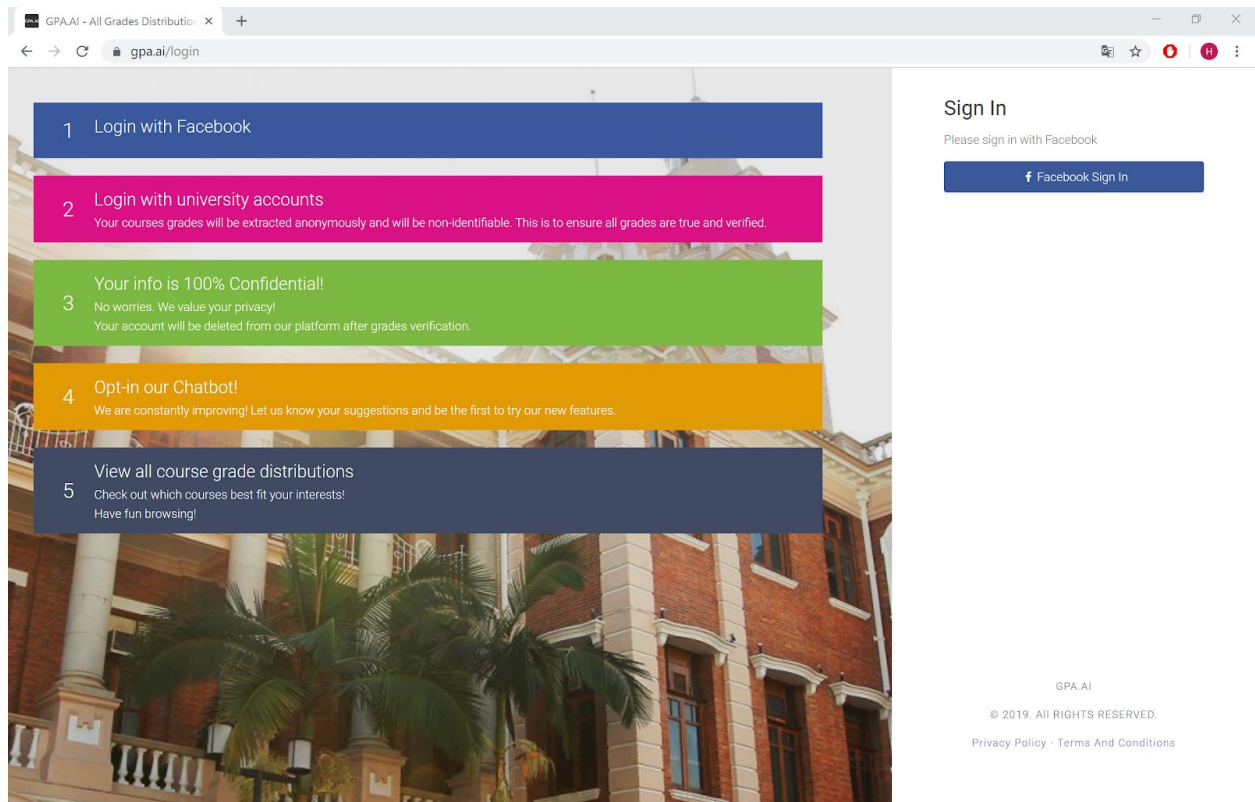

Figure 1. GPA.AI registration page

The GPA.AI project aims to provide all distribution of course grades in the university for the user. User is required to complete a registration progress by providing Facebook and university accounts. After that, GPA.AI will use the user's information to login to the university portal to check the user's course grades. Then, the user can use the chatbot feature to give some suggestions on the service. Finally, the user can also view all the course grade distribution.

Although GPA.AI can provide accurate data by directly logging in users' university portal system, there are obvious shortcomings making it a bad choice of online academic

advisor — it only shows the data without any processing or interpretation. Students might, for instance, be misled to choose courses which statistically provide good grades. However, those courses might not suit some of the students who have strengths in other areas. In addition to unprocessed data, there is a severe security issue since the users are required to directly hand in their username and password for processing. Realistic potential of information leakage might discourage users to use it.
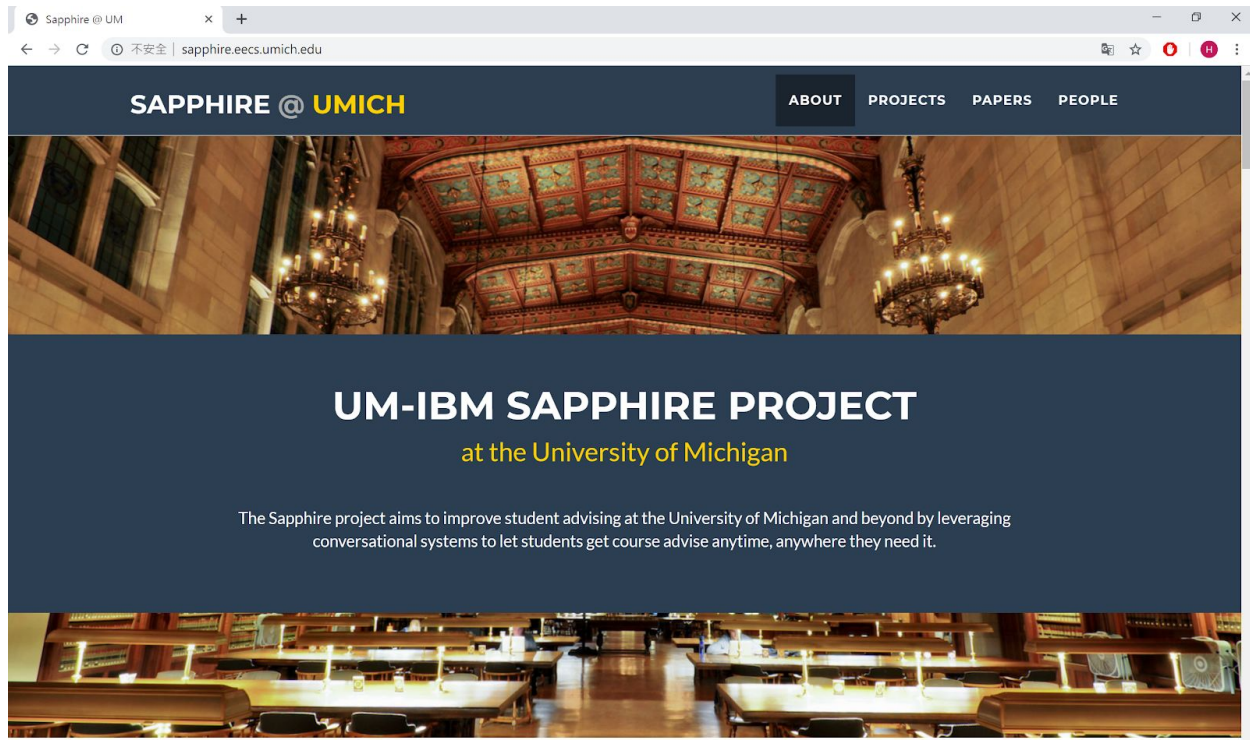

Figure 2. UM-IBM SAPPHIRE PROJECT homepage

The UM-IBM SAPPHIRE PROJECT in 2017 aimed to develop an AI student advising system. It adopted the method of AI personal assistance, allowing students to seek advice from the system verbally by converting their voice into corresponding SQL query to get data from the database and reply to the user [2]. However, this project focused more on the investigation of using AI technology in speech-to-text conversion and text-mining, while our project's primary goal is to give better advice to students in order to help them to make a better decision in course selection and career development.

2 Scope

The scope of this project would be limited to HKU CS courses and CS-related career paths (e.g. conventional information technology specialist, system analyst and computer forensic examiner).

The study deliberately excludes other non-CS engineering students in HKU because they can usually make informed choices while selecting courses since there are clear requirements for being a chartered engineer or registered professional engineer. Take civil engineering students in HKU as an example, they can get clear reference from HKIE website while choosing elective courses. If they want to get registration onto HKIE Scheme "A" Environmental Discipline after graduation for instance, they must take CIVL3107 during their study [3]. Similar guidelines are also provided in other engineering streams except the field of Computer Sciences.

As a result, CS students may comparatively face more difficulties in choosing electives as while there isn't any general post-graduate professional qualification, some job position still requires specific technical skills such as data analysis or database management. Therefore, it is important that there is a way to link course content to job relevant skills and provide course selection advice to CS students based on their prospective career.

3 Objective

This project aims to provide a platform for students to get academic advice regarding course selection and career planning. In order to attain the aim, our project will mainly focus on the objectives below:

- Develop a chatbot with deep learning that helps students with course selection and finding ideal career path.
- Maintain a database with course information and related job post.
- Provide a platform for users to get the latest news in the industry from alumni and academic advice from peers.
- Provide a user-friendly graphical user interface to display course selection advice.

Comparing our project with previous works mentioned above, our focus is on *what advice can students possibly obtain from AI* in contrast to "how" AI give academic advice to students by some previous works.

4 Methodology

The technological choices and how the application will be built will be covered in this section. Database, website and features are carefully designed with the criteria of fitting the purpose of this project, compatibility with the respective platforms, stability and community size.

4.1 Data Collection and Storage

To find out the relationships between courses and job positions, this project will link them up in accordance with **computer science topics**. With reference to CosmoLearning, there are 18 topics in CS [4]. Therefore, **two kinds of questionnaire** will be designed and sent to course coordinators and HKU CS alumni separately. The first will be used to find out what topics are involved in each CS course and their corresponding level of correlation (strong, moderate, weak). The second will be used to find out what topics are involved in each alumnus' job position and their corresponding level of correlation (strong, moderate, weak). The reason of choosing HKU CS alumni is that their response rate of similar questionnaires were much higher than others with respect to past experience. Also, it has been shown that alumni would provide more accurate information than others [5].
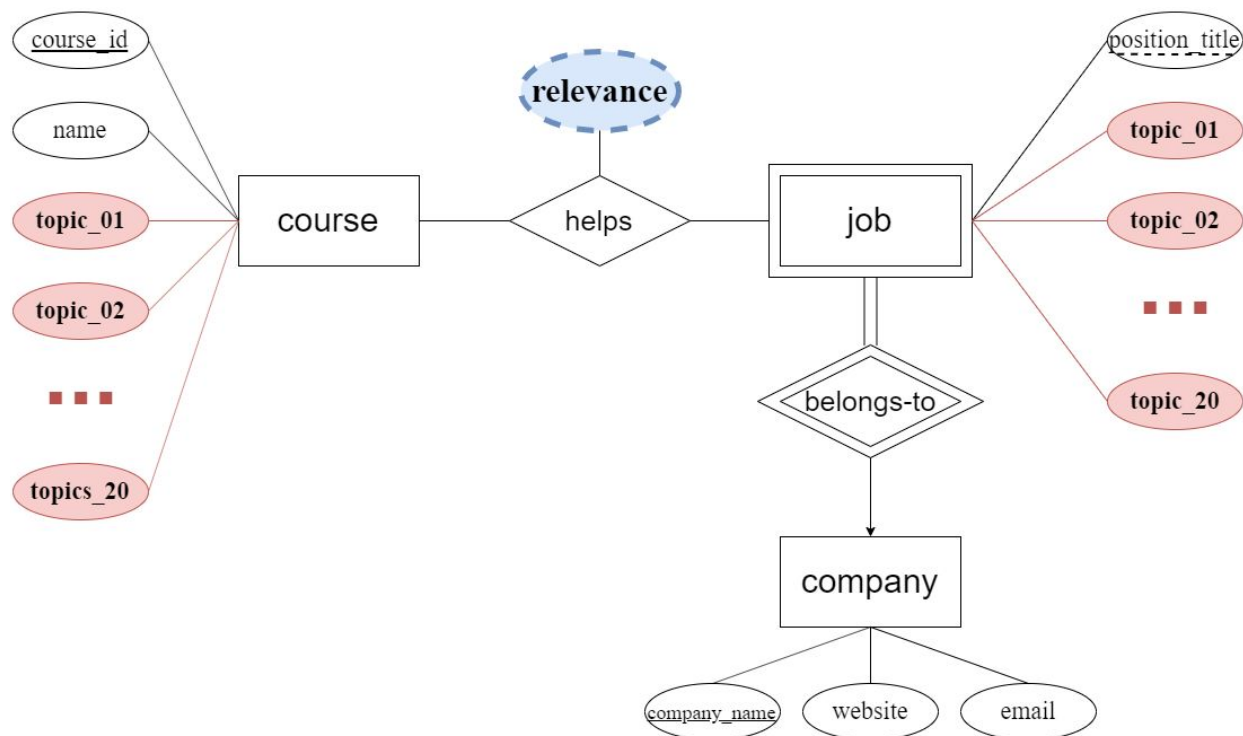

Figure 3. Entity Relationship Diagram of Database

The collected responses will then be stored in a well-designed database (see Fig. 3) which aims to be easily accessible and manipulated for the calculation of **course-job-relevance** shown below. By using the calculation, whenever a user specifies a job in a company, our system can easily prioritize the courses and show the result, and vice versa.

Course-Job-Relevance

$$\sum_{i=01}^{20} (\text{Rating of topic\_i of Course} * \text{Rating of topic\_i of Job})$$

(Rating: Strong=1, Moderate=0.5, Weak=0)

4.2 Website Design

Website is used as the presentation format of this project, which all features will be integrated into a website after development because it by far outperforms mobile in terms of its presentation of texts. Users hence may chat with the chatbot and complete the interest test in a more comfortable manner. By using website format, it can also be easily accessible on mobile as we would adopt responsive layout design.

To achieve a responsive web page design, we will use Bootstrap and AngularJS as CSS and frontend framework respectively.

Bootstrap is chosen because it adopt responsive structure so that with predefined terms inserted in HTML and CSS, the website can display according to the browser size providing a user friendly interface. The grid system of Bootstrap also simplified the design work of the website as it supports responsive tiers so that with one HTML file, we can fit in both desktop and mobile display.

AngularJS is used because it is a model view controller structured framework with great community support since it is a comparatively old framework which is compatible with various web browsers.

Considering the backend part, we use Node.js and MongoDB as the backend framework and database management. Node.js is used because it is based on javascript so that both frontend and backend can write in one language and almost all web browsers support javascript. Also, it handles simultaneous request more effectively so that it provides a better performance for the forum feature. MongoDB is used with

Node.js since objects in MongoDB are binary JSON therefore it is simpler to access it by javascript.

4.3 Supporting Features

4.3.1 AI Chatbot

The first feature included in the website will be a chatbot. It allows user to interact with it in a natural way so that users can get the information they want without reading a bunch of text and data. For example, when students want to know what jobs are related to the courses they have taken, they just need to enter the course code and ask the chatbot instead of checking them in a document or database one by one.
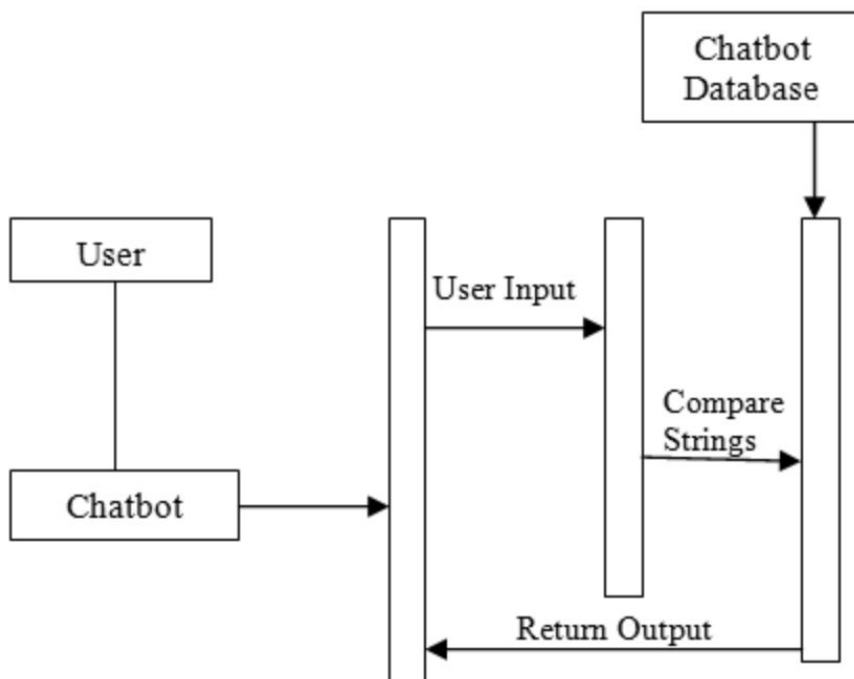

Figure 4. Design of the Chatbot [6]

Fig. 4 demonstrates the exact design of the chatbot. It will be implemented by Tensorflow because it has a great deal of examples and tutorials online. In addition, our team are most familiar with its best support language, Python.

4.3.2 Discussion Forum

The second feature is a discussion forum for professors, students, and alumni. It aims to facilitate peer discussion on major or course enrollment topics and the interaction between current students, alumni, and professors. On top of that, students can acquire the latest news in the IT industry posted by professors or alumni.

4.3.3 IT Interest Test

The third feature is a personality test in IT career. It is a fun and effective means for students to discover the most suitable IT career pathway determined by their interests, thought-processes, and personality. This is meant to help them identify their strengths and match them up with a specific IT pathway. Certain job details are also shown, namely job titles, descriptions, and salaries.

The test consists of 9 sections. Each section has 10 statements. Users are required to complete each section by choosing statement(s) which accurately describes them. If they are unable to identify themselves with any of the statements, space should be left blank. At the end of the quiz, results will be shown.

The rationale of this test is that each section represents a kind of intelligence. All 10 statements are describing the same intelligence in different ways and situations. As a result, users can know what intelligence they got with the corresponding scores (from 0 to 10). Lastly, job suggestions will be listed according to each intelligence at the end of the quiz.

5 Limitations

In this section, the challenge which cannot be solved at this moment will be discussed. Together with the scope, they act as a reference frame against which proposed features and requirements changes can be evaluated.

5.1 Accuracy Problem

The course-job-relevance might be challenged for its accuracy as collected responses might not give a well-evaluated observation. This is because students can only discover the correlation between the selected courses and a particular career position after they actually work in the company. Therefore, the platform heavily relies on feedback from students who have worked a while after their graduation, say, 1 years. Hopefully, solutions can soon be proposed when this project comes to the next stages.

6 Project Schedule

September 2019	- Research on Conversational Chatbot - Detailed project plan - Project web page **Deliverables of Phase 1 on 29 September 2019**
October 2019	- Collect data from alumni - Scrape data from course outlines and job search engines
November 2019	- Preprocess collected data - Prepare database
December 2019	Implement first deep learning model for the chatbot
January 2020	- Develop forum feature - Interim report **First Presentation on 13 – 17 January 2020**
February 2020	- Modify chatbot model based on interim evaluation - Develop the website **Deliverables of Phase 2 on 2 February 2020**
March 2020	Integrate web forum feature and chatbot
April 2020	- Final report **Deliverables of Phase 3 on 19 April 2020** **Final Presentation on 20 – 24 April 2020**
May 2020	**Project Exhibition on 5 May 2020**

7 Conclusion

The difficulties regarding course selection faced by CS students can be solved by building up a database with information about the linkage between course content and future career. Using the database and by building a communication platform for alumni and current students, this project can provide suitable advice to students according to their own interests and abilities.

8 Reference

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