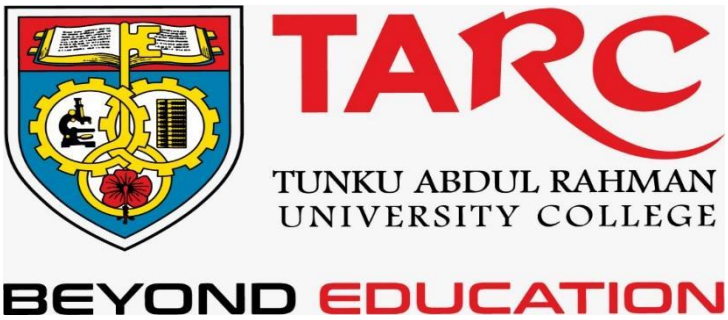
# Web scraping and data analytics (ranking, sorting and student activities) for UIP databases.

By

Kong Mun Jun




FACULTY OF COMPUTING AND
INFORMATION TECHNOLOGY

TUNKU ABDUL RAHMAN UNIVERSITY COLLEGE
KUALA LUMPUR

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# Web scraping and data analytics (ranking, sorting and student activities) for UIP databases

By

Kong Mun Jun

Supervisor: Dr. Lim Siew Mooi

A project report submitted to the
Faculty of Computing and Information Technology
in partial fulfillment of the requirement for the
Bachelor of Computer Science (Honours) in Data Science.

**Department of Computer Science and Embedded Systems**
Faculty of Computing and Information Technology
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Kuala Lumpur

# Declaration

The project submitted herewith is a result of my own efforts in totality and in every aspect of the project works. All information that has been obtained from other sources had been fully acknowledged. I understand that any plagiarism, cheating or collusion or any sorts constitutes a breach of TAR University College rules and regulations and would be subjected to disciplinary actions.

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Kong Mun Jun

**Bachelor of Computer Science (Honours) in Data Science**

ID: 20WMR08867

# Abstract

In this Cenozoic era, graduating from University is like a standard procedure for getting a diligent job in the society. University also getting more in numbers and became common for students to achieve their high level studies in every industry. However, informations from every university's website are rarely standardize and some even fragmented which had caused the third party such as students and parents had their hard time to do researches with every single university. This phenomena will bring students into an unfavorable situation where they might choose the wrong university for themselves due to the difficulties in investigating the aspects and beneficial in each university.

This project is aimed in developing for educators in Universities to convert their areas of expertise into prototypes, curriculum, industry-friendly collaboration models and develop new areas of research with AI-enabled engine. This project will discover each educator and his/her specialisation and achievement, then create a personalised AI expert system.

# Acknowledgement

I would like to give my greatest gratitude towards my supervisor, Dr. Lim Siew Mooi for giving me a chance to assist and contribute to this high potential Artificial Intelligence (AI) company, MyFinB for doing an industry project for this company. I also very much appreciate Dr Lim for giving me and my partners, Lee Kah Wei, Chin Qian Ying, Ng Yi Xuan, Koay Mei Siew, Eng Kay Tze and Lee Wei Kang, a lot of guidance in helping each of us in this FYP project. Furthermore, I also would like to thank the MyFinB team who gave a lot of guidance and fantastic ideas in this project.

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# Chapter 1

# Introduction

# Introduction

This project is involved in big data analytic to help universities and industries in creating a linked connection between Universities, Industries and Investors. With the connections, the published researches and uncommercialized patents from the universities able to seen by the investors and industries to turn these universities works become commercialised in the community. The data sets used by this projects involves the details of Universities, the governments, and et cetera.

This project includes functions such as data crawling from various websites, segmenting raw data into data clusters and insert into an online database. These functions are handling by 2 groups which involve with 7 different teammates.

## 1.1 Background

MyFinB (MFB) is one of the award-winning AI company that frequent plays a role of an AI-as-a-Service (AIaaS) platform for various industry. They focus on building new proprietary analysis platform with excellent tools that able to transform structures and unstructured data into a readable and user-friendly format for the third party.

## 1.2 Problem Statement

With these loads of universities in Malaysia, it takes time for third party such as the teenagers, parents and lecturers to explore and do researches of the universities with every aspects such as the Courses, Subject material, Social activities, Portfolios and et cetera. However, it is found guilty that the information that we can find in websites of most universities are counted as fragmented information which are all broken pieces of data that are not close together. Some universities even irresponsible to update their university information to the latest such as the alumni of the university and facilities developments. Therefore, these fragmented data became the core problem of third party having difficulties in getting true real-time information.

This core problem, the fragmented data issues in every university had effected two main phenomena in the society. The phenomena could easily discovered are the third party had hard time to produce a better choice in targeting the most suitable university for every individual. Feedbacks of every subject from every student will always collect from the universities after every semester. However, the feedbacks are disclosed by every universities

which actually the feedbacks are very vital to the third party as they able to feel the true learning environment from the feedbacks of the students. Websites and advertising will always show the best from their facilities but feedbacks will show the true feeling towards the surrounding. Thus, It is possible for students to remain anonymous and providing feedbacks in the surveys or forums to show the true experience received from the universities

The second phenomena is the connection between the industry, universities and investors is weak which happens to categorized as part of the fragmented data. It is to believe that every universities have numerous of published researches and non-commercialized patents that need more engagement and adoption by the industries. Moreover, technology is getting more contact with the methods in teachings of educators which change the norms in students learning experience. Hence, industries needs to have a strong connection with the educators to ensure the enhanced learning scope and contents to be learnt by the students in universities.

## 1.3 Company Background of Industry Collaborator

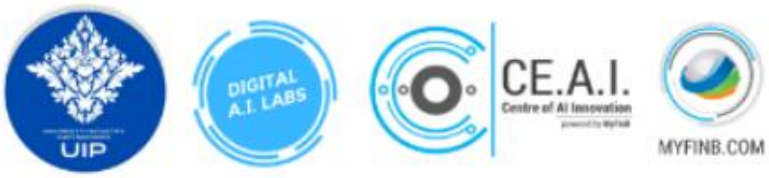


Figure 1.3.1 UIP, CE.A.I., and MyFinB Logo

MyFinB is a risk analytic platform that uses artificial intelligence to process assessments and insights to the users and industries. With the big need of Artificial Intelligence in next few years, they start providing a platform by gathering all different patents and researches for a efficient way to community and investors to understand and look through all educations data.

## 1.4 Project Background

The characteristics of this project is based on analysing a huge amount of various universities data that look meaningless and turn them into meaningful by segmentation which able to assist in findings insights from the informations of universities.

### 1.4.1 Problem Statement

With these loads of universities in Malaysia, it takes time for third party such as the teenagers, parents and lecturers to explore and do researches of the universities with every aspects such as the Courses, Subject material, Social activities, Portfolios and et cetera. However, it is found guilty that the information that we can find in websites of most universities are counted as fragmented information which are all broken pieces of data that are not close together. Some universities even irresponsible to update their university information to the latest such as the alumni of the university and facilities developments. Therefore, these fragmented data became the core problem of third party having difficulties in getting true real-time information.

This core problem, the fragmented data issues in every university had effected two main phenomena in the society. The phenomena could easily discovered are the third party had hard time to produce a better choice in targeting the most suitable university for every individual. Feedbacks of every subject from every student will always collect from the universities after every semester. However, the feedbacks are disclosed by every universities which actually the feedbacks are very vital to the third party as they able to feel the true learning environment from the feedbacks of the students. Websites and advertising will always show the best from their facilities but feedbacks will show the true feeling towards the surrounding. Thus, It is possible for students to remain anonymous and providing feedbacks in the surveys or forums to show the true experience received from the universities

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learning experience. Hence, industries needs to have a strong connection with the educators to ensure the enhanced learning scope and contents to be learnt by the students in universities.

### 1.4.2 Target Market

The target market of this project are the Universities researchers, the academic community, Centres of Excellence of Universities, Government agencies and Ministries, SMEs and Corporation in 15 industry Groups, Investors, and Undergraduates and Postgraduate students.

1. University researchers and the academic community

They plays a role of contributing and sharing their research or patent ideas to the platform as the platform tends to accept as much as possible of researches and patents to display and commercialise the education materials to the public

2. Centres of Excellence of Universities

Centres of Excellence in Universities are targeted as they could assist the project outside of the platform to filter out the best team of experts to help out with the researches or the uncommercialised patents.

3. Government agencies and Ministries

Government are one of the target market as we aim to get the attention of the government so that the agencies and ministries willing to plan it as part of their project for the future industries and education institutions for a better wisdom level in the country.

4. SMEs and Corporations in 15 industry groups

Small Medium Enterprise plays a role of invest into various patents to be part of the contributors and use the patent technology or ideas in the community for the increment of their business and economics.

5. Investors (venture capitalists and private equity groups)

We need investors as the platform are a long lasting project and platform for the education community. Cannot be denied that minority of the researches or patents need long lasting equity to continue and succeed in their researches. Hence, Investors from venture capitalists and private equity groups are one of the target market we would capture.

6. Undergraduates and Postgraduate students

We would like undergraduates and post-graduate students to be part of the platform as they could easily find their interest researches from the platform and build up their passion from it. They also able to analyse the universities from the activities and information from the platform and make a good decision to pursue their studies in a right university institutions.

### 1.4.3 Competition / Contribution

Currently, similar purpose and characteristic platform does not exist yet in Malaysia which are dedicated for academic researcher to have a collaboration with various industries. However, other comparable aspects that are unforeseen would be the accelerators and incubators that are catering more when the start-ups phase.

The comparison will be used during competing will be the difference of UIPFuture platform and other accelerators and incubators platform. UIPFuture platform also will be juxtaposed with Crowdsourcing platform as they plays a role of inviting expertise into various projects.

The UIPFuture platform is purely contributing for academic researchers and lecturers in every Universities that are collaborating with.

## 1.5 Objectives

The Objectives of the project is obvious as below:

a. To crawl various information from websites into excel
b. To create a software which act as a centralized database to store every information related to the universities.
c. To extract all data from excel into a centralized online database
d. To provide a platform to gather all informations of universities
e. To provide a convenient, efficient and accurate visualisation results to the third party.

### 1.5.1 Project Related Questions

1) What is the quantity and the quality of the sources can be collected from every university?
2) What will be the main focus of the students when making decision?
3) Will the platform be accurate for the academic researchers when making decision?
4) How to retrieve information from institutions that insist in disclosing their information?
5) How fast will the system be respond and finish analyse the results?

### 1.5.2 Project Aims and Sub-Objectives

The project aims is to provide a convenient platform for academic researchers' universities researches and uncommercialised patents bring into the real life and various industries to be commercialized.

The project sub-objectives are as below:

a. To improve the skills of webscraping websites and extract from codes instead of displays.
b. To bring up the work and contributions of educators' researches.
c. To simplify the workflow and figure out the effectiveness of the platform.

## 1.6 Project Scopes

In this project, UIPFuture will be developed and during the development phase, several works and scope in this research will be focused as follow:

### 1.6.1 Dataset

The dataset will be used in this project are the set of data of every important information in every higher level study institutions, industries and government agencies.

### 1.6.2 Programming Language

The programming language that we will be using are HTML, CSS, JavaScript, Python, Php and Laravel. HTML, CSS and JavaScript will be used to assist in building user interface; Php and Laravel will be used to build the database; Python will be used to scrap data and analysis.

## 1.7 Project Plan

UIP, an AI-as-a-Service (AIaaS) platform will be built for educators in Universities to convert and commit their areas of expertise into prototypes, curriculum, industry-friendly collaboration models and develop the new areas of research with AI-enabled engine.

UIP will be created and designed to showcase every select UIP researches with various categories into one single platform. All researches will be categorised as Agriculture, Board Reporting, Business and et cetera. In the platform, user will able to explore the UIP projects based on their interest.

The project also will be undergo with 4 phases as below:

### 1.7.1 Phase 1 Research and Prototypes

Various researches are selected and prepare to insert into the platform to have a chance of joint collaboration with industries and develop a research prototype from the research itself. The researchers will have the opportunity to co-own the prototype when it is developed.

### 1.7.2 Phase 2 Website Scrapping Module

During this phase, we will scrap all information we need from the Universities, Government Agency and Industries. It is needed to understand more the connection between three of them to build a highly-usable platform.

### 1.7.3 Phase 3 Data Segmentation Module

In the phase, we will be gathering all data we got from phase 2 while we create a centralized online database to insert all the data into it. The raw data we collected from phase 2 will also convert into various sets of data clusters to become meaningful for us in the project.

### 1.7.4 Phase 4 Dashboard Module

At this phase, we will create a dashboard to export the data that are able to assist the user. Before viewed by the specific user, the data will be analyzed by various methods to display out meaningful insights in different formats such as bar graph, top ranking chart and et cetera.

## 1.8 Project Organisation and Timeline

Table 1.8.1: Table of Project Timeline

| Timeline | Mile Stone | | Mile Stone Goals |
|---|---|---|---|
| 16/03/2021 - 30/03/2021 | Web Scraping | Universities Staff Module | Scrap all the related information and produce output in .csv format. |
| 25/05/2021 - 29/05/2021 | | Government Agencies Module | |
| 19/04/2021 - 30/04/2021 | UI/UX development | UIPFuture website Module | Create a website as a platform to display various researches |
| | | UIP projects Module | Gather and Categorised researches which collaborated with MyFinB |
| | Database development | Push all the scraped information into one central database with auto search and filter functions. | |
| | Database UI/UX development | Development of UI/UX for the database to produce information needed and data flowchart. | |
| | Dashboard Design and Development | Design and development of the dashboard of the RoboAdvisor AI-based system. | |
| | Live feeds scraping | News scraping for latest development/trend | |

## 1.9 Advantages and Contributions

The finding of this research study will be reflected to the community and beneficial for the education community such as the universities, industries and the investors as this research will be seeking linked relationship and collaboration towards each of the universities. Academic researchers will also find easy and convenient to do their own finding as well as fund can be easily funded when the researches is easily found by investors in a platform.

# Chapter 2

# Literature Review

## 2.1 Literature Review


Diagram 2.1 UIP Logo

UIP is known as University - Industry Partnerships, is as AI-as-a-Service (AIaaS) platform for educators in Universities to convert their expertise and professionals into various prototypes, curriculum, industry-friendly collaboration models and develop new areas or research with AI-enabled engine. The researches will help UIP to expand their coverage and researches will be developed into fully-ready AI-based expert systems for industry adoption and commercialisation.

In UIP platform, It will help the educators to design its own personalised AI expert system based on their specialisation and achievements from their education biography, then transform their researches prototype into full commercialisation tools. Moreover, education community may need not ever spend enormous resources and credits in completing their prototypes such as the infrastructure, human capital expertise, capital expenditure costs and et cetera.

## 2.2 Feasibility Study

### 2.2.1 Technical Feasibility

Web Scraping

In order to develop this platform, Web Scraping method is very vital to assist in getting all sorts of information from various websites. Unlike screen scraping which only copies pixels displayed on-screen, Web Scraping is the process of using specific bots to extract data and information that is underlying HTML codes in the websites. It is undeniable that web scraping have been widely used in current digital businesses when they require the needs of data harvesting. Once the data were scrapped, it will be stored into a database for future uses.

Data in databases from scrapping ministry websites, agencies and university will be used to analyse the contents so the platform able to perform some analytic on the specific

tasks. Bots type such as ParseHub, Selenium and BeautifulSoup are used for Web Scrapping as they are fully customizable to:

1) Recognize the uniqueness of HTML site structures
2) Easily to extract and transform all sorts of content
3) Assisting to store scrapped data
4) Data from APIs are managed to be scraped and extracted

### 2.2.2 Operational Feasibility

To allow the platform to perform at its best, design thinking is a must process for creative problem solving in the platform. Design thinking has a human-centered core which easily to encourages organizations to focus on the people they are creating for to lead into a better products, services and internal processes. The "standard of procedure" to create a solution with design thinking is to figure out the desirable of a party from a human point of view with technologically feasible and economically viable. The challenges with this creative tools is to starts with making right actions and understanding the right questions. All the technique is about embracing the simplest mindset shifts and tackles the problems from a different directions.

Design thinking is best to addressing problems where multiple spheres of business and society issues, logic and emotions, rational and creative, human needs and economic demands collides each and another at the intersections between systems and individuals.

To go through the phases of design thinking, we have to go back and forth with the questions to leads us into a new innovative solutions. The phases of design thinking such as below:

- Frame a Question. By identifying the driving question which able to inspires others for a creative solutions.
- Gather Inspiration. Inspiring new thoughts to discover what the community really need.
- Generate Ideas. Segment past obvious solutions to get ideas breakthrough from a state of point.
- Make Ideas Tangible. By building rough and simple prototypes to learn how to improvise and make ideas better.
- Test to Learn. Refining ideas by gathering various feedback from others and then experimenting it afterwards.

- Share the Story. Craft and create a scenario that able to inspire others to be attracted for an action.

## 2.3 Chapter Summary and Evaluation

In this chapter, I talked about the company background and what their goals as well as the mission that get the company start in the first place. We also discussed the project background and why we were proposed to this project. Few of the reasons are to provide education a way to gather large amount of data in a platform and to analyse them to gather various insights of what resources they could get for their education researches and prototype. It is also mentioned that this is the only existing system to what we are developing to create a education analysis system that allows to provide insights for them to make better decisions and also gather the education community.

# Chapter 3

# Methodology and Requirements Analysis

## 3.1 Methodology

Various methodologies are used in education system which are existed in the market. The methodology that we are using to apply into this system is the Evolutionary Prototype Model. More will be discussed in the following introduction and fact gathering methods.

### 3.1.1 Software Development Model

The evolutionary prototype model is the most suitable for this project as the system will be developed and refined by the company in the future. Prototype model allow us to build, debugging and refining the prototype till a state that it can be defined as an acceptable and commercialized prototype. It also would assist to build a firm base for the future development of the finalised system.

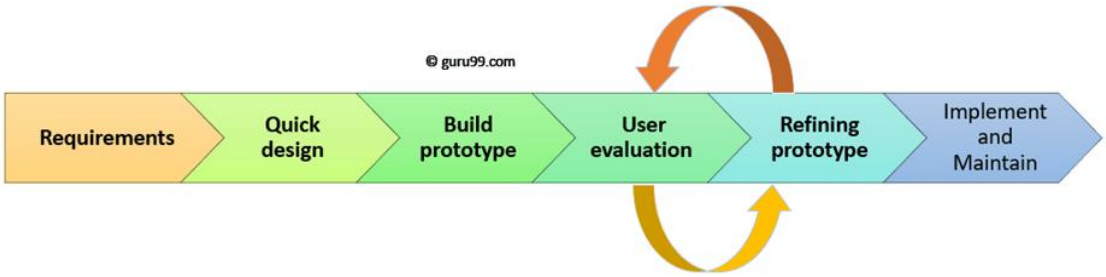


Diagram 3.1.1 The Phase of Prototyping Model

The reason of choosing prototype model methodology is evolutionary prototyping, a type of prototype, is suitable to apply into our projects for software development. With evolutionary prototyping, the project will be improved and developed better and better day by day with feedbacks. Moreover, projects which involved with AI are challenging in framing different specifications, evolutionary prototype will be much useful and easier to be built in this kind of exploratory programming.

## 3.2 Requirement Analysis

### 3.2.2 External Interface

**Graphical User Interface**

The design of the system will probably be towards the use of icons or other visualisable indicators alongside text for more easy understandable of the functions of a icon. The font chosen should easily caught the attention of the users and easily to be seen, font could be used such as Serif (e.g. Times New Roman) and Mono-space (e.g. Courier) to avoid being overwhelming. Theme colour used in the user interfaces needs to be eye-pleasing colour to allow a comfortable screening and not distracting users from the important things.

**Hardware Interface**

Due to the use of a desktop and computer that will be used to perform retrieving and receiving data information, pointing devices such as Mouse and TouchPad are a must to achieve controllable features for the end user. In addition, A stable internet connection is required because of the system developed is a web application system.

**Software Interface**

The web browser should install the later version to support the latest version of the web application which were supported by python3.8 and HTML5.

### 3.2.3 Functional Requirements

Web Scraping Module

1. This module needs to be able to scrap efficiently with the specific keywords based on requirements and store into the data after scraping.

Data Pattern Analysis Module

1. This module needs to filter the information which are useless to the user.
2. This module needs to sort the information in different format to allow easily observe from different views by the users.
3. This module needs to be able forming various insights for the users.

Data Mining Module

1. This module needs to be able to data mine a group of information into excel csv format.

Data Segmentation Module

1. This module needs to be able to segment raw data into a group of data clusters for further purposes.
2. This module needs to be able to store the real time segmented data into a database.

Dashboard Module

1. This module needs to be able to export data from database and convert into an editable format for the users.
2. This module needs to allow users to have the rights of manipulating the data features.

### 3.2.4 Non Functional Requirements

- Correctness
  - The information achieve from web scraping module must be the same with the information showed in the websites.
  - The web scraping module must always detect the latest update of the websites and scrap down the newest information from the websites.
  - The information that used for data mining must be same as the information in the excel.
  - The data mining module must not leave out any information that is from the excel file.
- Readability
  - The information scrap from the website in web scraping module must be filter into a readable format for the users.
  - The analysed result from the dashboard module must be show with a readable format to the users.
- Reliability
  - The system must not be losing connection more then 0.5% of the day.
  - With the huge information in the system, the display of the user-interface must show various information in the way of easy understandable for the users.
- Usability
  - The system must provide a guidance or tutorial to lead the users understanding the mechanism of the system. Thus, users able to have fast progress for their final results with the guidance.
  - The system needs to be created with various simple module and avoid complex module to confuse users.
- Maintainability
  - The structure of programming needs to be understandable by inserting various simple explanation in comments. Hence, future developer easily to maintain and upgrade the system.
- User-Friendly
  - The user-interface of the system needs to assist the users to easily understand and simplify various important information from a huge information on the display.

### 3.2.5 Development Environment

Python programming language will be used as the development language for this project. The python language will used to help us with scraping out specific information from websites based on keywords. Data extracted from excel files also will be assisted with Python language. This project will be developed in the form of web application and used by devices such as Desktop PC and laptops.

**Programming Language**

1. Python 3.8
2. PHP

**Other Software**

1. WordPress
2. Microsoft Excel

**Operating System**

3. Microsoft Windows 10

### 3.2.6 Operation Environment

**Desktop / Laptop**

Table 3.2.6.1: Table of Desktop/Laptop Environment

| Minimum Hardware and Software Requirement | |
|---|---|
| Processor (CPU) | Intel Core i3 and above |
| Operating System | Windows 7 and above |
| Memory | 4GB RAM or Higher |
| Storage | 4GB or higher space available |
| Other non-operating-system programs | Web Browser such as Internet Explorer version 6.0 or Google Chrome |
| Required Equipment | Mouse and Keyboard |
| Database | |
| Development Tools | |

## 3.3 Chapter Summary and Evaluation

In this chapter, we have explained the reason implementing prototyping as our software development model. Furthermore, the development environment and operational environments have displayed the minimum requirement of hardware and software component that will be used to develop this proposed project. Last but not least, non-functional requirements and functional requirements are listed which can help reader to understand the functions of the system easier.

# Chapter 4

# System Design

## 4.1 User Interface(UI) Design

We planned to develop UIPFuture as a web application. This web application will use the colour of green and white as the system theme. This is because green brings quietness, trust and confidence feelings towards the web application, It brings clam feelings of renewal for the user. With the theme of white, the background of the UI would allow users to pay more attention towards the interface due to its simplicity, it brings the feeling of wholesomeness towards the whole web application. These main theme colour allows users to feel comfortable when viewing the whole interface. It is also the most suitable theme for allowing users to think calmly and read every interested research to make every decisions.

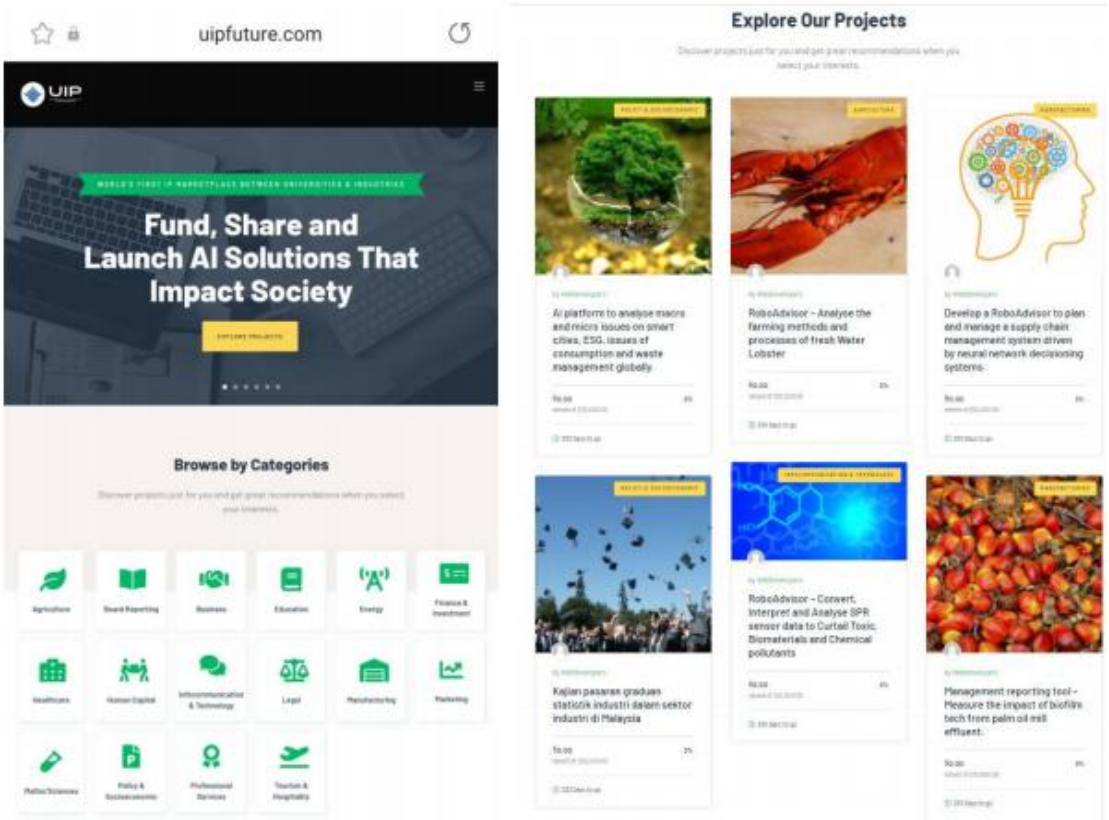


Figure 4.1.1 Main Page

In the figure 4.1.1 show the main page of our UIPFuture. This page will show the logo, navigation bar from header and every categories of the researches.


Figure 4.1.2 UIPFuture Logo

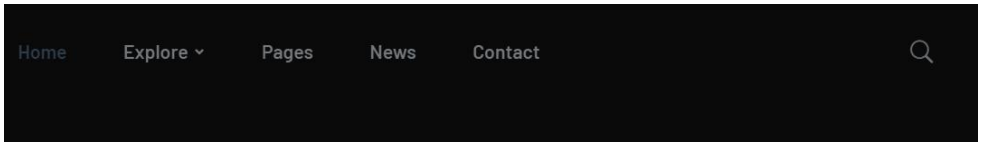


Figure 4.1.3 UIPFuture Navigation Bar

The logo and navigation bar will be shown in the header of the website. The user will be directed to the main page with the "Home" button shaded. Other than that, users able to navigate to other pages from the navigation bar such as the researches page from Explore, Pages, news related education from News and contact us for any queries from Contact.

## 4.4 Security Design

### Login

The data that provided by users such as students, lecturers and industries that will be using in the education analysis is much valuable. Hence, the data will be secured and protected to avoid data leakage to any other outsiders. In order to protect the data, we created login function for every users so data will be tracked with user's ID if leaked happens. Users also needs to login to UIPFuture in order to explore the website and use the dashboard anytime as long as the ID and password remain. Therefore, those users without ID will not be able to steal and leak any information from the website.

## 4.5 Chapter Summary and Evaluation

In this chapter, we will present the the user interface design of our UIPFuture look like, so the users could have a preview of the system to determine the satisfactions of theirs. We also explained the security design applied by us for the system to avoid data breech and leakage.

# Chapter 5

# Implementation and Testing

# 2 Implementation and Testing

A short introduction that describes what will be included in this chapter.

IMPORTANT NOTE TO STUDENTS: Include details about:

- **Implementation**

  A detailed description of how you actually carried out the implementation (e.g., coding, etc.) of your system/prototype.
  - Include code snippets and descriptions to show how the requirements of the application/prototype have been met –
    - For Smart Campus projects, code snippets of the MQTT protocol for both client side and server side has to be included with explanation.
  - Include descriptions of important settings - Setting for server, network protocol, IP, database, security
  - Note: this should **not** be a chronological account of the work you carried out.

- **Testing**

  All test cases that have been carried out must be provided - To tabulate the test cases in tables

Note: Students may also opt to split Implementation and Testing into 2 separate chapters.

## 2.1 Sub-section 1 Heading

Sub-sections should be used to divide the chapter into logical parts.

### 2.1.1 Sub-subsection Heading

Sub-section numbering should be limited to a maximum of 3 levels (e.g. 5.3.1) in order to avoid confusion.

## 2.2 Sub-section 2 Heading

## 2.3 Sub-section 1 Heading

Sub-sections should be used to divide the chapter into logical parts.

### 2.3.1 Sub-subsection Heading

Sub-section numbering should be limited to a maximum of 3 levels (e.g. 5.3.1) in order to avoid confusion.

## 2.4 Sub-section 1 Heading

Sub-sections should be used to divide the chapter into logical parts.

### 2.4.1 Sub-subsection Heading

Sub-section numbering should be limited to a maximum of 3 levels (e.g. 5.3.1) in order to avoid confusion.

## 2.5 Chapter Summary and Evaluation

*At the end of each chapter, evaluate the contents stated or discussed in the relevant sub-sections.*

# Chapter 6 *(if applicable)*

# System Deployment

# 3 System Deployment

This chapter would be applicable for students who have embarked on a real-life industrial project. Students in this case would need to describe how the deployment has been carried out. Some of implementation tasks which need to be described include: training, file conversion or creation, and changeovers.

## System Backup and Risk Management

Describe the procedures to backup the existing system for changeover purpose. Discuss the potential risk(s) for the changeovers and the solution.

## On-site Setup

Describe the preparations to be done prior to the setup of the new system on client's site. Discuss the procedures to setup the new system, schedule, etc.

## Training Procedure

Describe the procedures on the training procedures, contents, schedule, etc.

## Follow-up

Describe the plan or procedures to follow up with the client (company) to verify the system reliability.

## Chapter Summary and Evaluation

*At the end of each chapter, evaluate the contents stated or discussed in the relevant sub-sections. For example,*

- Problems faced. Describe the various problems faced by students in the course of doing the project.
- Solutions. What have been done to solve the problems?
- What tools and techniques have been used and reasons for using them.

# Chapter 7

# Discussions and Conclusion

# 4 Discussions and Conclusion

Each student is required to make an *evaluation of the project* he/she has embarked on. The project evaluation may include the following sections.

IMPORTANT NOTE TO STUDENTS: In this chapter, for problems related to code, hardware, internet connection, etc (where applicable):

- List the technical problems faced and state how they were resolved
- List the unsolved technical problems for future enhancement
- List the achieved objectives/modules
- List the incomplete parts for future enhancement - this is regardless the parts listed in the pre-determined scope. Suggestions for future improvement

## Summary

Summarize the project including the problem and proposed solutions, justification of the choice of tools, techniques and methodologies used in this project.

## Achievements

Students are required to evaluate the project's achievement against project objectives, completion of the project, students' view of the strengths and weaknesses of the work done.

## Contributions

Discuss the creativity, innovativeness, contribution of the proposed system. Explain why the proposed system is necessary. Describe the marketability of the system.

## Limitations and Future Improvements

Identify the limitations of the research or project. Provide suggestions for improvement or further development of the system or research in the future.

## Issues and Solutions

Students are required to describe the various problems faced by students during the project development and explain what has been done to solve the problems. The valuable experiences gained or lessons learnt through the project as a whole. The issues may include technical issues, project management issues, team dynamics problems, and other difficulties

encountered and lessons learnt. How the issues are solved or can be solved to ensure the project can be completed on time or to be improved in the future.

# References

The list of references should contain all the items that have been explicitly referred to in the report. Students may have referred to some manuals or conducted research on certain knowledge areas, for example Oracle, RFID scanners etc.

If the students choose to write a bibliography, then they should list down all materials that are useful either directly or indirectly to the project concerned and which the students have read. An example of material useful could be an article or an Oracle user manual etc.

References should be cited in the main text using Author-Year system. The full references should be given as below (essentially Harvard Referencing format), in the alphabetical order in 10 pt. Times New Roman, with a 6pt spacing between each. References should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters "a", "b", "c", etc., placed after the year of publication.

Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full.

*Web references* used as a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

# Appendices

In order to enhance better understanding of the project, students should as far as possible include all directly relevant materials, figures or diagrams in the **main body** rather than in the Appendix. The appendix is reserved only for items which may not directly be relevant or essential to enhance a reader's understanding of the project, or which may interrupt the smooth reading of the project document (for example being too voluminous).

Appendices should only include supportive materials **directly referred** to in the writing and should be kept to a **minimum**, e.g. selected pages of an annual report, not the entire document. Examples of items included in Appendices are:

- Company's report and documentation, such as sample invoice, purchase order form, etc.
- Project meeting documentation e.g. minutes of meetings, tracking documents, memos etc.
- Questionnaires and results, interview questions and results, pilot test and results, observation sheet and results, experiment test plan and results, etc.
- Analysis/design diagrams (only those not incorporated in the main body of the report).

If there is more than one appendix, they should be identified as A, B, etc (e.g. Appendix A). Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

IMPORTANT NOTE TO STUDENTS

**APPENDIX *n* User Guide**

- List the username and password of multiple roles (if applicable)
- Provide clear screen shots of each page, explain the functions of each button

As a rough guide, the user guide should include the following sections:

**System Document**

In this section, students should provide the following pieces of information:

- **System (hardware and software requirements)**. Students should describe the minimum hardware and software requirements to install the software application which has been developed by the students, for example, DBMS, OS, program development tools etc.
- **Installation**. Under this section, students should create an 'installation' CD and provide a brief step-by-step guide on how a new user can install the software on a computer system. Students should indicate any special setup information, such as the

specific location of placing the database files, the SQL statements to add tables, etc. Software source code should also be included in this CD. Students are not required to print out the software code.

**Operation Document**

Under this section, students are required to provide a brief step-by-step guide on how to use the installed software. The guides should teach the user how to run the software and use its major functions and features. For example, steps show guide the users on how to run the system, e.g. to use an executable file or to use the IDE. The login information such as username and password for each of the different users (or roles) must be provided. Some screen interfaces would be useful.

## APPENDIX *n+1* Developer Guide*

*To be included for ***Smart Campus Projects*** and ***Real-Life Projects***. This section should include the following:

- List the necessary software, installer, API, library that must be installed
- List the authentication details, such as username and password for all security

## Other Appendices:

- Supporting documents
- Non-disclosure agreement (if applicable)
- Other detailed documentation, such as important references, interview results, survey results, etc.

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