SC2002 – Object Oriented Design & Programming

Group Report

Declaration of Original Work for CE/CZ2002 Assignment

We hereby declare that the attached group assignment has been researched, undertaken, completed and submitted as a collective effort by the group members listed below.

We have honored the principles of academic integrity and have upheld Student Code of Academic Conduct in the completion of this work.

We understand that if plagiarism is found in the assignment, then lower marks or no marks will be awarded for the assessed work. In addition, disciplinary actions may be taken.

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1. Design Considerations

1.1 Software design

Our software design is predominantly based on the Model-View-Controller (MVC) concept. The Model component manages the relevant data required to run the program. Data is stored from an Excel database *FYP_database.xlsx*. The View component handles the user interface, which is shown to the user. Finally, the Controller component is the intermediate component between the Model and View component, taking user input and data manipulation.

OOP concepts of Abstraction, Inheritance, Encapsulation, Polymorphism and Composition are integrated into our design. Additionally, we apply the SOLID object-oriented principles to our program to be easily maintainable and modifiable. These concepts are applied to minimise impacts of change via code organisation, ultimately improving the modularity and reusability of our program.

1.2 Data management

A LinkedHashmap is used for data management in our project due to the following benefits:

Maintains Order of insertion	Order of when user data was added to our LinkedHashMap is maintained. This enables chronological sorting of requests between user types of our FYP management system.
Unique Keys	Keys act as unique identifiers to enable linking for objects
Iteration	Iteration in a LinkedHashmap enables us to display object details such as in viewing all available projects
Easy Object Manipulation	Entries in a LinkedHashmap can be removed by their key This enables quick access in looking up user information

On program initialization, data is read from the given Excel workbooks with the ***Apache POI*** library. This data is then written into LinkedHashmaps in Java for subsequent manipulation by the Model-View-Controller based system. Upon program termination, data is written into an Excel Database *FYP_database.xlsx* according to its entity. Each entity is written into a specific worksheet, with worksheets *student, FYPSupervisor, FYPCoordinator, Project, StuToFYPReq, StuToSupReq, SupToFYPReq*. Subsequently, when a new user initializes the system, the program checks if a *FYP_database.xlsx* Excel workbook exists, and initializes the data.

1.3 Applications to OOP principles

Single Responsibility Principle (SRP)

SRP is applied via separation of contents principle. The program is divided into specific classes and components that are responsible for its specific tasks. Detailed below are a few examples of encapsulation and inheritance used in our project.

Class Name	Class Description
RequestStatus.java *RequestType.java* *ProjectStatus.java* *Request.java (Superclass)*	Each class is responsible for managing either the status or types of requests/projects. I.e., there is no one single "Status" class to store all types of requests/projects statuses.
Student.java *Supervisor.java* *User.java (Superclass)* *FYP.java*	These classes are responsible for managing student, supervisor, FYP coordinator and user information, respectively. Each class has a single responsibility to manage information specific to its corresponding entity.

This extends to our Excel database, with each entity's data separated into individual worksheets for compartmentalised access. This ensures each class has a clear and specific responsibility, simplifying code and making it easier to maintain and modify over time. Assigning a unique responsibility to each class ensures that there is only at most one reason for modification each time.

Open-Closed Principle (OCP)

OCP is used in extending the behaviour of our classes without modifying its source code. Defining interfaces such as *Request.java,* with accessor and mutator methods for request status, adds functionality without modifying additional classes. In the table below, we introduce the Request interface and create independent implementations of different user-to-user requests. Therefore, we do not need to modify *Request.java* whenever we add unique features.

Interface	Implementations
Request.java	StuToSupReq.java StuToFYPReq.java SupToFYPReq.java

Dependency injection was also incorporated to decouple classes for easy testing and maintenance. Specifically, setter injection was used in the ExcelData class whereby the Student class was passed to the ExcelData through a mutator method rather than the ExcelData creating the student itself.

Liskov Substitution Principle (LSP)

LSP was applied using Inheritance and Polymorphism for objects of the superclass to be replaced by objects of the subclass. Illustrated below are the Superclasses with their corresponding subclasses:

Superclass	Subclass
User.java	Student.java FYP.java Supervisor.Java
Request.java	StuToSupReq.java StuToFYPReq.java SupToFYPReq.java

Since the Student class is a subclass of the User class then any instance of the Student class can be used in place of the User class without errors. In other words, they are substitutable for their base types.

Interface Segregation Principle (ISP)

ISP is applied in our project by ensuring users are only required to implement necessary methods in our Interface classes. This was integrated into designing our StudentView and StudentController class. The StudentView class provides a set of methods for displaying options and handling user input, while the student controller class provides methods such as changing the password, selecting projects and viewing request history. Hence, the StudentView class adheres to ISP by depending only on methods it needs and avoiding dependencies on methods it does not use.

Dependency Inversion Principle (DIP)

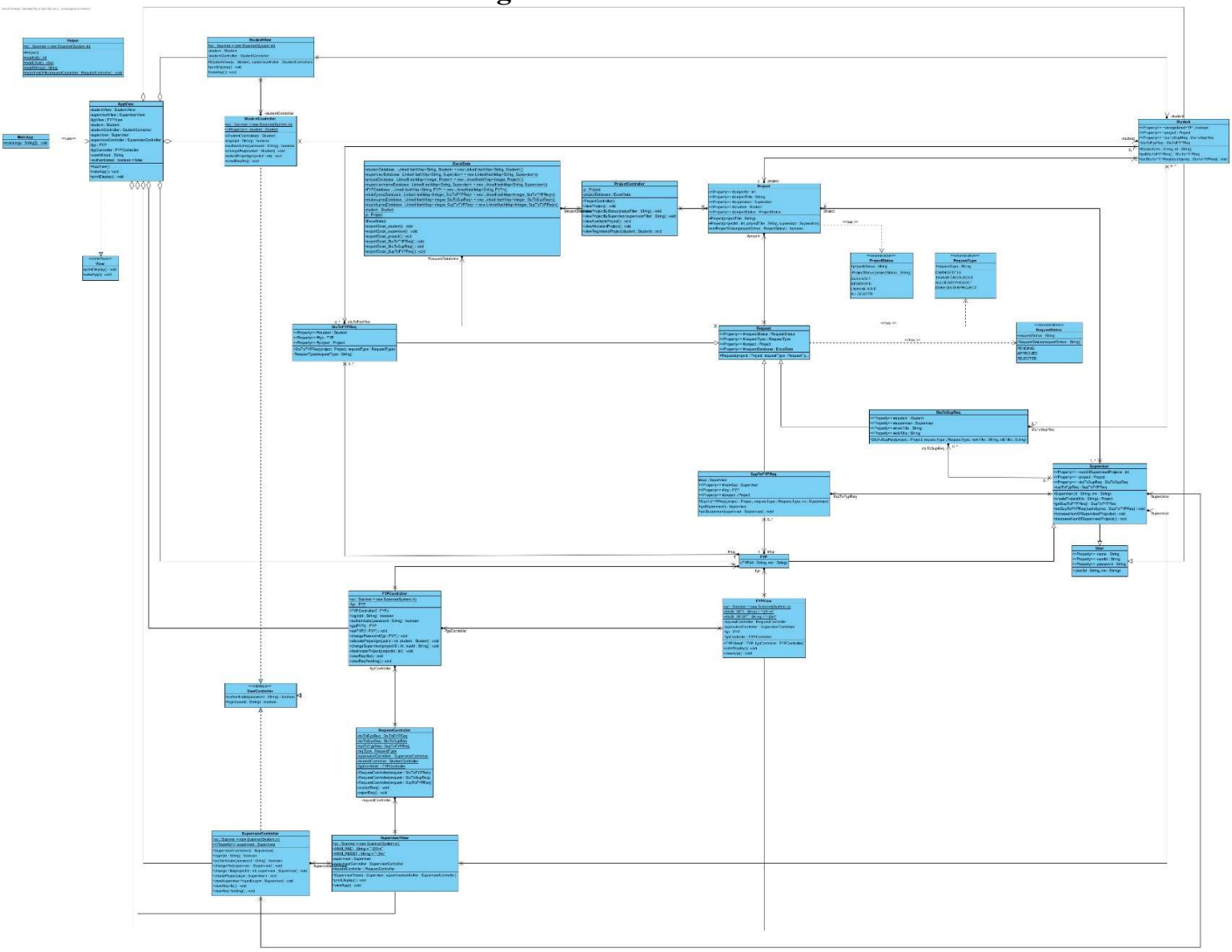
DIP was used in our Project, ProjectController and ProjectStatus classes. The Project Controller class depends on the ExcelData class to get the project database. However, the ProjectController class does not depend on the ExcelData class *directly* but instead depends on an abstraction of the ExcelData class. This was similarly reflected in our Project class

depending on abstractions of the Supervisor and Student class instead of concrete implementations of these classes directly.

1.4 Design Extensibility and Maintainability

Using the MVC pattern separates concerns and makes it easy to modify and extend each component without affecting the others. This facilitates maintainability by providing a clear structure for the codebase. Easy data retrieval with LinkedHashmaps and Apache POI library makes data retrieval and manipulation easy, facilitating extensibility and maintainability. Integrating the SOLID principles alongside Abstraction and Encapsulation ensures system's components are loosely coupled allowing them to be modified or extended without causing ripple effects on other components in the system. Inheritance and polymorphism facilitate code reuse, likewise making it easier to extend the system's functionality.

2. Detailed UML Class Diagram



(Kindly refer to UML Diagram attached along as image file in zip folder if unclear.)

3. Testing

Student #1

STUDENT - View registered project fails. Error message: *You have not registered a project.*

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
4
You have not selected a project!
```

STUDENT - View all available projects

```
You have not selected a project!
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
2
```

Project ID	Project Title	Supervisor Name	Supervisor Email	Project Status
1	Machine Learning-based Interference Mitigation in a Multi-tier Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
2	Deep Learning-Driven Edge Caching for 5G-and-Beyond Industrial IoT Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
3	Sonification of geometry 1	Alexei Sourin	ASSOURIN@NTU.EDU.SG	AVAILABLE
4	Edge/Cloud Resource Management for Time-Sensitive Applications (2)	Arvind Easwaran	ARVINDE@NTU.EDU.SG	AVAILABLE
5	Deep Reinforcement Learning for Complex Environment	Bo An	BOAN@NTU.EDU.SG	AVAILABLE
6	Build Software Agents for Power Trading Agent Competition	Bo An	BOAN@NTU.EDU.SG	AVAILABLE
7	Designing Negotiation Agents to Parcitipate in International Competition	Bo An	BOAN@NTU.EDU.SG	AVAILABLE
8	Creation of Meta-model for Agent-based Simulation Using Machine Learning Approach	Cai Wentong	ASWTCAI@NTU.EDU.SG	AVAILABLE
9	Encoding Images to Text Prompts with CLIP	Chen Change Loy	CCLOY@NTU.EDU.SG	AVAILABLE
10	Smart Monitor for Studio Photographer	Chia Liang Tien	ASLTCHIA@NTU.EDU.SG	AVAILABLE
11	Developing a demonstration system for spatial data exploration and visualization	Cong Gao	GAOCONG@NTU.EDU.SG	AVAILABLE
12	Deep Learning Supported Location-aware Keyword Query	Cong Gao	GAOCONG@NTU.EDU.SG	AVAILABLE
13	An AI based Li-ion fast battery charger for power tools	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
14	A Li-ion fast battery charger	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
15	Metaverse for virtual education 1	Dusit Niyato	DNIYATO@NTU.EDU.SG	AVAILABLE
16	Graph-based Deep Models for Image Semantic Segmentation	Ke Yiping, Kelly	YPKE@NTU.EDU.SG	AVAILABLE

STUDENT - Select a project by specifying the projectID.

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
3
```

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```
Please enter project id to select a project!
5
Your project is now reserved and waiting to be approved by the fyp coordinator
```

FYPCOORDINATOR – Approve Request

```
What would you like to do ?
(1) Change password
(2) Create/Update/View projects
(3) View all projects
(4) View pending requests 1 NEW REQUEST!!!
(5) View requests and status history
(6) Approve/reject requests
(7) Log out
Enter your choice:
6
```

Request ID	Request Type	Sender	Receiver	Request Status
1	ALLOCATEPROJECT Deep Reinforcement Learning for Complex Environment To CHERN	YCHERN	ASFLI	PENDING

```
Enter the SenderId to choose request
YCHERN
Enter (y) to approve or enter (n) to reject this request
y
The request has been accepted
```

STUDENT - View all available projects fails. Error message: *You are currently allocated to a FYP and do not have access to available project list.*

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
2
You are currently allocated to a FYP and do not have access to available project list.
```

STUDENT - View registered project.

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
4
+------------+-------------------------------------------------------------+-----------------+-----------------+----------------+
| Project ID |                        Project Title                        |  Supervisor Name |  Student Name   | Project Status |
+------------+-------------------------------------------------------------+-----------------+-----------------+----------------+
| 5          | Deep Reinforcement Learning for Complex Environment         | Bo An           | CHERN           | ALLOCATED      |
+------------+-------------------------------------------------------------+-----------------+-----------------+----------------+
```

STUDENT - Request to change title by providing a new title.

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
6
Please enter the new title for your project:
TESTING123
```

FYPSUPERVISOR – Approve Change of title request

```
What would you like to do ?
(1) Change password
(2) Create/Update/View projects
(3) View pending requests 1 NEW REQUEST!!!
(4) View requests and status history
(5) Request transfer student
(6) Log out
Enter your choice:
3
+------------+-------------------------------------------------------------------------------------------+-----------+-----------+----------------+
| Request ID |                                       Request Type                                        |  Sender   |  Receiver |  Request Status |
+------------+-------------------------------------------------------------------------------------------+-----------+-----------+----------------+
| 1          | CHANGETITLE From Deep Reinforcement Learning for Complex Environment To TESTING123        | YCHERN    | BOAN      | PENDING        |
+------------+-------------------------------------------------------------------------------------------+-----------+-----------+----------------+
Enter the studentId to choose request
YCHERN
Enter (y) to approve or enter (n) to reject this request
y
The request has been accepted
```

STUDENT – View registered project to verify the title change

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
4
+------------+-------------------------------------------------------------+-----------------+-----------------+----------------+
| Project ID |                        Project Title                        |  Supervisor Name |  Student Name   | Project Status |
+------------+-------------------------------------------------------------+-----------------+-----------------+----------------+
| 5          | TESTING123                                                  | Bo An           | CHERN           | ALLOCATED      |
+------------+-------------------------------------------------------------+-----------------+-----------------+----------------+
```

STUDENT – Request to deregister the project

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
7
Please type (y) to confirm that you want to deregister:  TESTING123
Or press any other button to go back
y
Your request has been processed and waiting for the FYP coordinator to approve!
```

FYPCOORDINATOR – Approve deregistering request

```
What would you like to do ?
(1) Change password
(2) Create/Update/View projects
(3) View all projects
(4) View pending requests 1 NEW REQUEST!!!
(5) View requests and status history
(6) Approve/reject requests
(7) Log out
Enter your choice:
6
+------------+-------------------------------------------------------------------------------------------+-----------+-----------+----------------+
| Request ID |                                       Request Type                                        |  Sender   |  Receiver |  Request Status |
+------------+-------------------------------------------------------------------------------------------+-----------+-----------+----------------+
| 1          | DEREGISTERPROJECT TESTING123 To CHERN                                                     | YCHERN    | ASFLI     | PENDING        |
+------------+-------------------------------------------------------------------------------------------+-----------+-----------+----------------+
Enter the SenderId to choose request
YCHERN
Enter (y) to approve or enter (n) to reject this request
y
The request has been accepted
```

STUDENT – View registered project (Fail with error message)

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
4
You have not selected a project!
```

STUDENT – View all available projects (Fail with error message)

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
2
You are not allowed to make selection again as you deregistered your FYP.
```

Supervisor's cap

Student #2 selects Bo An's project (and FYP coordinator approves)

```
Please enter:
(s) if you are a student
(f) if you are a faculty member
s
Please enter your userId:
KOH1
Please enter your password:
password
Log in successful!

What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
3
```

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14	A Li-ion fast battery charger	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
15	Metaverse for virtual education 1	Dusit Niyato	DNIYATO@NTU.EDU.SG	AVAILABLE
16	Graph-based Deep Models for Image Semantic Segmentation	Ke Yiping, Kelly	YPKE@NTU.EDU.SG	AVAILABLE

```
Please enter project id to select a project!
6
Your project is now reserved and waiting to be approved by the fyp coordinator
```

Student #2 changes title (and Bo An approves)

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
6
Please enter the new title for your project:
hello world
```

Student #3 selects Bo An's project (and FYP coordinator approves)

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
3
```

Project ID	Project Title	Supervisor Name	Supervisor Email	Project Status
1	Machine Learning-based Interference Mitigation in a Multi-tier Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
2	Deep Learning-Driven Edge Caching for 5G-and-Beyond Industrial IoT Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
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12	Deep Learning Supported Location-aware Keyword Query	Cong Gao	GAOCONG@NTU.EDU.SG	AVAILABLE
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14	A Li-ion fast battery charger	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
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```
Please enter project id to select a project!
7
Your project is now reserved and waiting to be approved by the fyp coordinator
```

Student #4 view all available projects, Bo An's remaining projects are NOT included in the list.

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
2
```

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FYPSupervisor(Bo An) transfers a project to FYPSupervisor(Dusit Niyato) and FYP coordinator approves.

```
What would you like to do ?
(1) Change password
(2) Create/Update/View projects
(3) View pending requests
(4) View requests and status history
(5) Request transfer student
(6) Log out
Enter your choice:
5
Enter the student's id who you want to transfer:
KOH1
Enter the supervisor's id who you want to transfer to:
DNIYATO
What would you like to do ?
(1) Change password
(2) Create/Update/View projects
(3) View pending requests
(4) View requests and status history
(5) Request transfer student
(6) Log out
Enter your choice:
6
```

Student #4 view all available projects, Bo An's remaining projects are included in the list.

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
2
```

Project ID	Project Title	Supervisor Name	Supervisor Email	Project Status
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2	Deep Learning-Driven Edge Caching for 5G-and-Beyond Industrial IoT Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
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10	Smart Monitor for Studio Photographer	Chia Liang Tien	ASLTCHIA@NTU.EDU.SG	AVAILABLE
11	Developing a demonstration system for spatial data exploration and visualization	Cong Gao	GAOCONG@NTU.EDU.SG	AVAILABLE
12	Deep Learning Supported Location-aware Keyword Query	Cong Gao	GAOCONG@NTU.EDU.SG	AVAILABLE
13	An AI based Li-ion fast battery charger for power tools	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
14	A Li-ion fast battery charger	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
15	Metaverse for virtual education 1	Dusit Niyato	DNIYATO@NTU.EDU.SG	AVAILABLE
16	Graph-based Deep Models for Image Semantic Segmentation	Ke Yiping, Kelly	YPKE@NTU.EDU.SG	AVAILABLE

Student #4 selects Dusit Niyato's project (and FYP coordinator approves).

```
What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
3
```

Project ID	Project Title	Supervisor Name	Supervisor Email	Project Status
1	Machine Learning-based Interference Mitigation in a Multi-tier Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
2	Deep Learning-Driven Edge Caching for 5G-and-Beyond Industrial IoT Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
3	Sonification of geometry 1	Alexei Sourin	ASSOURIN@NTU.EDU.SG	AVAILABLE
4	Edge/Cloud Resource Management for Time-Sensitive Applications (2)	Arvind Easwaran	ARVINDE@NTU.EDU.SG	AVAILABLE
5	Deep Reinforcement Learning for Complex Environment	Bo An	BOAN@NTU.EDU.SG	AVAILABLE
8	Creation of Meta-model for Agent-based Simulation Using Machine Learning Approach	Cai Wentong	ASWTCAI@NTU.EDU.SG	AVAILABLE
9	Encoding Images to Text Prompts with CLIP	Chen Change Loy	CCLOY@NTU.EDU.SG	AVAILABLE
10	Smart Monitor for Studio Photographer	Chia Liang Tien	ASLTCHIA@NTU.EDU.SG	AVAILABLE
11	Developing a demonstration system for spatial data exploration and visualization	Cong Gao	GAOCONG@NTU.EDU.SG	AVAILABLE
12	Deep Learning Supported Location-aware Keyword Query	Cong Gao	GAOCONG@NTU.EDU.SG	AVAILABLE
13	An AI based Li-ion fast battery charger for power tools	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
14	A Li-ion fast battery charger	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG	AVAILABLE
15	Metaverse for virtual education 1	Dusit Niyato	DNIYATO@NTU.EDU.SG	AVAILABLE
16	Graph-based Deep Models for Image Semantic Segmentation	Ke Yiping, Kelly	YPKE@NTU.EDU.SG	AVAILABLE

```
Please enter project id to select a project!
15
Your project is now reserved and waiting to be approved by the fyp coordinator
```

Dusit Niyato submits a new project.

```
What would you like to do ?
(1) Change password
(2) Create/Update/View projects
(3) View pending requests
(4) View requests and status history
(5) Request transfer student
(6) Log out
Enter your choice:
2
Create/Update/View projects
Please type:
 (C) to create project
 (U) to update project
 (V) to view project
C
Enter project title:
SC2002
```

Student #5 view all available projects, Dusit Niyato's remaining projects are NOT included in the list.

```
ELI34
Please enter your password:
password
Log in successful!

What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
2
```

Project ID	Project Title	Supervisor Name	Supervisor Email
1	Machine Learning-based Interference Mitigation in a Multi-tier Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG
2	Deep Learning-Driven Edge Caching for 5G-and-Beyond Industrial IoT Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG
3	Sonification of geometry 1	Alexei Sourin	ASSOURIN@NTU.EDU.SG
4	Edge/Cloud Resource Management for Time-Sensitive Applications (2)	Arvind Easwaran	ARVINDE@NTU.EDU.SG
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16	Graph-based Deep Models for Image Semantic Segmentation	Ke Yiping, Kelly	YPKE@NTU.EDU.SG

```
What would you like to do ?
(1) Change password
```

Student #4 deregisters FYP (and FYP approves).

```
Please enter your userId:
DON84
Please enter your password:
password
Log in successful!

What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
7
Please type (y) to confirm that you want to deregister:  Metaverse for virtual education 1
Or press any other button to go back
```

Student #5 view all available projects, Dusit Niyato's remaining projects including the deregistered project will be displayed in the available project list.

```
ELI34
Please enter your password:
password
Log in successful!

What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
2
```

Project ID	Project Title	Supervisor Name	Supervisor Email
1	Machine Learning-based Interference Mitigation in a Multi-tier Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG
2	Deep Learning-Driven Edge Caching for 5G-and-Beyond Industrial IoT Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG
3	Sonification of geometry 1	Alexei Sourin	ASSOURIN@NTU.EDU.SG
4	Edge/Cloud Resource Management for Time-Sensitive Applications (2)	Arvind Easwaran	ARVINDE@NTU.EDU.SG
5	Deep Reinforcement Learning for Complex Environment	Bo An	BOAN@NTU.EDU.SG
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12	Deep Learning Supported Location-aware Keyword Query	Cong Gao	GAOCONG@NTU.EDU.SG
13	An AI based Li-ion fast battery charger for power tools	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG
14	A Li-ion fast battery charger	Douglas Leslie Maskell	ASDOUGLAS@NTU.EDU.SG
15	Metaverse for virtual education 1	Dusit Niyato	DNIYATO@NTU.EDU.SG
16	Graph-based Deep Models for Image Semantic Segmentation	Ke Yiping, Kelly	YPKE@NTU.EDU.SG
17	SC2002	Dusit Niyato	DNIYATO@NTU.EDU.SG

Student #5 selects the recycled project.

```
Please enter:
(s) if you are a student
(f) if you are a faculty member
s
Please enter your userId:
ELI34
Please enter your password:
password
Log in successful!

What would you like to do ?
(1) Change password
(2) View available projects
(3) Select a project
(4) View my project
(5) View requests and status history
(6) Request title change
(7) Request to deregister FYP
(8) Log out
Enter your choice:
3
```

Project ID	Project Title	Supervisor Name	Supervisor Email	Project Status
1	Machine Learning-based Interference Mitigation in a Multi-tier Networks	A S Madhukumar	ASMADHUKUMAR@NTU.EDU.SG	AVAILABLE
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16	Graph-based Deep Models for Image Semantic Segmentation	Ke Yiping, Kelly	YPKE@NTU.EDU.SG	AVAILABLE
17	SC2002	Dusit Niyato	DNIYATO@NTU.EDU.SG	AVAILABLE

```
Please enter project id to select a project!
15
Your project is now reserved and waiting to be approved by the fyp coordinator
```

4. Reflection

Over the course of our project, most of the difficulties encountered revolved around the design of our software. Specifically, starting out with the UML diagram, we realised our classes were too interdependent, with the diagram becoming too well-connected. This resulted in relationships represented by lines overlapping with each other. To circumvent this issue, we had to create well-defined interfaces such that there would be loose coupling between the classes. This also implied that we had to apply OO principles such as inheritance to create subclasses from abstract classes and define them as required for their purposes. This ensured we do not have a one-size-fits-all super class which performs all functions.

Additionally, data management was another difficulty encountered, with the key challenge of writing and reading data in and out of our Excel database. To overcome this difficulty, we utilised OOP principles such as encapsulation for this process. Data was written into specific classes to help to maintain data compartmentalization.

One recommendation we would integrate to improve our current design is to assign the respective controllers, models, etc. into different modules for better reference and access. Another recommendation would be to create classes for the purpose of exception handling. This can assist us to catch more general exceptions and improves code readability.

Overall, we learnt about the multiple OOP design principles for creating a system, as well as techniques for design extensibility and maintainability, which are crucial for successful OOP systems.