WIA1002 DATA STRUCTURE
SEMESTER 2, SESSION 2023/2024

GROUP PROJECT
TOPIC 5: HACKING THE FUTURE

Everything around us was once an idea in someone's brain. If we take that into consideration, we can look around us and see a room of endless possibilities that have changed our lives.

In today's rapidly-advancing world, the importance of STEM (Science, Technology, Engineering, and Mathematics) education cannot be overstated. STEM literacy is not only crucial for understanding the world around us but also for preparing the next generation of innovators, problem solvers, and leaders.

Another crucial benefit for students actively participating in hands-on STEM challenges is that they will increase intellectual complexity and develop critical thinking, creativity, and teamwork skills beyond theoretical knowledge.

However, despite its significance, many young children lack exposure to engaging STEM activities because most STEM education in primary and secondary schools focuses on theory rather than on application and experiential learning and is taught in a way that reinforces a disconnect between the different STEM disciplines. This will lead to a potential shortage of skilled professionals in STEM fields in the future.

Project Introduction

In this project, we aim to provide the solution towards the lack of exposure problems mentioned above, and to somewhat align our project with the United Nation's Sustainable Development Goals below:

- SDG 04: Quality Education
- SDG 09: Industry, Innovation, and Infrastructure
- SDG 17: Partnership for the Goals

To give exposure to the concept and importance of STEM knowledge to the young generations, we will be focusing on simple gamification to make the STEM learning experience interesting and appealing.

There are 3 roles in this project:

- Young Students
- Parents to the Students
- Educators (inclusive of External Parties)

Young Students are the main target audience of this project. As they are young at the age of below 18, the application simplicity should be tailored for them. Parents to the Students will help in managing their children's involvement in STEM activities, whereas Educators and External Parties will be in-charge of the content creation for this application.

Our app provides a platform for students to engage with industry-related content to better understand the relevance of STEM in their future careers by having booking pages for tours to STEM related companies, discovery places or museums so that students increase interest towards STEM.

Besides that, we also need a reward-based system to ensure our project's end-users keep using our software. So, we need a point system which can be obtained by answering quizzes and joining STEM events from our platform.

What You Will Need To Do

We separated our project functionalities into basic features and extra features. The basic features are the main basic functionalities that our project must have in order to make it workable, the extra features on the other hand will be the additional functionalities which improve the project overall as a whole, which includes scalability and accessibility.

Note that GUI (Graphical User Interface) is considered an extra feature, you may decide to use the CLI (Command-Line Interface) as the interface for the end users to interact with the software.

Furthermore, the Pages mentioned in the following feature descriptions are just suggestions. Feel free to relocate, split or combine multiple features into the same page as long as it is sensible, logical and user-friendly.

You should apply your algorithms by implementing appropriate data structures in your code and justify your choices during the presentation to demonstrate your understanding of data structure implementation.

Basic Features (12 Marks)

User Account [1 mark]
Each user will have their own user account. Therefore, you will need to create a User class which contains the following required fields:

- Email
- Username
- Password
- Role
- Parent(s) (for Young Students)
- Children (for Parents)
- Location Coordinate
- Current Points (for Young Students)

Login / Registration Page [1 mark]
Since our project is user-based, we will need a sign-up page for the users to register themselves and a login page for users to log into their accounts from any location. The user can choose to log in with a valid email or with a valid username.

During the registration, users will set their respective "role" which will define their access to the app as described in the Access Management feature.

Also, it is "technically illogical" for users to enter their current coordinate during account registration. To simplify the complexity of this project, the Location Coordinate field should be automatically generated (randomly) as a cartesian coordinate in the format of (X, Y), where X and Y each can be any real values in the range of -500.0 and 500.0.

Data Storage [1 mark]
Throughout the project, we expect various data generated like user details, user's current state and many more. So, we will need to store all related data in data storage so that the data remains saved even after the program is terminated. For basic features, you may save each user's data in CSV, TXT or BAT format.

Note that using external data storage or databases *(refer to Extra Features)* are counted as extra features.

View Profile [1 mark]
The profile page will display all data (excluding password) about the user like name, role, coordinates etc.

- If the user has the role “Educators”, display also the number of quizzes created and number of events created
- If the user has the role “Parents”, display also the past bookings made
- If the user has the role “Young Students”, display also their points and friends

Access Management [1 mark]
Each role will have access to different pages, as indicated below:

- All 3 roles can access Event Page, View Personal / Others’ Profile, and Discussion Page
- ONLY **Educators** can access Create Event Page to create an event, access Create Quiz page to create quizzes
- ONLY **Parents** can access Booking Page to book for tour to STEM-related companies, discovery centres or museums
- ONLY **Students** can access Quiz Page to attempt quizzes and gain points, and also add friends to their network

Create Event & Quiz [1 mark]
Educators can create an event in the Create Event Page with the following fields:

- Event Title
- Event Description
- Event Venue
- Event Date
- Event Time

Educators can create a quiz in the Create Quiz Page with the following fields:

- Quiz Title
- Quiz Description
- Quiz Theme (Science / Technology / Engineering / Mathematics)
- Quiz Content

Since quizzing is not part of the main focus of this assignment, the Quiz Content can be replaced with a Quizizz Link for now.

You are required to use this feature to create **at least** 10 events and 10 quizzes.

View Event [1 mark]

All roles can view the events created in the View Events Page. Only the **Live Events** (events happening on current day) and **Closest 3 Upcoming Events** will be displayed. For example, on the day of 31/08/2024, and the Upcoming Events are on:

> 01/09/2024, 01/09/2024, 03/09/2024, 04/09/2024, 08/09/2024, 12/09/2024

the Closest 3 Upcoming Events displayed will be the one on:

1. 01/09/2024
2. 01/09/2024
3. 03/09/2024

Young students can choose to register themselves for any events displayed and gain 5 points per event registered.

However, it is technically impossible for them to attend an event that clashes with another event they have registered for. Since the event time clashing is prohibited, to make it easier, an error message shall be displayed if the event to be registered is on the same day as his / her other registered events.

Attempt Quiz [1 mark]

Young Students can view the quizzes on the Quiz Page and attempt some to receive points. The themes for the quizzes for now will only be Science, Technology, Engineering or Mathematics, and students can use it to filter the quizzes that they want to view. By default, all themes are selected, and all quizzes are displayed.

Students should be able to select 1 to all 4 themes as the filter. For example, if the student selects Technology and Mathematics theme, quizzes with the theme of Technology or Mathematics will be displayed, whereas those with the theme of Science and Engineering will not be displayed.

Upon completion of quiz, the student will be awarded 2 marks and that quiz will be marked as completed.

Make Bookings [1 mark]

Parents can make bookings / purchase tickets for their children (Young Students) on tours and visits to STEM-related companies, discovery centres or museums. The destination suggestions are displayed in ascending order of the Euclidean distance between the user's coordinate upon registration and the coordinate of the target destination.

Below we provide a list of booking destinations and their respective coordinates in the format of X, Y. Copy and paste it into a `BookingDestination.txt` file.

`BookingDestination.txt`

```
Petrosains Science Discovery Centre
-133.24, -12.33

Tech Dome Penang
20.87, 9.63

Agro Technology Park in MARDI
-23.28, 16.55

National Science Centre
-90.02, 226.48

Marine Aquarium and Museum
27.51, -136.98

Pusat Sains & Kreativiti Terengganu
263.99, -57.31

Biomedical Museum
96.68, 127.54

Telegraph Museum
7.02, -359.28

Penang Science Cluster
21.33, -0.59
```

The Euclidean distance shall also be displayed along with each suggested destination like the following:

```
Booking Page
================================================================================

[1] Petrosains Science Discovery Centre
    2.56 km away

[2] National Science Centre
    5.37 km away

[3] Tech Dome Penang
    28.19 km away

[4] Agrotechnology Park in MARDI
    29.13 km away

[5] Marine Aquarium and Museum
    45.32 km away
```

Again, similar to the View Event feature above, it is technically impossible for the parent's children (young students) to go for a visit that clashes with his / her registered events. Thus in the booking page for each visit, the parent can only make bookings on days where all children do not have any registered events. For the example where one of the children has a registered event on 03/09/2024:

```
Enter destination ID for booking: 2
================================================================================

Selected booking for: National Science Centre

Available Time Slots:
[1] 01/09/2024
[2] 02/09/2024
[3] 04/09/2024
[4] 05/09/2024
[5] 06/09/2024
[6] 07/09/2024

Enter a time slot:
```

You will only need display time slots up to one (1) week from the current day, assuming the current day is 31/08/2024 for the example above.

Parent-Child Relationship [1 mark]

In the assumption of this project, one parent can have one to many children (young students), and one child (young student) can only have one to two parents. So, the profile page of each young student shall display his / her parent(s). Similarly, the profile page of each parent shall display his / her children under responsibility.

Below we provide a list of 10 parent-child relationships for you to populate your relational graph. The format of the file is <parent_username>, <child_username>.

`ParentChild.txt`

```
TanChinPeng, Adamtan09
TanChinPeng, Laura_tan
firdaus_an, ahmadfirdaus07
Santya24, reelansantya
noobmaster68, loremipsum96
johndoe3698, yinjiadoe20
TanChinPeng, jason0319
johndoe3698, katyln_doe
aliabdul10, Samadabdul
Nevergonna19, giveYouup3
```

Global Leaderboard [1 mark]

The leaderboard page will display the current points of each Young Student. You will need to display the username and the current points in the leaderboard, sorted in descending order according to the current points.

The leaderboard follows the “first-come, first-serve” basis. Thus for the case where two students have the same number of points, the student that reaches that amount of points will be on top of those that get it afterwards. You may use an `pointLastUpdated` state to help you determine the order.

Send & Manage Friend Request [1 mark]

Young Students can add friends by sending friend requests to other Young Students that are not part of their friend list upon clicking into their profile.
Young Students can also manage the incoming friend requests that they receive. They can either accept the request and add the person into their friend list, or reject the request and remove the request from the request list.

Suggested Extra Features (4 Marks)

Graphical User Interface

A Graphical User Interface (GUI) is a visual interface that allows users to interact with software applications through graphical elements such as windows, icons, buttons, and menus. In a GUI, the visuals displayed in the user interface convey information relevant to the user, as well as actions that they can take. A nice-looking and user-friendly GUI will give the user a better experience using the software. You may elevate user experiences by leveraging intuitive GUI tools like JavaFX (GUI toolkit for building desktop application), React (Library for web UI), Android Studio (IDE for Android app development), and other frameworks and libraries, instead of relying solely on traditional command-line interfaces.

Database

A database is a structured collection of data stored electronically, enabling efficient organisation, retrieval, and manipulation of information. It serves as a **persistent repository** for storing and managing data, ensuring its availability and durability over time. To prevent your data being lost when you restart your application, you are not limited to using Oracle Database, MySQL, Firestore or other databases to do so.

Password Hashing

Storing the raw passwords of our users in any kind of storage violates the basic privacy of the users. According to the United Kingdom's *Article 5 of Regulation (EU) 2016/679* of the European Parliament and of the Council, personal data shall be processed in a manner that ensures appropriate security of the personal data, including protection against unauthorised or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organisational measures ('integrity and confidentiality'). You may use hashing, Caesar cipher, or any other encryption algorithm to tackle this matter. However, you must be able to **justify the algorithm** during the presentation.

Back Navigation

Back navigation functionality enables users to effortlessly revisit previously accessed sections of the user interface, enhancing ease of use and streamlining navigation within the application. This feature empowers users to efficiently retrace their steps, reducing frustration and improving overall user satisfaction. You may implement a suitable data structure to efficiently manage navigation history and

enable users to easily navigate back to previously visited pages if they entered the wrong page.

Friendship Found: Where Connections Begin

Birds of a feather flock together. As young students connect with others, they often desire to expand their social circle by connecting with their friends' friends. They wish to view their connections in graphical visualization to discover new friends and foster meaningful connections. To facilitate this, you need to implement your data structure knowledge in the application to visually represent the connections between **young students**, their **friends**, and their **friends' friends** in a **graph**

Think Out of the Box

The Sky is your limit! You are always encouraged to brainstorm and try out anything.

Tips For This Assignment

To help you complete the assignment easily, here are some tips from our experiences in doing project-based assignments.

Modularity

This project is modular and can be separated into a few parts:

- Login / User Registration
- User Class creation and Data Storage
- Educators Feature
- Parents Feature
- Young Students Feature

This eases your team to delegate the tasks among the team members to effectively construct each functionality separately and compile together after testing has been done. Note that the separation above is just a suggestion and not compulsory to follow while your team distributes tasks and responsibilities.

Version Control

We encourage you to utilise Git versioning and the GitHub platform while collaborating with your team to complete this project. You may read more about Git and GitHub in the following links:

- What is Git?
- Getting Started on GitHub
- Creating Pull Requests on GitHub
- Resolving Merge Conflicts on GitHub

Relative Path

Since there are many File I/O involved in this assignment, there is a tendency that developers use their local absolute file path in their code. Here's a sample difference between absolute path and relative path:

- Absolute Path:
  `C:\Users\Documents\WIA1002\Assignment\SampleInput.txt`

- Relative Path:
  `./SampleInput.txt` (given that the project root ~ is at the `\Assignment\` folder as shown in the Absolute Path)

We strongly advise you to NOT use the absolute path but use the relative path since the file path in your PC will NOT necessarily be the same for your other project collaborators, but the file hierarchy in the project should be the same for all of your project collaborators.

Contact Us

If you have any questions or need clarifications about the assignment, please contact either of us:

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We will try our best to answer your questions as soon as possible. Hope you enjoy this assignment!