



B.Sc (Hons) in Computing Science

CSC3004: Cloud and Distributed Computing

Lab Assessment: gRPC Python Safe Entry System

27 June 2022

Team Members	Student ID
Lim Jun Xian	2000905
Charleston Tan Yee Lin	2001284

Overall Design	3
Design Goals and its Requirements	3
Potential Enhancements	5
Testing Instructions	8

Overall Design

The SafeEntry system was designed based on a simple command-line interface, consisting of basic functionality that resembles the actual SafeEntry app features. This system ensures the users can perform the check-in and check-out of the specified location, sending them notifications of the recent COVID-19 location they visited.

Interface Design

The text-based user interface contains mainly the user input function to ensure the design is simple and easy to navigate the SafeEntry system. With less cognitive load, first-time users will tend to learn how to use the system easily.

However, there are limitations for using this system such that the interface design relies heavily on the command line between the client and server communication. This implies that the user would have to be precise while interacting with the system. The interface is also less user-friendly as compared with the GUI interface.

Data Storage

Parquet is used in our system implementation which serves as a database platform for efficient data storage and retrieval. It supports handling the column-oriented data file format and is known to be one of the fastest file types to read data generally than both JSON and CSV.

Design Goals and its Requirements

The aim of this SafeEntry system is to provide users a platform to resolve the need for effective and practical visitor management amidst COVID-19. As such, there are various key considerations for designing the SafeEntry system for users.

Design Goals

System	Design Goals	Description
User Interface System	Efficiency	To provide fast response time with minimal resources used.
	Effectiveness	To increase the accuracy and completeness
	Concurrency	To handle multiple clients communicating with the server at the same time.
	Satisfaction	To ensure users' comfort and acceptability of use

Requirements

The requirements follow closely with the given handout to meet the intended functionalities to perform the SafeEntry system.

S/N	Requirements	Features Implemented
1	Users can log in to safe entry portal	A login page for users to manage their respective SafeEntry system. Login Portal for Individual users and MOH officers.
2	User can register an account to access the safe entry system	A registration page for users to sign up an account using their NRIC.
3	Users can log out from their respective safe entry system	A logout option for users to sign out from its system and redirect them to the login page.
4	Users can receive and view notifications (if any) after successful login to their portal	Providing notifications to inform them with the possible exposure based on the places they visited in the past 14 days. [Health Risk Warning (HRW)] A 'view covid exposure' option for the individual users to view the information.
5	Users can view the list of past check-in/out records that they visited	A page to display the list of records containing the user information (name, nric), the check-in location, date and time
6	Users can check-in and check-out individually at the particular location.	<u>Check-In/ Check-Out</u> An input option for users to enter the name of the location in which the system would generate the current date and time.
7	Users can check-in and check-out with the family members at the particular location.	<u>Check-In/ Check-Out</u> An input option for users to enter the name of the family members whom they are checking in/out with and also enter the name of the location. The system would then generate the current date and time upon submission.
9	Users can view the safe entry status	A simple text-based display to inform users

	after performing check-in or check-out.	the successful/failure outcome of the safe entry.
10	MOH officers can declare the location as COVID-19 case.	An input option for MOH officers to declare the location that is exposed with COVID-19.

Limitations/ Constraints

The SafeEntry system has several constraints that would restrict performing seamless operations.

Basic Error Handling

As of the current design, the system can only support basic error prevention and input validation to manage the user error. This may not be as effective if the program encounters such complex errors that would result in program failure. An example would be the networking failure that may cause interruption between the client and server communication. Therefore, further extensions of error handling will be needed to detect various types of errors before performing the recovery strategy to prevent possible failures.

Textual Based Interface Design

The use of Text-based User Interface (TUI) may not be as efficient as Graphical User Interface (GUI) which means the user interface in the current program is less user-friendly and prone to user error if the users are less precise when performing the task. The main goal for interface design is to ensure the application is convenient for users in terms of ease of use, ease of learning, and resistance to error. However, TUI is much more complex to use for beginners and does not offer the same ease and ability to work with multiple programs simultaneously.

In TUI, users may spend more time interacting with the program and require high precision to perform certain tasks in order to prevent possible user failure. Users will have to rely heavily on typing using keyboards to interact with the user program. As such, GUI is preferred more than TUI to allow for more multitasking and efficiency.

Potential Enhancements

Based on the current development of the SafeEntry system, there are still areas of improvement to manage the system such as the fault tolerance and the interface design.

Transient Fault Handling

As there is a possibility of transient fault interrupting the gRPC call, it is necessary to implement RpcException to detect transient fault, such as loss of network connectivity or timeouts, which

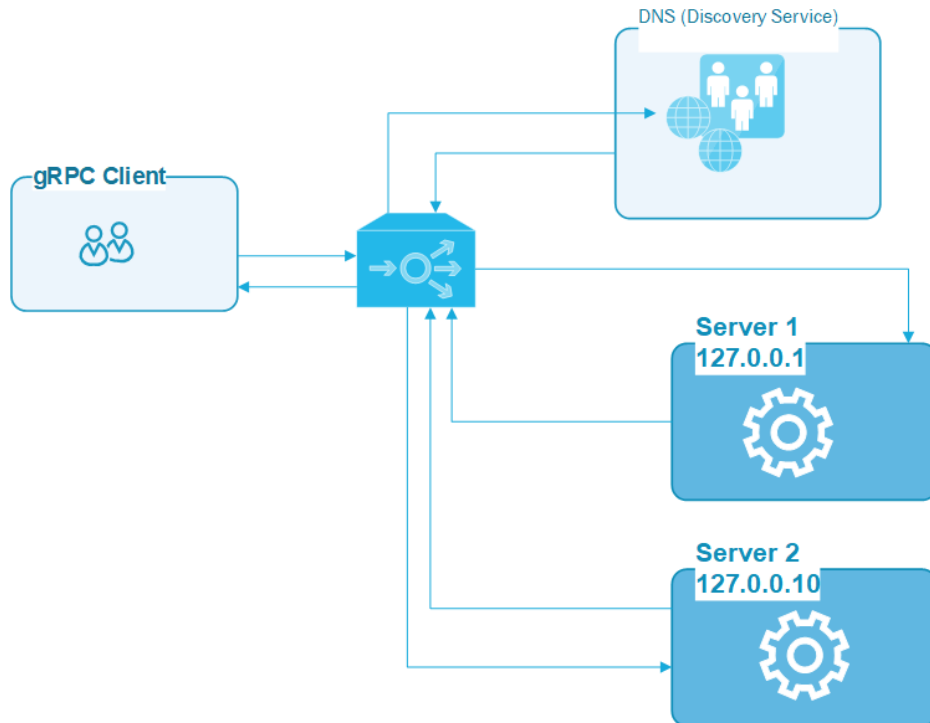
will carry out the built-in logic for automatic retries. This transient fault handling allows the system to respond to errors effectively and to be able to retry the operation if it determines that the fault is likely to be transient. This would make sure gRPC clients will be able to automatically retry failed calls without hassle.

```
var defaultMethodConfig = new MethodConfig
{
    Names = { MethodName.Default },
    RetryPolicy = new RetryPolicy
    {
        MaxAttempts = 2,
        InitialBackoff = TimeSpan.FromSeconds(1),
        MaxBackoff = TimeSpan.FromSeconds(3),
        BackoffMultiplier = 1.5,
        RetryableStatusCodes = { StatusCode.Unavailable }
    }
};

// Clients created with this channel will automatically retry failed calls.
var channel = GrpcChannel.ForAddress("https://localhost:7143", new GrpcChannelOptions
{
    ServiceConfig = new ServiceConfig { MethodConfigs = { defaultMethodConfig } }
});
```

Client-Side Load Balancing

With client-side load balancing, gRPC clients can distribute the load optimally across the available servers. It does not require a proxy for load balancing. At a point when there is any of the endpoints fails, the load balancer will automatically switch to the other healthy endpoints.



Input Controls - Select/List Options

Due to the implementation of a text-based interface, there are limiting factors that cause the users not being able to interact with the system efficiently. Lacking input controls reduces the ease of use in performing tasks. This unnecessary issue may lead to inconsistency and time-consuming in which it can be addressed using additional libraries, like python inquirer, to make the text-based interface more interactive. With python inquirer, users can be easily accessible to both the checkbox and list options, providing more flexibility for users to select the options with minimal errors.

```

[?] What size do you need?:
Jumbo
Large
Standard
> Medium
Small
Micro

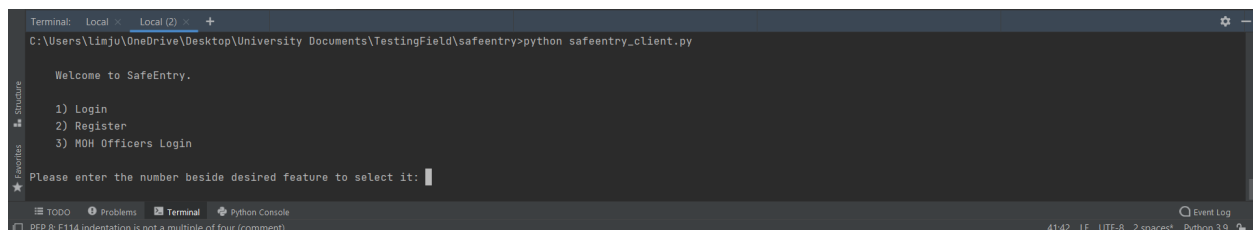
[?] What are you interested in?:
o Computers
X Books
o Science
X Nature
> o Fantasy
o History
  
```

Testing Instructions

Following are sets of instructions explicitly created to allow efficient testing of the entire SafeEntry system to be possible, accompanied with images of our own execution of the instructions showing the expected results.

Prerequisites before Testing

Please refer to “Instructions.pdf” before moving on to the following sections. Upon completing the steps in the document, you should reach the following screen on the client which allows for the normal SafeEntry users to Login, Register, and the MOH Officers to log in to the special access system to declare locations visited by COVID-19 cases. Please do also expand your Terminal, as messages may be pushed up due to large amount of things displayed at times



```
Terminal: Local Local (2) +
C:\Users\limju\OneDrive\Desktop\University Documents\TestingField\safeentry>python safeentry_client.py

Welcome to SafeEntry.

1) Login
2) Register
3) MOH Officers Login

Please enter the number beside desired feature to select it: |
```

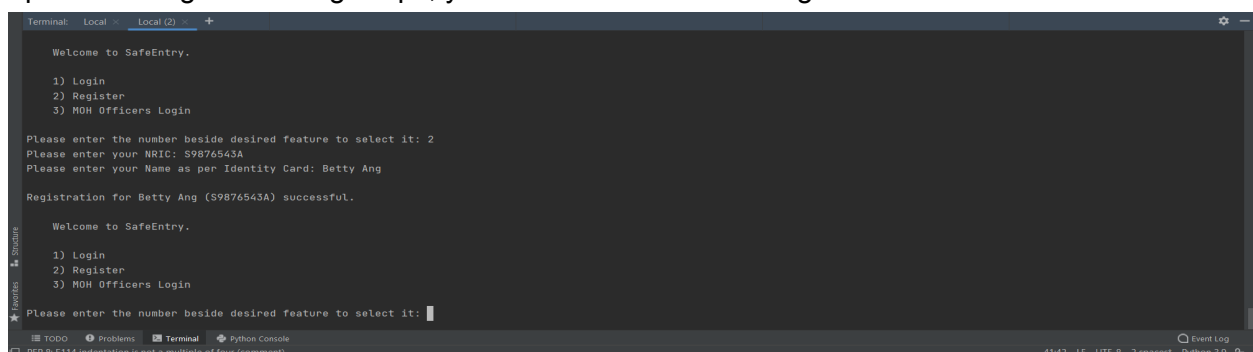
Register

Our team has rethought the SafeEntry System and decided to implement a simple registration for the users. As we recalled in the past when using SafeEntry before the TraceTogether App it was cumbersome to have to key in our NRIC and Name each time we check-in or check-out a location. Hence, by implementing a register function the NRICs and Names can be stored in a Parquet File “userParticulars.parquet” and along with the Login function, the NRIC and Name can be retrieved accordingly and automatically populated whenever a user check-in or check-out.

Testing Steps:

- 1) Enter “2” to select Register Function
- 2) Enter “S9876543A” for NRIC
- 3) Enter “Betty Ang” for Name

Upon following the Testing Steps, you should see the following results:



```
Terminal: Local Local (2) +
Welcome to SafeEntry.

1) Login
2) Register
3) MOH Officers Login

Please enter the number beside desired feature to select it: 2
Please enter your NRIC: S9876543A
Please enter your Name as per Identity Card: Betty Ang

Registration for Betty Ang (S9876543A) successful.

Welcome to SafeEntry.

1) Login
2) Register
3) MOH Officers Login

Please enter the number beside desired feature to select it: |
```


Login

Allows the users to login with their NRIC upon registration. If the user login with an registered NRIC, a message will prompt stating the user has successfully logged in. If the user tries to login with an unregistered NRIC, a message will prompt the user to register before logging in.

Testing Steps:

Unregistered User/NRIC

- 1) Enter "1" to select Login Function
- 2) Enter "S9573373Z" for NRIC, which is an unregistered NRIC

```
Terminal: Local < Local (2) < +
Welcome to SafeEntry.
1) Login
2) Register
3) MOH Officers Login
Please enter the number beside desired feature to select it: 1
Please enter your NRIC to login with SingPass: S9573373Z
NRIC S9573373Z not registered, please register to login.
```

Registered User/NRIC

- 1) Enter "1" to select Login Function
- 2) Enter "S9876543A" for NRIC, which is the NRIC just registered in Register section

```
Terminal: Local < Local (2) < +
Welcome to SafeEntry.
1) Login
2) Register
3) MOH Officers Login
Please enter the number beside desired feature to select it: 1
Please enter your NRIC to login with SingPass: S9876543A
Successfully logged in as Betty Ang (S9876543A)
No Existing Covid Exposure.
Welcome to SafeEntry, Betty Ang (S9876543A)
1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout
Please enter the number beside desired feature to select it: 
```

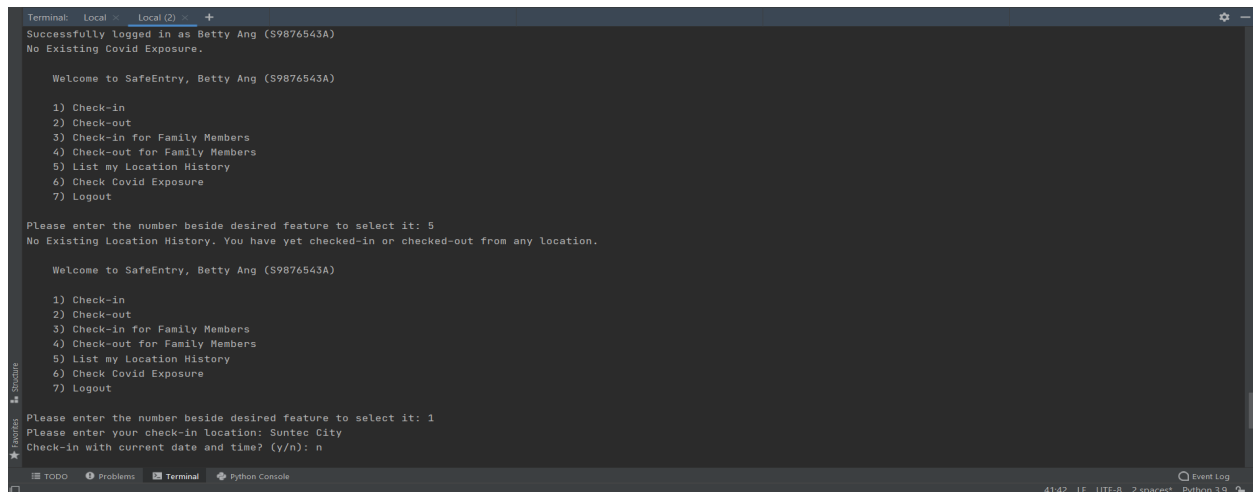
Check-in

Upon login, an user can check-in to a location he specify and choose whether to use the current date and time or specify their own date and time for check-in.

Testing Steps:

Use custom date and time

- 1) Enter "5" to select List my Location History, the result should show there is "No Existing Location History" as the user was just registered and have yet checked-in or checked-out
- 2) Enter "1" to select Check-in
- 3) Enter "Suntec City" for location
- 4) Enter "N" or "n" to specify custom date and time
- 5) Enter "2022-06-13" for date
- 6) Enter "14:35:00" for time
- 7) Enter "5" to select List my Location History, the result should now show the check-in entry with custom date and time just added



```
Terminal Local Local (2) +
Successfully Logged in as Betty Ang (S9876543A)
No Existing Covid Exposure.

Welcome to SafeEntry, Betty Ang (S9876543A)

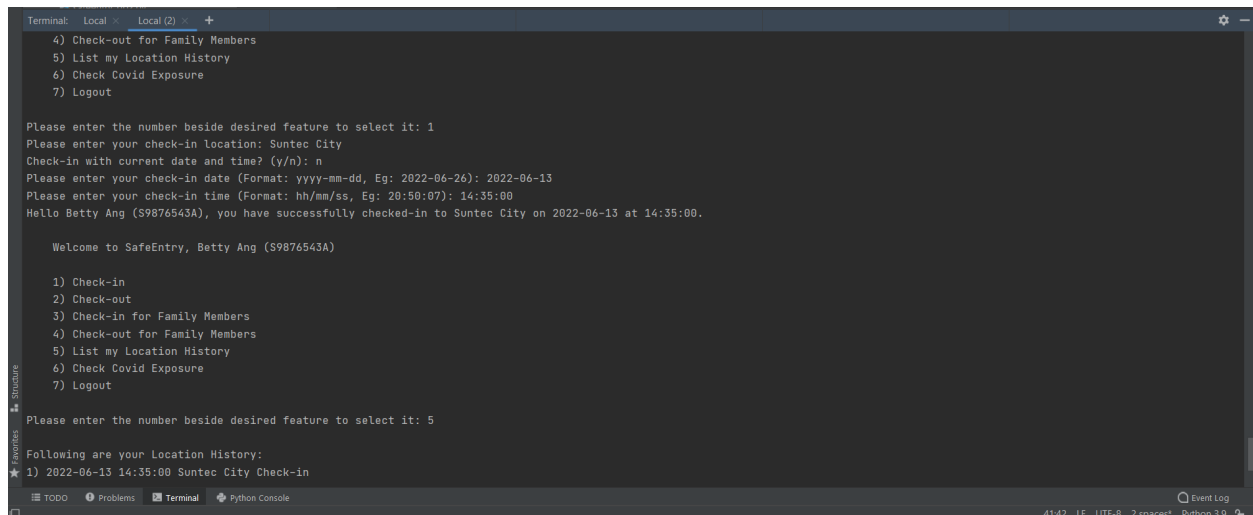
1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5
No Existing Location History. You have yet checked-in or checked-out from any location.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 1
Please enter your check-in location: Suntec City
Check-in with current date and time? (y/n): n
```



```
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 1
Please enter your check-in location: Suntec City
Check-in with current date and time? (y/n): n
Please enter your check-in date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter your check-in time (Format: hh/mm/ss, Eg: 20:50:07): 14:35:00
Hello Betty Ang (S9876543A), you have successfully checked-in to Suntec City on 2022-06-13 at 14:35:00.

Welcome to SafeEntry, Betty Ang (S9876543A)

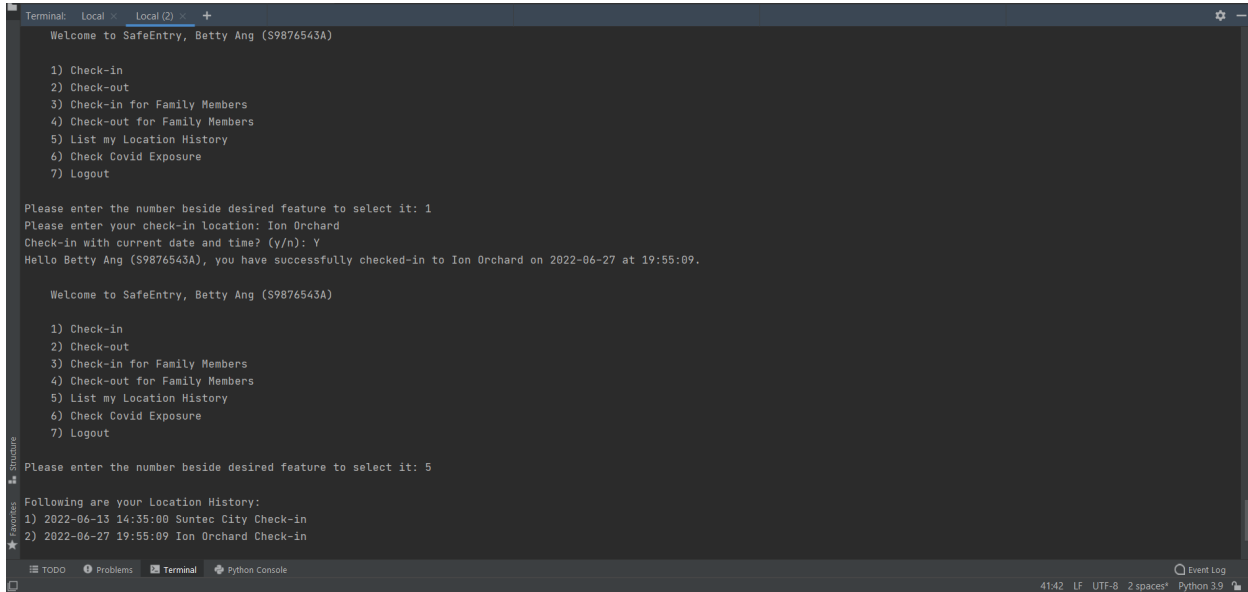
1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
★ 1) 2022-06-13 14:35:00 Suntec City Check-in
```

Use current date and time

- 1) Enter "1" to select Check-in
- 2) Enter "Ion Orchard" for location
- 3) Enter "Y" or "y" to use current date and time
- 4) Enter "5" to select List my Location History, the result should now have the check-in entry with current date and time just added



```
Terminal: Local - Local (2) +
Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 1
Please enter your check-in location: Ion Orchard
Check-in with current date and time? (y/n): Y
Hello Betty Ang (S9876543A), you have successfully checked-in to Ion Orchard on 2022-06-27 at 19:55:09.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in

41/42 LF UTF-8 2 spaces Python 3.9
```

Check-out

Upon login, an user can check-out from a location he specify and choose whether to use the current date and time or specify their own date and time for check-out.

Testing Steps:

Use custom date and time

- 1) Enter "2" to select Check-out
- 2) Enter "Suntec City" for location
- 3) Enter "N" or "n" to specify custom date and time
- 4) Enter "2022-06-13" for date
- 5) Enter "17:57:31" for time
- 6) Enter "5" to select List my Location History, the result should now have the check-out entry with custom date and time just added

```
Terminal: Local x Local (2) x +
Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 2
Please enter your check-out location: Suntec City
Check-out with current date and time? (y/n): N
Please enter your check-out date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter your check-out time (Format: hh/mm/ss, Eg: 20:50:07): 17:57:31
Hello Betty Ang (S9876543A), you have successfully checked-out from Suntec City on 2022-06-13 at 17:57:31.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
```

```
Terminal: Local x Local (2) x +
Check-out with current date and time? (y/n): N
Please enter your check-out date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter your check-out time (Format: hh/mm/ss, Eg: 20:50:07): 17:57:31
Hello Betty Ang (S9876543A), you have successfully checked-out from Suntec City on 2022-06-13 at 17:57:31.

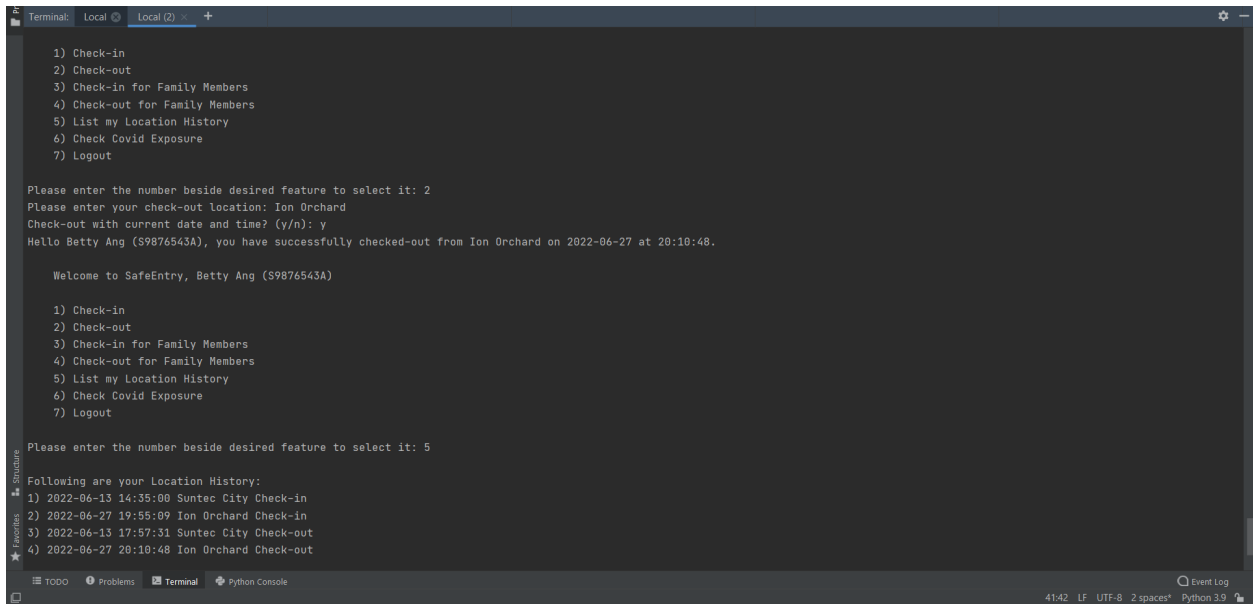
Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5
Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in
3) 2022-06-13 17:57:31 Suntec City Check-out
```

Use current date and time

- 1) Enter "2" to select Check-out
- 2) Enter "Ion Orchard" for location
- 3) Enter "Y" or "y" to use current date and time
- 4) Enter "5" to select List my Location History, the result should now have the check-out entry with current date and time just added



```
1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 2
Please enter your check-out Location: Ion Orchard
Check-out with current date and time? (y/n): y
Hello Betty Ang (S9876543A), you have successfully checked-out from Ion Orchard on 2022-06-27 at 20:10:48.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5
Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in
3) 2022-06-13 17:57:31 Suntec City Check-out
4) 2022-06-27 20:10:48 Ion Orchard Check-out
```

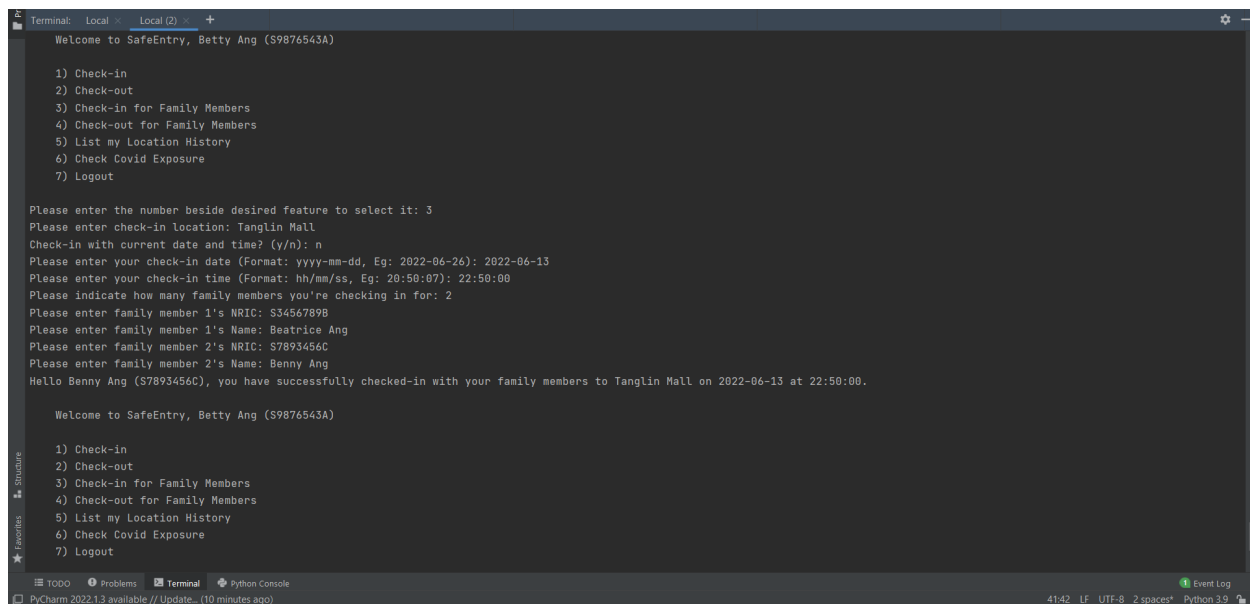
Check-in for Family Members

Upon login, a user can check-in for family members to a location he specifies and choose whether to use the current date and time or specify their own date and time for check-in. For practicality, as the user would usually also be with their family members when checking-in for them, our team has decided to check-in the user along with their family members when this function is used for the user's convenience and to improve their experience.

Testing Steps:

Use custom date and time

- 1) Enter "3" to select Check-in for Family Members
- 2) Enter "Tanglin Mall" for location
- 3) Enter "N" or "n" to specify custom date and time
- 4) Enter "2022-06-13" for date
- 5) Enter "22:50:00" for time
- 6) Enter "2" for family members
- 7) Enter "S3456789B" for family member 1's NRIC
- 8) Enter "Beatrice Ang" for family member 1's name
- 9) Enter "S7893456C" for family member 2's NRIC
- 10) Enter "Benny Ang" for family member 2's name
- 11) Enter "5" to select List my Location History, the result should now have the check-in entry with custom date and time just added



```
Terminal: Local - Local (2) +
Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 3
Please enter check-in location: Tanglin Mall
Check-in with current date and time? (y/n): n
Please enter your check-in date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter your check-in time (Format: hh/mm/ss, Eg: 20:50:07): 22:50:00
Please indicate how many family members you're checking in for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-in with your family members to Tanglin Mall on 2022-06-13 at 22:50:00.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout
```

```
Terminal: Local - Local (2) +

Please enter the number beside desired feature to select it: 3
Please enter check-in location: Tanglin Mall
Check-in with current date and time? (y/n): n
Please enter your check-in date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter your check-in time (Format: hh/mm/ss, Eg: 20:50:07): 22:50:00
Please indicate how many family members you're checking in for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-in with your family members to Tanglin Mall on 2022-06-13 at 22:50:00.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in
3) 2022-06-13 17:57:31 Suntec City Check-out
4) 2022-06-27 20:10:48 Ion Orchard Check-out
5) 2022-06-13 22:50:00 Tanglin Mall Check-in
```

Use current date and time

- 1) Enter “3” to select Check-in for Family Members
- 2) Enter “City Square” for location
- 3) Enter “Y” or “y” to use current date and time
- 4) Enter “2” for family members
- 5) Enter “S3456789B” for family member 1’s NRIC
- 6) Enter “Beatrice Ang” for family member 1’s name
- 7) Enter “S7893456C” for family member 2’s NRIC
- 8) Enter “Benny Ang” for family member 2’s name
- 9) Enter “5” to select List my Location History, the result should now have the check-in entry with current date and time just added

```
Terminal: Local - Local (2) +

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 3
Please enter check-in location: City Square
Check-in with current date and time? (y/n): y
Please indicate how many family members you're checking in for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-in with your family members to City Square on 2022-06-27 at 20:53:41.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout
```

```
Terminal: Local x Local (2) x +
Please enter the number beside desired feature to select it: 3
Please enter check-in location: City Square
Check-in with current date and time? (y/n): y
Please indicate how many family members you're checking in for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-in with your family members to City Square on 2022-06-27 at 20:53:41.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in
3) 2022-06-13 17:57:31 Suntec City Check-out
4) 2022-06-27 20:10:48 Ion Orchard Check-out
5) 2022-06-13 22:50:00 Tanglin Mall Check-in
6) 2022-06-27 20:53:41 City Square Check-in
```

Family Member 1, Beatrice Ang’s Location History

```
Terminal: Local x Local (2) x +
Welcome to SafeEntry, Beatrice Ang (S3456789B)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 22:50:00 Tanglin Mall Check-in
2) 2022-06-27 20:53:41 City Square Check-in
```

Family Member 2, Benny Ang’s Location History

```
Terminal: Local x Local (2) x +
Welcome to SafeEntry, Benny Ang (S7893456C)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 22:50:00 Tanglin Mall Check-in
2) 2022-06-27 20:53:41 City Square Check-in
```

Hence, as can be seen from above 2 images, the user using Check-in for family members was able to Check-in for her family members Beatrice Ang and Benny Ang.

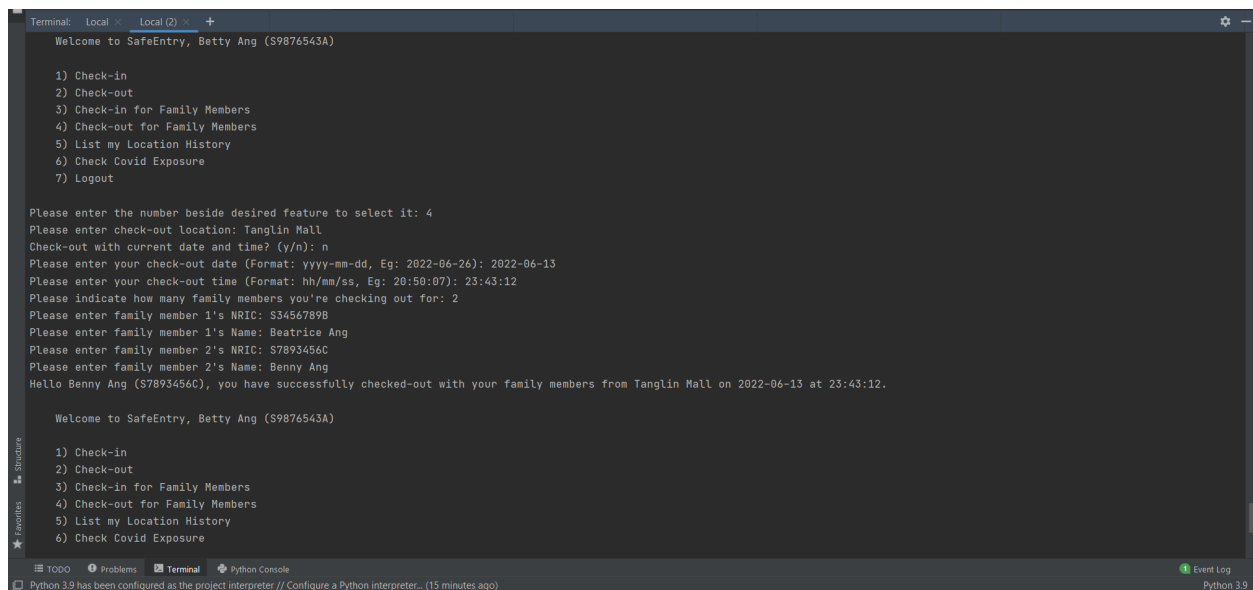
Check-out for Family Members

Upon login, a user can check-out for family members from a location he specifies and choose whether to use the current date and time or specify their own date and time for check-in. For practicality, as the user would usually also be with their family members when checking-out for them, our team has decided to check-out the user along with their family members when this function is used for the user's convenience and to improve their experience.

Testing Steps:

Use custom date and time

- 1) Enter "4" to select Check-out for Family Members
- 2) Enter "Tanglin Mall" for location
- 3) Enter "N" or "n" to specify custom date and time
- 4) Enter "2022-06-13" for date
- 5) Enter "23:43:12" for time
- 6) Enter "2" for family members
- 7) Enter "S3456789B" for family member 1's NRIC
- 8) Enter "Beatrice Ang" for family member 1's name
- 9) Enter "S7893456C" for family member 2's NRIC
- 10) Enter "Benny Ang" for family member 2's name
- 11) Enter "5" to select List my Location History, the result should now have the check-out entry with custom date and time just added



```
Terminal: Local - Local (2) +
Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 4
Please enter check-out location: Tanglin Mall
Check-out with current date and time? (y/n): n
Please enter your check-out date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter your check-out time (Format: hh/mm/ss, Eg: 20:50:07): 23:43:12
Please indicate how many family members you're checking out for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-out with your family members from Tanglin Mall on 2022-06-13 at 23:43:12.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
```

```
Terminal: Local - Local (2) +
Check-out with current date and time? (y/n): n
Please enter your check-out date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter your check-out time (Format: hh/mm/ss, Eg: 20:50:07): 23:43:12
Please indicate how many family members you're checking out for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-out with your family members from Tanglin Mall on 2022-06-13 at 23:43:12.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in
3) 2022-06-13 17:57:31 Suntec City Check-out
4) 2022-06-27 20:10:48 Ion Orchard Check-out
5) 2022-06-13 22:50:00 Tanglin Mall Check-in
6) 2022-06-27 20:53:41 City Square Check-in
7) 2022-06-13 23:43:12 Tanglin Mall Check-out
```

Use current date and time

- 1) Enter “4” to select Check-out for Family Members
- 2) Enter “City Square” for location
- 3) Enter “Y” or “y” to use current date and time
- 4) Enter “2” for family members
- 5) Enter “S3456789B” for family member 1’s NRIC
- 6) Enter “Beatrice Ang” for family member 1’s name
- 7) Enter “S7893456C” for family member 2’s NRIC
- 8) Enter “Benny Ang” for family member 2’s name
- 9) Enter “5” to select List my Location History, the result should now have the check-out entry with current date and time just added

```
Terminal: Local - Local (2) +

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 4
Please enter check-out location: City Square
Check-out with current date and time? (y/n): y
Please indicate how many family members you're checking out for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-out with your family members from City Square on 2022-06-27 at 21:56:33.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout
```

```
Terminal: Local Local (2) +
Please enter check-out Location: City Square
Check-out with current date and time? (y/n): y
Please indicate how many family members you're checking out for: 2
Please enter family member 1's NRIC: S3456789B
Please enter family member 1's Name: Beatrice Ang
Please enter family member 2's NRIC: S7893456C
Please enter family member 2's Name: Benny Ang
Hello Benny Ang (S7893456C), you have successfully checked-out with your family members from City Square on 2022-06-27 at 21:56:33.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in
3) 2022-06-13 17:57:31 Suntec City Check-out
4) 2022-06-27 20:10:48 Ion Orchard Check-out
5) 2022-06-13 22:50:00 Tanglin Mall Check-in
6) 2022-06-27 20:53:41 City Square Check-in
7) 2022-06-13 23:43:12 Tanglin Mall Check-out
8) 2022-06-27 21:56:33 City Square Check-out

Python 3.9 has been configured as the project interpreter // Configure a Python interpreter... (20 minutes ago)
```

Family Member 1, Beatrice Ang’s Location History

```
Terminal: Local Local (2) +
Welcome to SafeEntry, Beatrice Ang (S3456789B)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 22:50:00 Tanglin Mall Check-in
2) 2022-06-27 20:53:41 City Square Check-in
3) 2022-06-13 23:43:12 Tanglin Mall Check-out
4) 2022-06-27 21:56:33 City Square Check-out

Python 3.9 has been configured as the project interpreter // Configure a Python interpreter... (22 minutes ago)
```

Family Member 2, Benny Ang’s Location History

```
Terminal: Local Local (2) +
Welcome to SafeEntry, Benny Ang (S7893456C)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 22:50:00 Tanglin Mall Check-in
2) 2022-06-27 20:53:41 City Square Check-in
3) 2022-06-13 23:43:12 Tanglin Mall Check-out
4) 2022-06-27 21:56:33 City Square Check-out

Python 3.9 has been configured as the project interpreter // Configure a Python interpreter... (24 minutes ago)
```

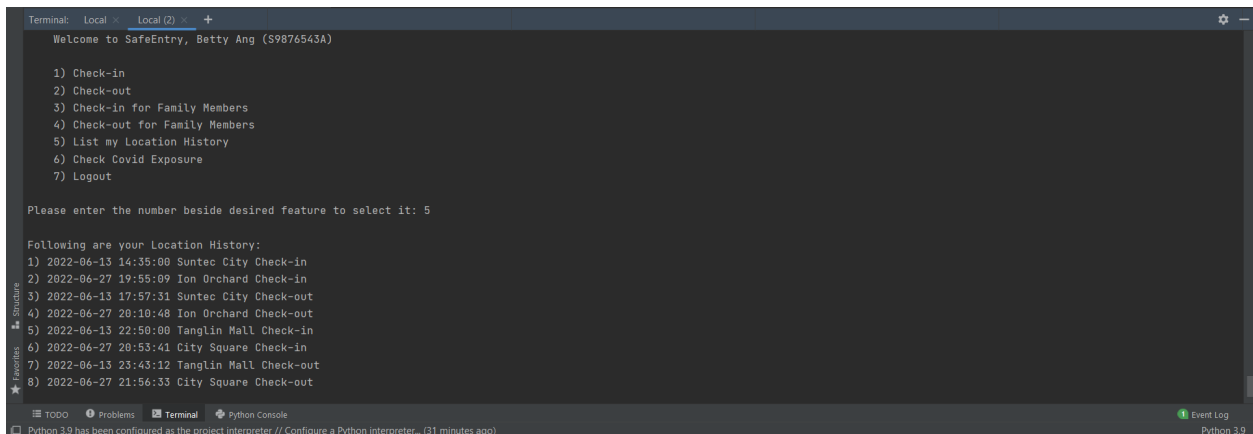
Hence, as can be seen from above 2 images, the user using Check-out for family members was able to Check-out for her family members Beatrice Ang and Benny Ang.

List my Location History

Upon login, an user can list their location history which displays the user's past SafeEntry check-ins and check-outs.

Testing Steps:

- 1) Enter "5" to select List my Location History, the result should show the past check-ins and check-outs of the user up till now



```
Terminal: Local x Local (2) x +
Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 5

Following are your Location History:
1) 2022-06-13 14:35:00 Suntec City Check-in
2) 2022-06-27 19:55:09 Ion Orchard Check-in
3) 2022-06-13 17:57:31 Suntec City Check-out
4) 2022-06-27 20:10:48 Ion Orchard Check-out
5) 2022-06-13 22:50:00 Tanglin Mall Check-in
6) 2022-06-27 20:53:41 City Square Check-in
7) 2022-06-13 23:43:12 Tanglin Mall Check-out
8) 2022-06-27 21:56:33 City Square Check-out

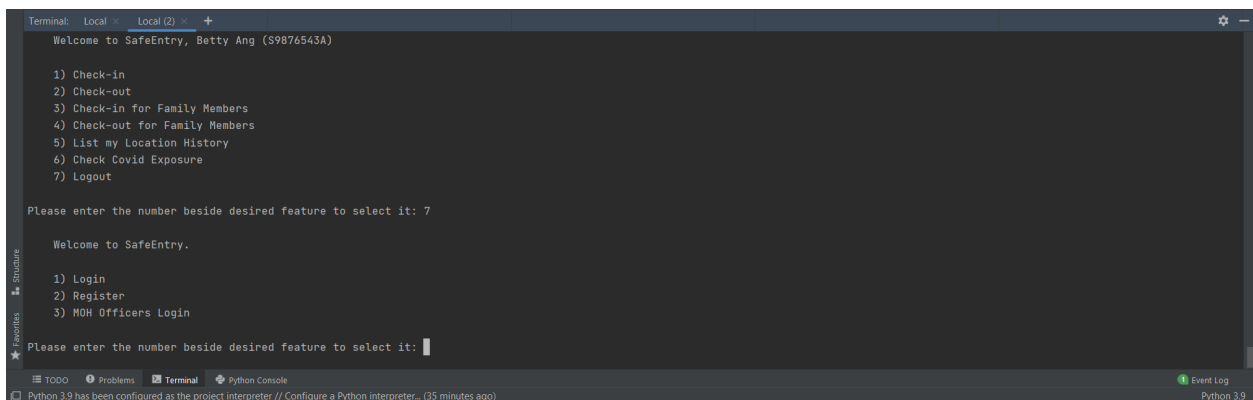
Python 3.9 has been configured as the project interpreter // Configure a Python interpreter... (31 minutes ago)
```

Logout

Upon login, this function allows the user to be able to logout of their login session bringing the user back to the User Registration, Login, and MOH Officer Login screen.

Testing Steps:

- 1) Enter "7" to select Logout



```
Terminal: Local x Local (2) x +
Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 7

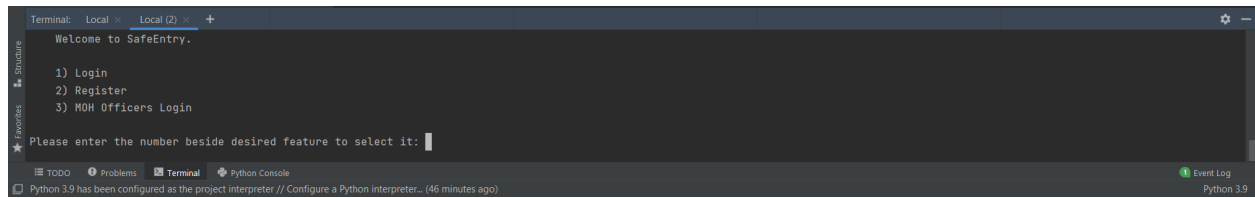
Welcome to SafeEntry.

1) Login
2) Register
3) MOH Officers Login

Please enter the number beside desired feature to select it:

Python 3.9 has been configured as the project interpreter // Configure a Python interpreter... (35 minutes ago)
```

MOH Officers Login



```
Terminal: Local - Local (2) +
Welcome to SafeEntry.

1) Login
2) Register
3) MOH Officers Login

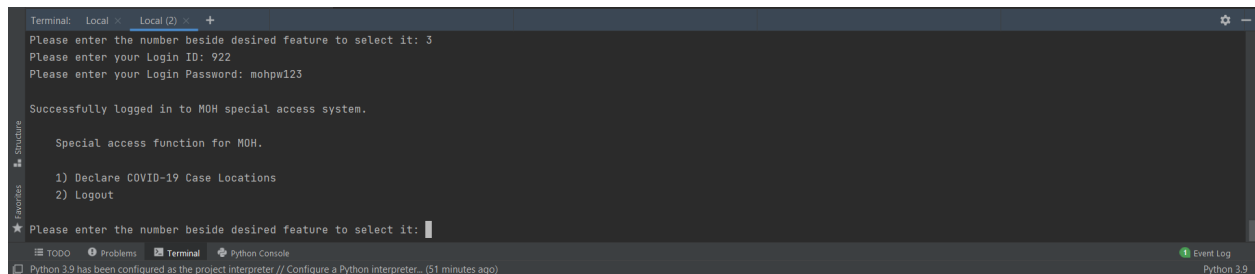
Please enter the number beside desired feature to select it: |
```

The screenshot shows a terminal window with a dark background. At the top, it says 'Terminal: Local - Local (2) +'. Below that, it says 'Welcome to SafeEntry.' followed by a list of options: '1) Login', '2) Register', and '3) MOH Officers Login'. At the bottom, it prompts 'Please enter the number beside desired feature to select it: |' with a cursor. The terminal window has a sidebar on the left with icons for Explorer, Search, and Run and Debug. At the bottom, there's a status bar with 'Python 3.9 has been configured as the project interpreter // Configure a Python interpreter... (46 minutes ago)' and 'Event Log Python 3.9'.

At the screen before users login or the logout screen, as seen above. Only MOH Officers with special access are able to login to the special access system.

Testing Steps:

- 1) Enter “3” to select MOH Officers Login
- 2) Enter “999”, “922” or “222” for Login ID
- 3) Enter “mohpw123” for Login Password



```
Terminal: Local - Local (2) +
Please enter the number beside desired feature to select it: 3
Please enter your Login ID: 922
Please enter your Login Password: mohpw123

Successfully logged in to MOH special access system.

Special access function for MOH.

1) Declare COVID-19 Case Locations
2) Logout

Please enter the number beside desired feature to select it: |
```

The screenshot shows a terminal window with a dark background. It displays the login process: 'Please enter the number beside desired feature to select it: 3', 'Please enter your Login ID: 922', and 'Please enter your Login Password: mohpw123'. After successful login, it says 'Successfully logged in to MOH special access system.' followed by 'Special access function for MOH.' and a list of options: '1) Declare COVID-19 Case Locations' and '2) Logout'. At the bottom, it prompts 'Please enter the number beside desired feature to select it: |' with a cursor. The terminal window has a sidebar on the left with icons for Explorer, Search, and Run and Debug. At the bottom, there's a status bar with 'Python 3.9 has been configured as the project interpreter // Configure a Python interpreter... (51 minutes ago)' and 'Event Log Python 3.9'.

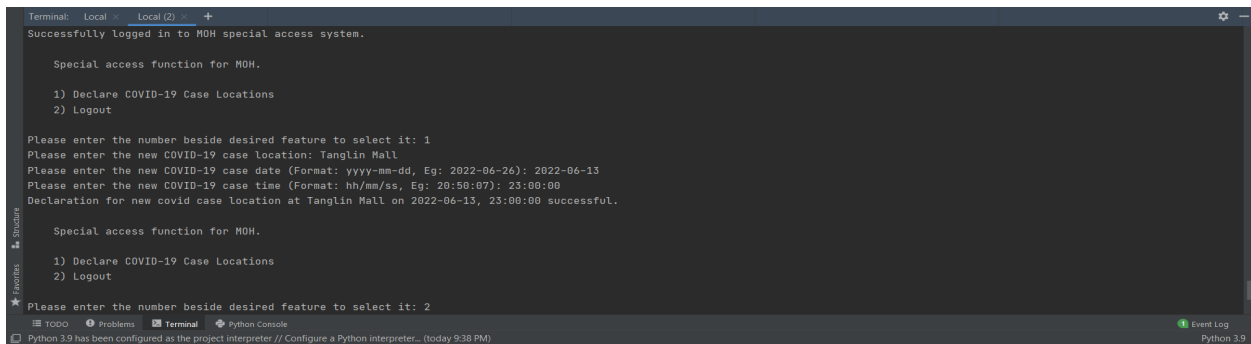
Declare COVID-19 Case Locations & Check Covid Exposure

Upon a MOH Officer logging in, the officer will be able to declare a location that has been visited by a COVID-19 case, doing so a notification will then be sent to the affected users that were at the location when the COVID-19 positive user visited within the past 14 days timeframe (taking consideration of the time as well), upon an user logging in. An user is also able to manually check their covid exposure by selecting option “6) Check Covid Exposure” when logged in.

Testing Steps:

- 1) Enter “1” to select Declare COVID-19 Case Locations
- 2) Enter “Tanglin Mall” for new COVID-19 case location
- 3) Enter “2022-06-13” for new COVID-19 case date
- 4) Enter “23:00:00” for new COVID-19 case time

Successful declaring a COVID-19 case visited location



```
Terminal: Local - Local (2) +
Successfully logged in to MOH special access system.

Special access function for MOH.

1) Declare COVID-19 Case Locations
2) Logout

Please enter the number beside desired feature to select it: 1
Please enter the new COVID-19 case location: Tanglin Mall
Please enter the new COVID-19 case date (Format: yyyy-mm-dd, Eg: 2022-06-26): 2022-06-13
Please enter the new COVID-19 case time (Format: hh/mm/ss, Eg: 20:50:07): 23:00:00
Declaration for new covid case location at Tanglin Mall on 2022-06-13, 23:00:00 successful.

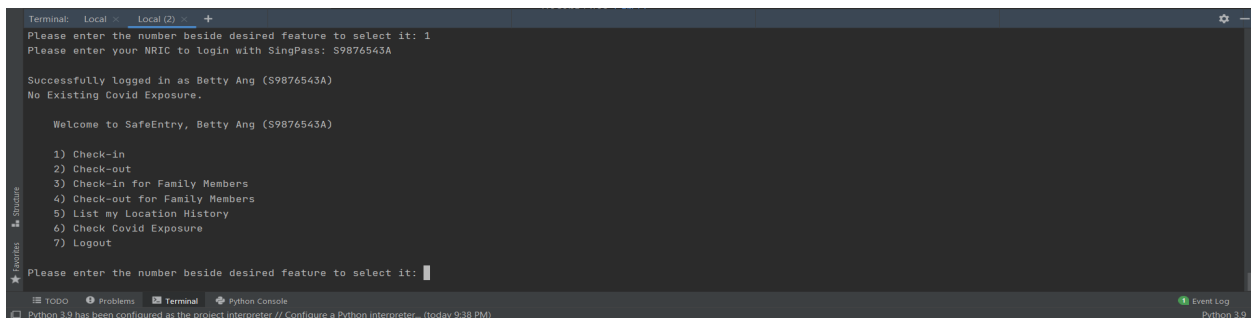
Special access function for MOH.

1) Declare COVID-19 Case Locations
2) Logout

Please enter the number beside desired feature to select it: 2
```

Upon user Betty Ang (S9876543A) logging in, a notification was sent to her (Refer to above image) notifying the potential exposure because she was at Tanglin Mall when the COVID-19 positive user visited on 2022-06-13 at 23:00:00, as she Check-in at 22:50:00 which is before the COVID-19 positive user's visit and Check-out at 23:43:12 which is after the COVID-19 positive user's visit. At the date and time of writing, 2022-06-27 22:48:00 the notification was still sent to Betty as 2022-06-27 22:48:00 backtrack 14 days is 2022-06-13 22:48:00, hence the COVID-19 positive user visit date of 2022-06-13 at 23:00:00 is still within 14 days.

However, at the time of writing on 2022-06-27 at 23:23:00, Betty no longer receives the notification upon logging in and instead only receives "No Existing Covid Exposure" (Refer to below image). This is because 2022-06-27 23:23:00 backtrack 14 days is 2022-06-13 23:23:00 and hence the COVID-19 positive user visit date of 2022-06-13 at 23:00:00 is no longer within 14 days but only 13 days, 23 hours, and 37 mins.



```
Terminal: Local - Local (2) +
Please enter the number beside desired feature to select it: 1
Please enter your NRIC to login with SingPass: S9876543A

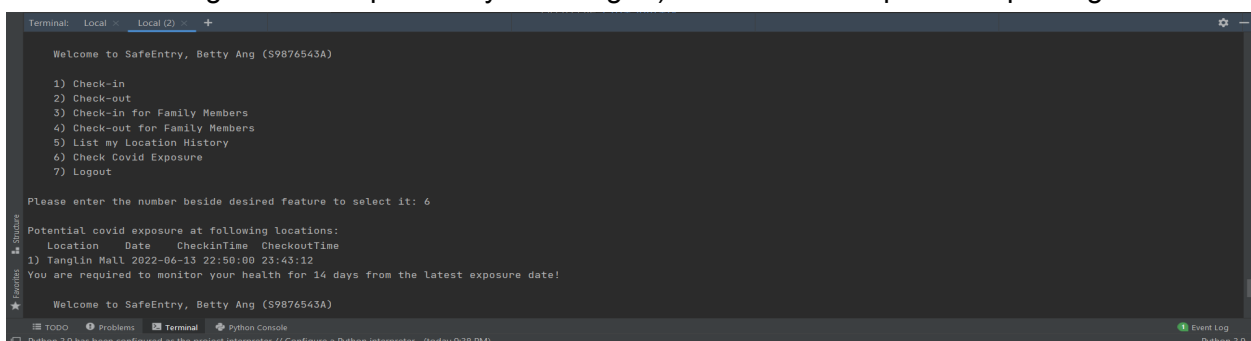
Successfully logged in as Betty Ang (S9876543A)
No Existing Covid Exposure.

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 
```

Manual checking of covid exposure by selecting "6) Check Covid Exposure" upon login



```
Terminal: Local - Local (2) +

Welcome to SafeEntry, Betty Ang (S9876543A)

1) Check-in
2) Check-out
3) Check-in for Family Members
4) Check-out for Family Members
5) List my Location History
6) Check Covid Exposure
7) Logout

Please enter the number beside desired feature to select it: 6

Potential covid exposure at following locations:
Location      Date      CheckInTime  CheckOutTime
1) Tanglin Mall 2022-06-13 22:50:00    23:43:12
You are required to monitor your health for 14 days from the latest exposure date!

Welcome to SafeEntry, Betty Ang (S9876543A)
```