Annex D: The Application Development Process

Firstly, the applications are developed in the Java programming language, and can run on the Android operating platform. The apps have been designed, taking into consideration object-oriented programming, segregation of classes and data access objects.

Object-Oriented Programming

The apps have different Java classes including the entities of the activity, mainly, User, Property, Card and Disruption classes; each class has its own attributes. The use of classes in the development is useful because firstly, it allows saving of the entire object into Firebase, together with the attributes. This allows reading and updating of the database server made easier. Next, these objects have accessor (get) and mutator (set) methods which also helps in displaying the details of the entities to the app and updating to the database. Hence, these are the reasons for implementing object-oriented programming. The Community Chest and Chance card classes inherit from the Card class, since both classes have the same attributes. The following screenshot is a snapshot of the User class to illustrate object-oriented programming.
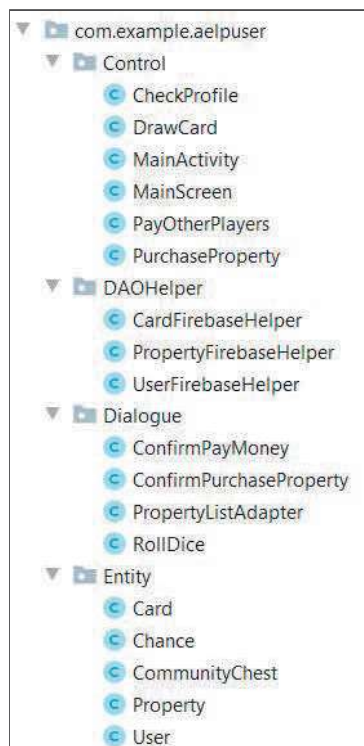
```java
public class User implements Serializable {
    private String id, chosenCharacter, nickName;
    private double balance;
    private int lastDiceValue;
    private boolean isJailed;

    public User() {

    }

    public User(String id, String chosenCharacter, String nickName, double balance,
                int lastDiceValue, boolean isJailed){
        this.id = id;
        this.chosenCharacter = chosenCharacter;
        this.nickName = nickName;
        this.lastDiceValue = lastDiceValue;
        this.balance = balance;
        this.isJailed = isJailed;
    }
}
```

Segregation of Classes

Next, segregation of classes is also practiced in the app development. Each class is designed to serve a unique function that differs from other classes, and are segregated into different folders. For example, the classes to display the dialogues or for the custom list view interface are saved in the "Dialogue" folder, different from the other classes. The following screenshot shows the classes in the respective folders for the User's application.

Data Access Objects (DAO)

In order to access the Firebase database, there are functions required to read and write from it. Hence, these functions are done in these data access objects (DAO). DAO is a pattern that provides an abstract interface to some type of database or other persistence mechanism,

providing some specific data read and write operations without exposing details of the database. In the case of the project, the DAO classes are required to access the Firebase server to extract data from, add new data to the server and update existing data. Hence, there are different DAO classes done for read and write operations for the different entity classes. CardFirebaseHelper.java is used for data operations on both Community Chest and Chance cards classes, while PropertyFirebaseHelper.java for Property class, UserFirebaseHelper.java for User class and DisruptionFirebaseHelper.java for Disruption class. The following is a screenshot taken from the UserFirebaseHelper.java showing the data operations.

```java
public interface DataStatus{
    void DataLoaded(ArrayList<User> users);
}

// Read all users from the database server
public void readUsers(final DataStatus dataStatus){
    userReference.addValueEventListener(new ValueEventListener() {
        @Override
        public void onDataChange(@NonNull DataSnapshot dataSnapshot) {
            userList.clear();

            for (DataSnapshot keyNode : dataSnapshot.getChildren()){
                User u = keyNode.getValue(User.class);
                userList.add(u);
            }
            dataStatus.DataLoaded(userList);
        }

        @Override
        public void onCancelled(@NonNull DatabaseError databaseError) { }
    });
}

// Add new user
public User addUser(String avatar, String nickname, double balance){
    String id = userReference.push().getKey();
    User user = new User(id, avatar, nickname, balance, lastDiceValue: 0, isJailed: false);
    userReference.child(id).setValue(user);
    return user;
}
```

Firebase Server

As mentioned earlier, Firebase is chosen to host the database server for the applications, in particular the Realtime Database in Firebase. The database stores the entire object and its attributes, which can be accessed easily too. When the database is accessed through the web browser, the objects and attributes can be seen clearly in a JSON format.

With regards to the add, update and delete operations, it is implemented through code. To perform the add operation, the entire object including its attributes is added to the database. For updating operation, it is done by identifying the attribute and directly updating the value. To delete the data, it is done by identifying the attribute and making the value null. The following screenshot shows an example of how the Community Chest card class is displayed on the browser.

Annex E: The Application User Interface Mockup

The following are user interface mockups drawn before the development of mobile applications

S/N	Interface Type	Image of Interface Mockup
1	Facilitator	

Game settings

Game Settings
← Game Settings

[globe icon] Send a player to Jail

[power off icon] Activate Power Shutdown

[↑↓ arrows icon] Change Prices of Properties

Game settings - send a player to Jail
← Game Settings

Select the player to send to Jail.

[six circles arranged in two rows of three, plus one circle below]

CANCEL

only allowed to select one player to jail at a time

Game settings - adjust properties prices
← Game Settings

Adjust the price of properties here.

| Unsold Properties | Sold Properties |

Select the list of properties to change the price:

[list rows]

CANCEL

Name of the properties will be listed here.

Game settings - adjust properties prices
← Game Settings

<Name of Property>
Current Price:

M$12,000   ⊕
            ⊖

CONFIRM

BACK   CANCEL

2	Individual Participant	

Welcome Screen

Welcome to the Game!

Please choose your avatar:

[Petronas Tower ▽]

NEXT

- drop down box of the figurines representing the players
- click next to the main screen

Main Screen

Petronas Tower

Your Balance: M$12,000.20

What would you like to do?

- Purchase Property
- Pay to Other Players
- Roll Dice
- My Profile

- current balance of the players are shown
- available options to the players
- check the player's financial details

Pay to other Players

Petronas Tower

M$ 900.00

1	2	3	⌫
4	5	6	.
7	8	9	0

CANCEL   NEXT

- enter the price to pay others
- click next to proceed

Petronas Tower

Select the player to send money to.

☐ Select all current players
☑ ___ mention
☐ ___ Ryker Volt
☐ TTR ___ Bay Sands

BACK   NEXT

- Select multiple players to pay to
- click next to proceed

Petronas Tower

Select the player to send money to.

☐ Select all current players
☐
  Confirm sending mf$900.00 to mention!
  YES   NO
☐

BACK   NEXT

Confirm screen

Petronas Tower

Select the player to send money to.

☐ Select all current players
☐
  Payment successfully sent to mention
  OK
☐

BACK   NEXT

Roll Dice

Petronas Tower

Your Balance: M$12,000.20

Rolling....

🎲 🎲

- Pay to Other Players
- Roll Dice

Petronas Tower

Your Balance: M$12,000.20

You've got 6 and 3!

OK

- Pay to Other Players
- Roll Dice

- result of both dice are then shown.

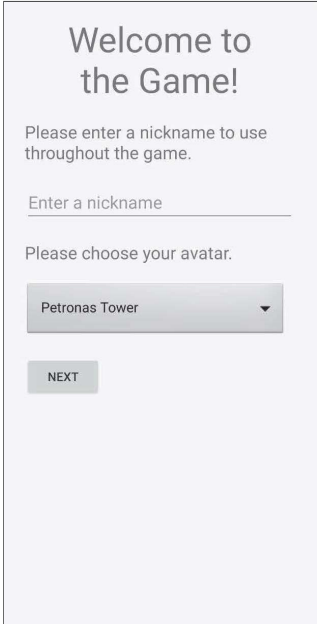|		
		Player's Profile Petronas Tower, Kuala Lumpur Current Balance: M$12,000.20 Owned Properties: Current Chance Cards: Acquit from Jail Current Community Chest: Did you know that the Petronas Tower was once the tallest building in Asia? Find out more — fun fact about the chosen avatar
3	Main Interface	CHANCE 3 5 ↑ dice area ASEAN EXPERIENTIAL LEARNING PROGRAMME remarks / comments section COMMUNITY CHEST Chance BANK PAYS YOU DIVIDEND OF $50 Community Chest GO TO JAIL Go Directly to Jail DO NOT PASS GO DO NOT COLLECT $200

Annex F: The Application's Interface

The following are details on the application interface for the three completed applications. This annex serves as a guide on the functionalities of the applications.

<u>User's App</u>

Welcome to the Game! Please enter a nickname to use throughout the game. Enter a nickname Please choose your avatar. Petronas Tower ▼ NEXT	1. The user will enter the nickname they want for the activity. 2. The user will select from the dropdown box the avatar to represent them in the activity. 3. Once done, press 'Next'.

Jane, Banane Rice Terraces Your Balance: M$1500.00 What would you like to do? Purchase Property Pay to Others Players Roll Dice Draw Card Pass Go! Check Profile	1. The nickname and chosen avatar is reflected at the main menu. 2. The user's existing balance is also shown. 3. Purchase Property: The user can purchase available properties. 4. Pay to Other Players: The user can make financial transactions to other players or to the bank. 5. Roll Dice: The user can roll the dice and the value is reflected at random. 6. Pass Go!: The user collects M$200 when passing Go!, simply by pressing the button. 7. Check Profile: The user can view their own profile for assets and balance.

Purchase Property

1. The user can view a list of unsold properties for sale.

2. The price is stated, and 'Available' means the property is not sold yet.

3. To purchase a property, select from the list and the dialogue box is shown to confirm the transaction.

Screen 1 (Property list):

Your Balance:
M$1500.00

Select a property to purchase

Jakarta	M$240.00 Available
Bali	M$220.00 Available
Hanoi	M$140.00 Available
Luang Prabang	M$140.00 Available
Vientiane	M$160.00 Available
Phuket	M$260.00 Available
Krabi	M$260.00 Available

Screen 2 (Confirmation dialogue):

Your Balance:
M$1500.00

Select a property to purchase

Do you confirm the transaction?

Purchase
Vientiane

Confirm   Cancel

Phuket	Available
Krabi	M$260.00 Available
Bangkok	M$280.00 Available

Pay to Other Players

1. The user needs to enter an amount to make the financial transaction.

2. The user can choose a player from the list or pay to the bank.

3. If the user wants to pay to the bank, they will press 'Pay to Bank'.

4. If the user is paying to another player, they will select the player's nickname and a dialogue box is shown to confirm the transaction.

Screen 1 (Pay amount):

Jane, Banane Rice Terraces

You currently have:
M$250.00

Please select the amount ($M) to pay:

1250

Here are the list of active players:

Pay to Bank

KJ
John
ZY
Joy
Ying
Ice

Screen 2 (Confirmation dialogue):

Jane, Banane Rice Terraces

You currently have:
M$250.00

Do you confirm the transaction?

Pay   M$1250.00

To   John

Confirm   Cancel

John
ZY
Joy
Ying
Ice

Jane, Banane Rice Terraces Your Balance: M$1254.00 V ? Your dice value is **3** **6** Got it! P ers Pass Go! Check Profile	**Roll Dice** 1. The values of the 2 dice are shown and for the user to acknowledge the value, they will press 'Got it!'.
← **Draw Community Chest or Chance Cards here** **Get out of Jail Free** This card may be kept until needed or sold/traded **Go back Three Spaces** ?	**Draw Card** 1. To draw the Community Chest card, the user presses on the Community Chest logo button. 2. To draw the Chance card, the user presses on the Chance logo button. 3. The card title and instruction will be displayed on the app.

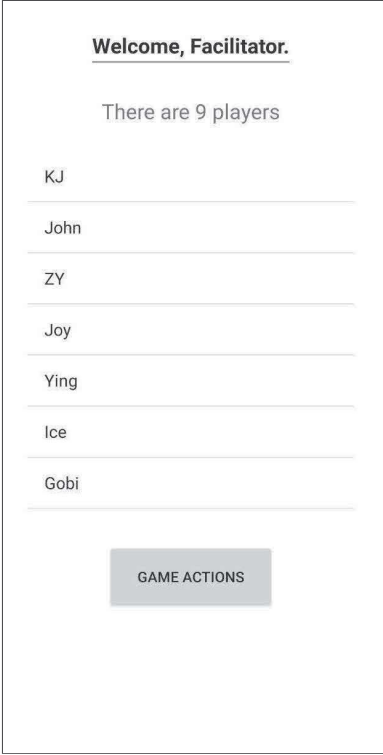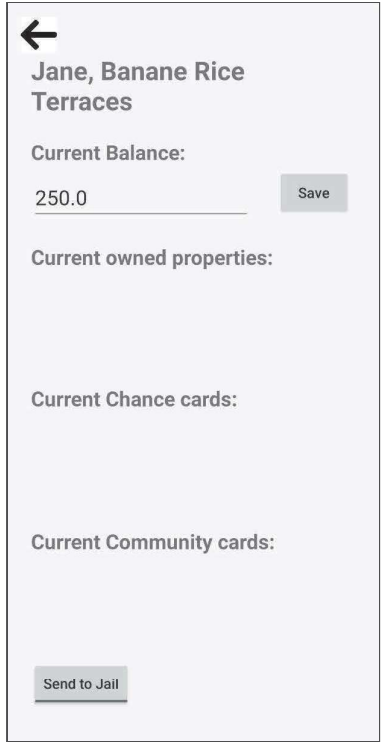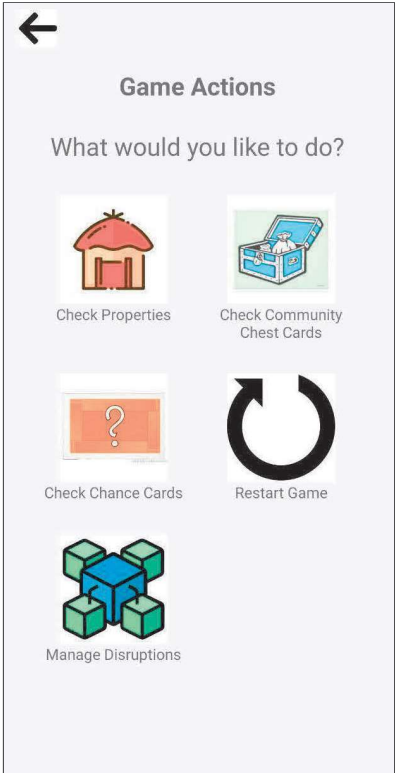|	Check Profile
← **Jane, Banane Rice Terraces** **Your Balance:** M$1514.00 **Your owned properties:** Luang Prabang **Your Chance cards:** Go back Three Spaces **Your Community cards:** Get out of Jail Free	1. The nickname and chosen avatar is reflected at the main menu. 2. The user's existing balance is also shown. 3. The user's owned properties, Chance and Community Chest cards are displayed as a list.

Facilitator's App

Welcome, Facilitator. There are 9 players KJ John ZY Joy Ying Ice Gobi GAME ACTIONS	1. The facilitator can see the total number of active players. 2. The facilitator can also select any of the players in the list to check their profile. 3. The facilitator can access the additional game actions by pressing 'Game Actions'.
← **Jane, Banane Rice Terraces** **Current Balance:** 250.0 Save **Current owned properties:** **Current Chance cards:** **Current Community cards:** Send to Jail	1. The selected user's profile is displayed, showing the nickname, avatar, balance and owned properties and cards. 2. The facilitator can adjust the balance of the user and press 'Save' to update the database. 3. The facilitator can also send the user to jail and release the user, by pressing the toggle button 'Send to Jail' to send the player to jail. Press

	'Release' to release the player from jail. 4. If the user is not in jail, the toggle button will reflect as 'Send to Jail', while reflect as 'Release' if the user is in jail.
Game Actions What would you like to do? Check Properties Check Community Chest Cards Check Chance Cards Restart Game Manage Disruptions	1. The following options of game actions are available for the facilitator. 2. Check Properties: The facilitator can check and manage the properties in the game. 3. Check Community Chest Cards and Check Chance Cards: The facilitator can check and manage the game cards in the activity. 4. Reset Game: The facilitator resets the game by deleting all players' profiles and reset the statuses of the cards, properties and disruptions. 5. Manage Disruptions: The facilitator can check and manage the

	disruptions in the activity.
Check and configure properties Jakarta — 240.00 — Available Bali — 220.00 — Available Surabaya — 220.00 — Purchased Hanoi — 140.00 — Available Luang Prabang — 140.00 — Purchased Vientiane — 160.00 — Available Add — Reset	Check Properties 1. The list of all properties are displayed. 2. The name, price and availability is shown. When the property is purchased, the status is 'Purchased'. 3. The facilitator can press 'Reset' to reset the purchase status of the property.

Check and configure properties	Check Properties

Check and configure properties

Jakarta   240.00
       Available

Add new property

Name   Enter name

Colour   Enter colour

Price   Enter price (M$)

Rental Price   Rental pric

Lu

[Add]   [Cancel]

[Add]   [Reset]

Check Properties

1. When the facilitator presses 'Add', they will enter the details of the new property and press 'Add' again for successful addition.

2. The following details are to be given: Name, Colour category, Price and Rental Price.

Check and configure properties

Jakarta   240.00

Surabaya

Name   Surabaya

Colour   Red

Price   220.0

Rental Price   0.0

Lu   [Purchased]

Owner: KJ

[Save]   [Cancel]

[Add]   [Reset]

Check Properties

1. The facilitator can select the property from the list and view the details, including the Name, Price and the Owner's nickname if the property is purchased.

Check Community Chest Cards and Check Chance Cards

1. The list of all cards are displayed.

2. The name and availability is shown. When the card is drawn, the status is 'Taken'.

3. The facilitator can press 'Reset' to reset the drawn status of the cards.

Check Community Chest Cards and Check Chance Cards

1. When the facilitator presses 'Add', they will enter the details of the new card and press 'Add' again for successful addition.

2. The following details of the card, Name and Content, are to be given.

Check Community Chest Cards and Check Chance Cards

1. The facilitator can select the card from the list and view the details, including the Name, Content, which is the instruction, and the Owner's nickname if the card is drawn.

Manage Disruptions

1. The list of disruptions is displayed.
2. The title and the instruction for the disruption are shown.
3. The facilitator can press 'Reset' to reset the shown status of the disruptions.
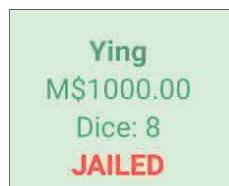
Manage Disruptions to the Game

Add new Disruption

Title Enter title

Content Enter content

Add   Cancel

Manage Disruptions

1. When the facilitator presses 'Add', they will enter the details of the new disruption to be introduced and press 'Add' again for successful addition.

2. The following details are required: title and content, which is the instruction.

Manage Disruptions to the Game

Enter lockdown   Pandemic
Intervention of Market Prices

Price of properties will now change.

Available

OK

Add   Reset

Manage Disruptions

1. The facilitator can select the disruption from the list and view the details, including the Name, Instruction, and the status of whether the disruption has been shown to the participants.

2. 'Available' means the disruption has not been shown in the activity, while 'Drawn' means the disruption was shown previously.

Overall Dashboard App

1. The main page displays all the active players in the activity, their balance and last roll dice value. If a player is sent to jail, the interface will indicate as well.

2. On the left, the area in blue shows the information of the last Community Chest card drawn by any user. The title and instruction of the card are displayed.

3. On the left area in red shows the disruption message, when it is activated by the facilitator. The title and instruction of the disruption are displayed.