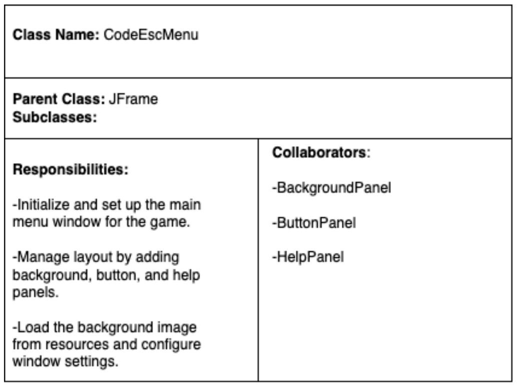
System Design

EECS 3311
CodeEsc

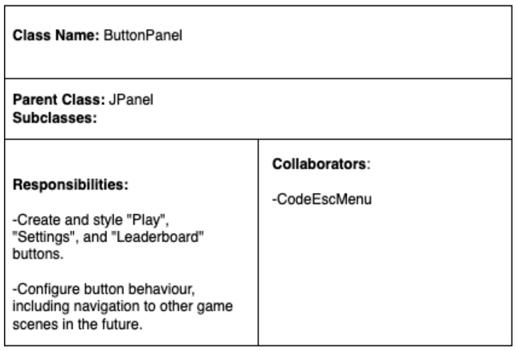
Project Overview

The CodeESC project is an interactive escape room puzzle game designed to challenge players through various levels with engaging gameplay, a leaderboard system, and other features. The application will be developed using Java.

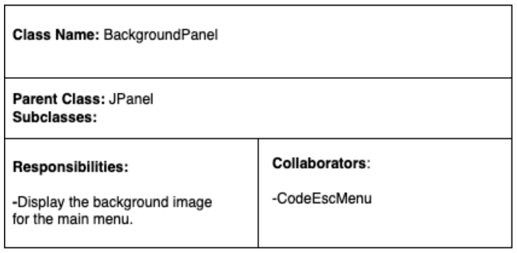
CRC Cards



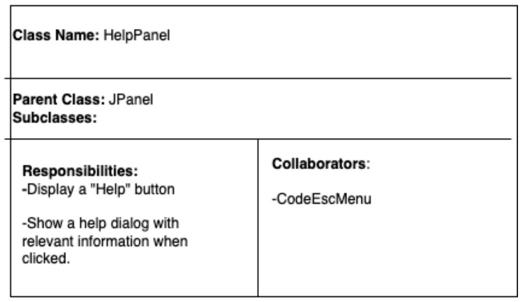
Class Name: CodeEscMenu	
Parent Class: JFrame **Subclasses:**	
Responsibilities: -Initialize and set up the main menu window for the game. -Manage layout by adding background, button, and help panels. -Load the background image from resources and configure window settings.	**Collaborators**: -BackgroundPanel -ButtonPanel -HelpPanel



Class Name: ButtonPanel	
Parent Class: JPanel **Subclasses:**	
Responsibilities: -Create and style "Play", "Settings", and "Leaderboard" buttons. -Configure button behaviour, including navigation to other game scenes in the future.	**Collaborators**: -CodeEscMenu



Class Name: BackgroundPanel	
Parent Class: JPanel **Subclasses:**	
Responsibilities: -Display the background image for the main menu.	**Collaborators**: -CodeEscMenu



Class Name: HelpPanel	
Parent Class: JPanel **Subclasses:**	
Responsibilities: -Display a "Help" button -Show a help dialog with relevant information when clicked.	**Collaborators**: -CodeEscMenu

Class name: LoginForm	
Parent Class (if any): None **Subclasses (if any):** None	
Responsibilities: ● The main responsibility of the Login Form is to provide a UI where a user can login and sign-up into their respective accounts. ● To have a visually appealing and easy to use UI. ● To gracefully handle errors and display	**Collaborators:** ● interfaceHelper ● handleLoginInterface ● handleLoginLogic ● LoginFrame ● Account ● Main ● loginFormQueries

error messages to the user.	

Class name: LoginFrame	
Parent Class (if any): JFrame **Subclasses (if any):** None	
Responsibilities: ● To be a fitting background frame for the Login Form with correct JFrame configurations.	**Collaborators:** ● LoginForm

Class name: interfaceHelper	
Parent Class (if any): None **Subclasses (if any):** None	
Responsibilities: ● To provide error-free and useful helper methods for the various UI components within the project.	**Collaborators:** ● LoginForm

Class name: passwordHashing	
Parent Class (if any): None **Subclasses (if any):** None	
Responsibilities: ● To provide functionality for hashing passwords and making them secure. ● To provide functionality for comparing passwords against hashed passwords correctly.	**Collaborators:** ● loginFormQueries

Class name: Account
Parent Class (if any): None **Subclasses (if any):** None

Responsibilities: ● To provide an organised model of a user Account within the system. ● To be a pathway between the Login Form and the main menu of the program (CodeEscMenu).	**Collaborators:** ● LoginForm ● CodeEscMenu ● handleLoginLogic

Class name: loginFormQueries	
Parent Class (if any): None **Subclasses (if any):** None	
Responsibilities: ● To provide methods that can query the SQL database used for the project for login and sign-up reasons.	**Collaborators:** ● LoginForm ● passwordHashing ● handleLoginLogic

Class name: handleLoginInterface	
Parent Class (if any): None **Subclasses (if any):** None	
Responsibilities: ● To provide methods that alter the LoginForm's UI based on needed functionality.	**Collaborators:** ● LoginForm

Class name: handleLoginLogic	
Parent Class (if any): None **Subclasses (if any):** None	
Responsibilities: ● To provide methods that perform various tasks on the backend to do with the database, and to then return those results to the LoginForm or Account.	**Collaborators:** ● LoginForm ● Account ● loginFormQueries

Class name: Main	
Parent Class (if any): None **Subclasses (if any):** None	
Responsibilities: ● To provide an entry point for the CodeEsc project that correctly launches the program. ● To provide a connection to the database for the rest of the program to use throughout the remainder of the program flow.	**Collaborators:** ● LoginForm

System Interaction with Environment

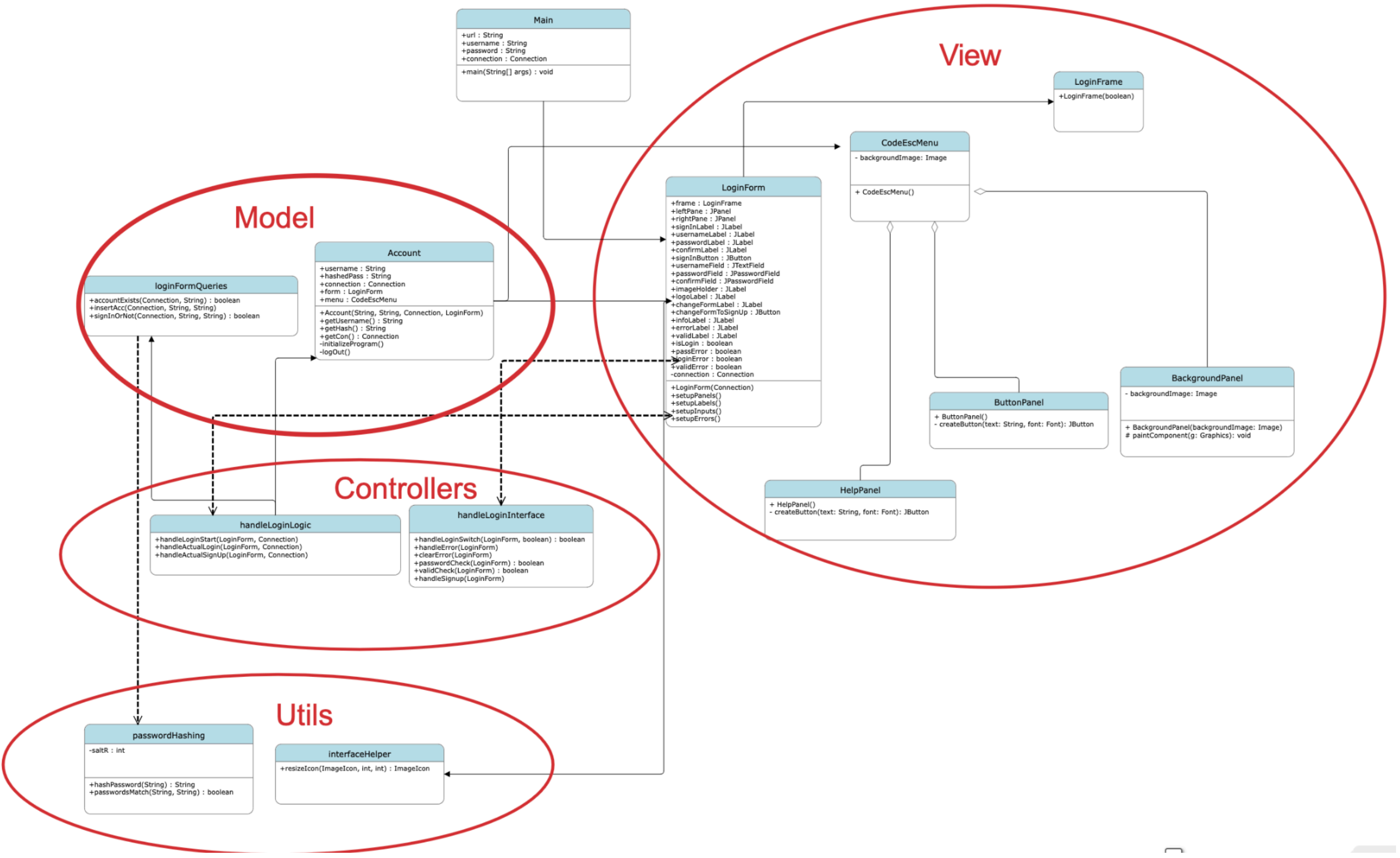
Dependencies and Assumptions

1. **Operating System:**
    - The CodeEsc application is designed to run on multiple operating systems, including Windows, macOS, and Linux.
    - The CodeEsc application is not designed to run on mobile devices such as Android or IOS devices.
2. **Programming Language:**
    - The application is developed using Java, so it is assumed that whatever OS is running this program has either the JRE (Java Runtime Environment) and/or JDK (Java Development Kit) installed to be able to compile and run the application.
3. **Virtual Machine:**
    - Due to the application's nature of being a simple Java program with its used libraries/dependencies included, it can run on any VM that has a supported OS and the right JDK/JRE versions installed.
4. **Database:**
    - This application uses an SQL database for all of its data storage, however the SQL database used for this project is running on a 24/7 server. This means that the user does not have to install or configure anything for the database to work properly, the user just has to have an internet connection while running the application.
5. **Network Configuration:**
    - Since this application uses a database that is hosted on an online server, the user of the application must have a working internet connection. The network configuration is not important as long as they can open commonly used websites on a browser at minimum.
    - An internet connection that is too slow may cause the application to slow down due to a slow connection between the application and the database.

System Architecture

Clearer image provided in sprint1 folder.

https://github.com/EECS3311F24/project-codeesc/blob/main/doc/sprint1/architecturalDiagram.png



System Decomposition

Component Roles in High-Level Architecture

1. **Main Component**
    - *Role:* Entry point and initializer.
    - *Detailed Design:*
        - Database Initialization: The Main class establishes a database connection, which is passed to other components that interact with data. It provides essential database parameters (e.g., URL, username, password) securely.
        - Interface Launching: Launches LoginForm, setting the starting point for user interaction.
2. **Model Components**
    - *Role:* Data management and business logic.
    - *Detailed Design:*
        - Account: Manages account data, including user attributes and session information. Acts as a central repository for user-specific operations.
        - loginFormQueries: Executes database queries for account validation, lookup, and insertion. It relies on secure methods provided by passwordHashing to verify user credentials.
3. **Controller Components**
    - *Role:* Coordinate between Model and View, manage logic and flow.
    - *Detailed Design:*
        - handleLoginLogic: Handles business logic for login processes, such as validating user credentials, creating sessions, and managing login state.
        - handleLoginInterface: Manages the display of views, updating the interface based on user actions or model responses.
4. **View Components**
    - *Role:* Present the user interface, display data, and gather user input.
    - *Detailed Design:*
        - LoginForm: The initial user interface for logging in or signing up. It communicates user inputs and displays errors or success messages from the Controller.
        - CodeEscMenu: Provides a secondary interface post-login, containing panels like BackgroundPanel, ButtonPanel, and HelpPanel, each managing distinct UI components.
5. **Utility Components**
    - *Role:* provide essential supporting functionalities to enhance the overall efficiency, security, and usability of the system.
    - *Detailed Design:*

- passwordHashing: Used by loginFormQueries for secure password handling, this utility hashes passwords before they are stored or compared with the database.
- interfaceHelper: Assists the View components, providing image resizing and formatting to ensure a polished user experience.

Error Handling Strategy

In any application errors can happen, and they can happen for various reasons. This is something we take into consideration as we develop our application for CodeEsc, so we have developed various ways to handle these errors.

To start off, let's talk about non user-interaction errors. The application needs access to a database server to actually launch itself, so if the user does not have an internet connection or the connection just doesn't work for whatever reason then the application will not launch and an error message will be printed to the console about the connection failing which is easy to understand. If the database connection ever stops working while the application is running, then error messages will be printed to the console for the user to see while the application still retains some functionality and doesn't completely fail.

To continue, let's talk about user-interaction errors, these are ones that include things like user input for their account information on a sign-up or login page, which are two big features added in Sprint 1. We have considered these errors as well, and have added validation for user input to match certain length restrictions that are displayed as error messages in the UI if not followed, we have also added a confirm password feature that always checks that a user has entered two matching passwords whether it's a sign-up or login event they are trying to push through. There are many errors considered in the login/sign-up process when dealing with the database as well, such as wrong username or password, or an account existing with the specified username already, and those all display their own unique error messages to make an easy to follow process for the user.

When we develop this application, we make sure that common and uncommon errors are handled in a way that keeps the user experience as pleasant as possible, and our above considerations show this. For our future sprints we plan to add more validation to user input for the sign-up/login process, and to show more clear error messages for database connections that use pop ups instead of console messages to make it more easily understandable for the user.