

COSC2659 iOS Development

Assignment 2

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I. Introduction

Nowadays, there are a lot of puzzle games in the game industry. These puzzle games give players chances to improve their memorization skills, as well as their deep thought process. Hence, the idea of developing a simple but challenging game of Sudoku popped up in my head. Sudoku is a logic-based, combinatorial-number placement puzzle game that is suitable for those who like math and puzzle solving, and wish to improve their memorization, calculation, and concentration skills.

II. How to Play

In classic Sudoku, the objective is to fully fill a 9x9 grid with digits so that each row, each column, and each 3x3 sub-grids of the full grid contain all the digits from 1 to 9. The game is finished when the 3x3 grid is fully filled (victory), or when the user reaches the error limit of that difficulty (fail). There are many techniques when it comes to Sudoku, scaling from Beginner techniques to Intermediate techniques, and finally Advanced techniques [1].

III. Implementation Details

There are 5 main views that the users can navigate to and interact with: menu view, game view, leaderboard view, settings view, and how to play view.

1. Main Features

a) Menu View



Figure 1: Menu View (Light and Dark)

The first main view of Sudoku is the menu view. This view will navigate users to other views. View navigation is handled using a view that will contain all other views, and one state variable that is used with switch case to switch between views. View navigation also has fade-in and fade-out animations.

b) Leaderboard View

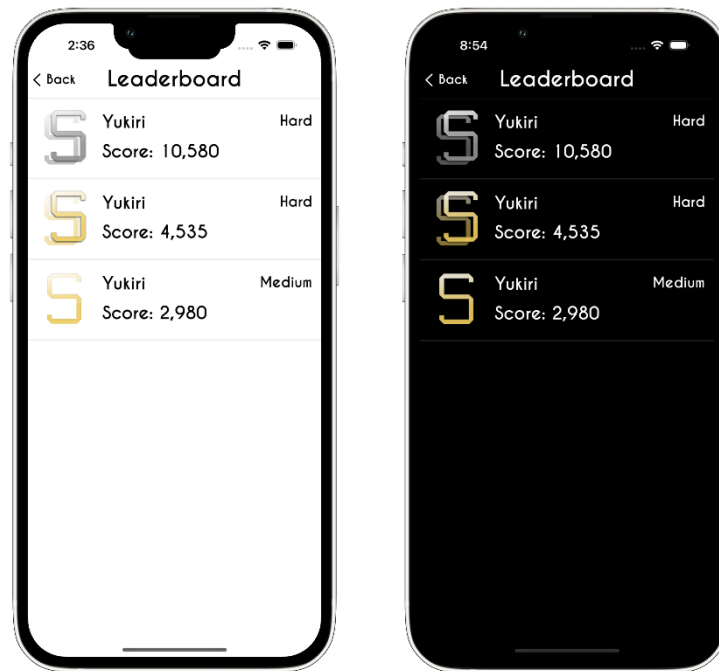


Figure 2: Leaderboard View (Light and Dark)

The second main view is the leaderboard view. The leaderboard will display a maximum of 20 best records of clearing sudoku puzzles, sorted by their achievement. There are 6 different achievements: Perfect SS, SS, Perfect S, S, A, and D. If the achievements are the same, then the records will be sorted using their score. To enhance the score system, the game takes combo into account, that is the more consistent the user gets the guess correct without any help, the higher the score increase will be.

c) Game View

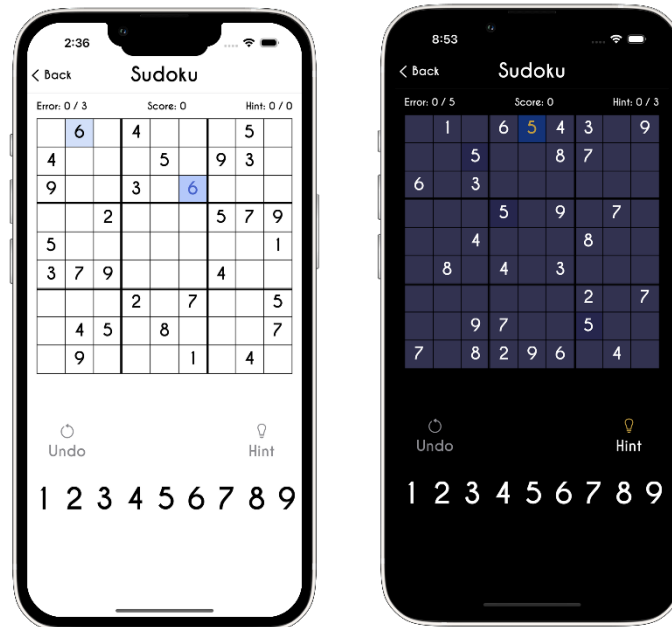


Figure 3: Game View (Light and Dark)

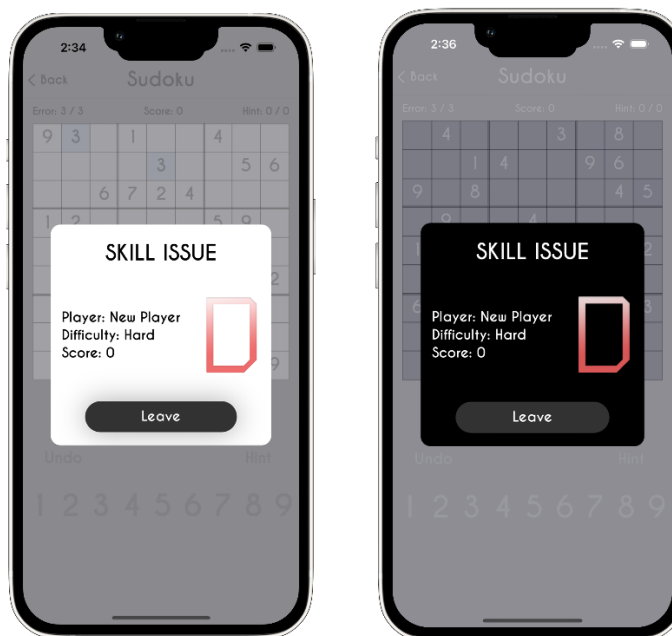


Figure 4: Game Popup (Light and Dark)

The third main view is game view. The game view consists of a sudoku grid, error and hint count, score display, undo button, hint button, and the digit 1 to 9 buttons. The user plays the game by selecting an empty cell and picking a number. If the number is correct, it will be highlighted with blue, if not then the number will be red, and error count will increase. The user can undo when making a mistake. The user can use hint on the currently selected cell, or the hint will appear on the first empty cell occurrence. The hint count will increase after the user uses hint. When the game finishes, the popup will appear with spring animation. The popup contains player name, puzzle difficulty, score, and the achievement.

d) Settings View

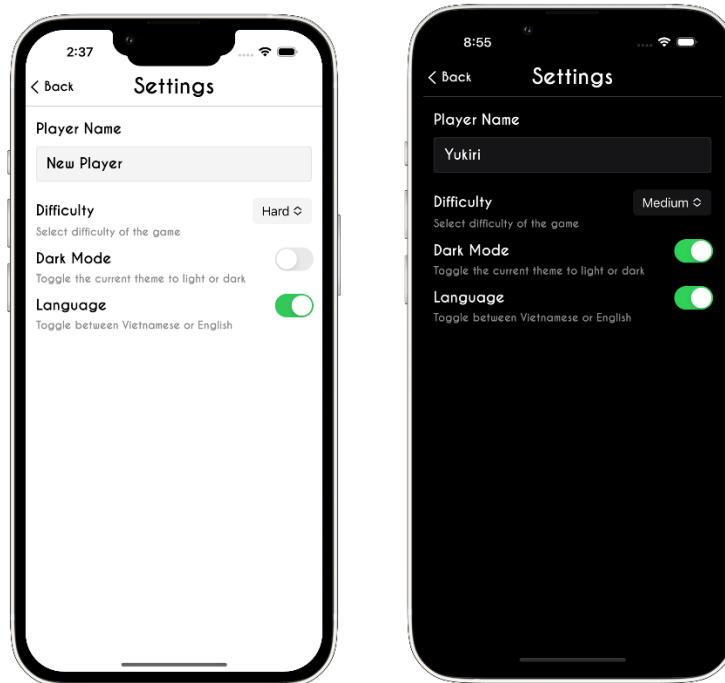


Figure 5: Settings View (Light and Dark)

The fourth main view is the settings view. In the settings view, the user can change their username, which will take effect when a new game is loaded (resume game uses the previous name). Moreover, the user can change the puzzle difficulty between easy, medium, and hard. Puzzle difficulty rating will increase as the difficulty increases. Each puzzle difficulty can give a better achievement. User will achieve SS when clearing hard, Perfect SS when clearing hard with no error and hint, S when clearing medium, Perfect S when clearing medium with no error and hint, A when clearing easy, and D when losing the game. The user can also toggle dark mode and language between English and Vietnamese to make the app more comfortable.

e) How to Play View

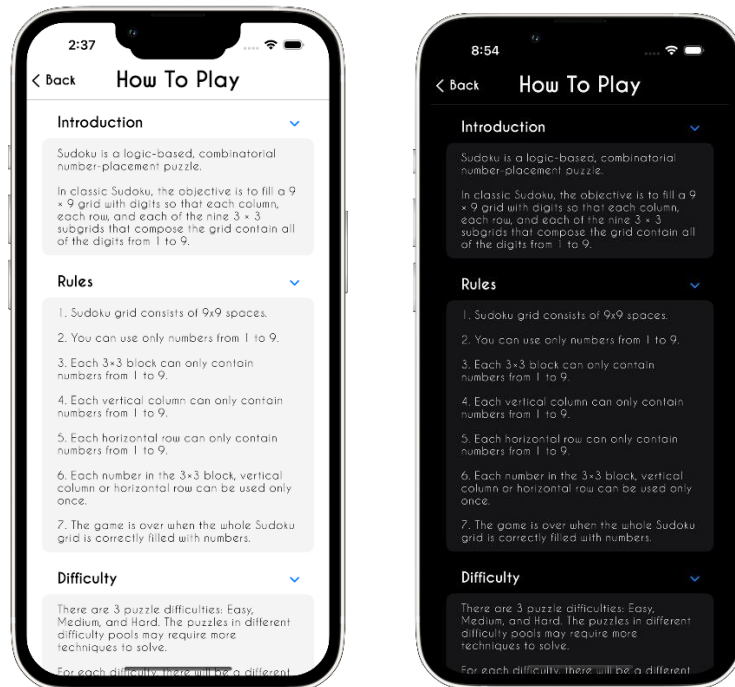


Figure 6: How to Play View (Light and Dark)

The final main view of Sudoku is the How to Play view. This view consists of 3 section: game introduction, game rules, and game difficulty. Game introduction section gives a brief introduction about the game Sudoku. Game rules section states the basic rules of the game. Game difficulty provides the difference between each difficulty regarding the puzzle difficulty rating, number of hints provided and number of errors allowed.

f) Sound Requirements

Sudoku also has audio to enhance user experience. When the app launches, the background music will start playing. This background music will play in the menu view, how to play view, leaderboard view, and settings view. In the game view, there will be no background music to give user better time calculating moves. However, there will be sound effects when clicking buttons, such as selecting grid cells, digit buttons, undo and hint buttons. The audio will also change depending on whether the user selects the correct or wrong number. Moreover, when the game ended, different music will play depending on whether the user's result is a clear or a fail. Audio is handled using AVAudioPlayer class of Swift.

g) Device Compatibility

Firstly, the game can work both in light mode and dark mode. By default, the app will launch in light mode. Secondly, the game can run on both iPhone or iPad, specifically iPhone 14 series and iPad Pro (11-12.9 inch). This is implemented by setting the size values of UI components in the app using the device width and height as the base.



Figure 7: iPad Views (excluding Game View)

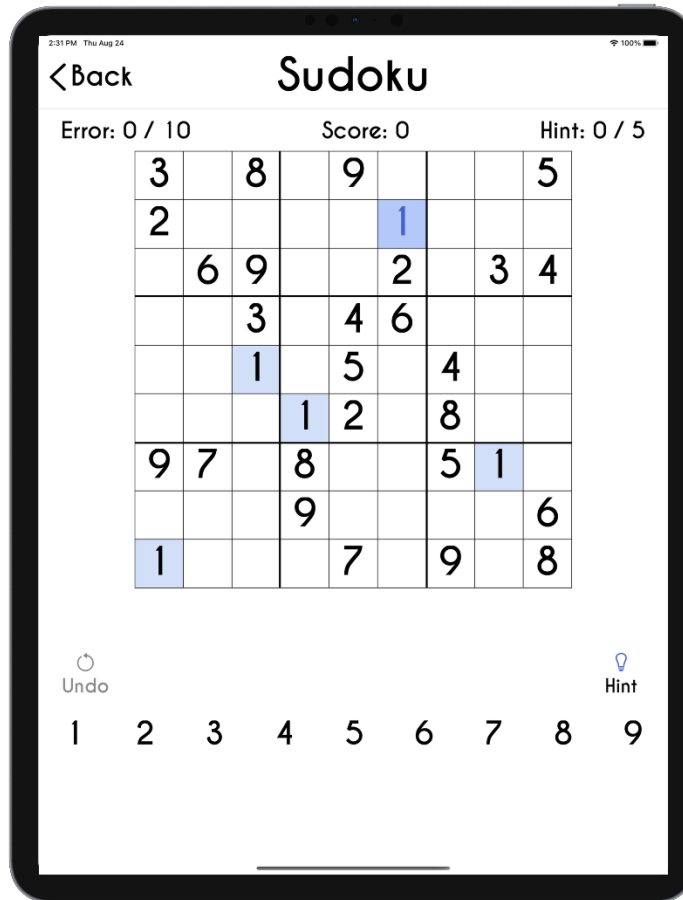


Figure 8: Game View (iPad)

2. Advanced Features

a) Save and Resume

To bring more convenience to the users, the save and resume feature is implemented so that users can pause their current game if needed and continue their unfinished game. Once a puzzle is loaded, the option to resume will be available until the game is finished. The game will also update in real time with every move the user makes. To resume the game, the user only needs to go to the menu view and press the Resume button. Moreover, not only the current game is saved, but the current player's name for the current puzzle, and the current app settings such as language and color theme will also be saved and loaded when relaunching the app. These saved settings and games are stored in UserDefaults. The save and resume procedure is demonstrated in a video called "game resume.mp4" in "Demo Videos" folder inside the project folder.

b) Game Progression

Since Sudoku can target different types of players, including those who seek challenging content or those who want to learn the game, the game progression is the difficulty of the game. Each difficulty contains several puzzles with similar difficulty rating; therefore, players can select the easier difficulty when starting to learn sudoku and choose a higher difficulty to test their new techniques. Moreover, higher difficulty results in better achievement badges, therefore players can try to improve their skill and

progress through harder content. Players can change the difficulty of the puzzles by navigating into the settings view from the menu view, and then selecting the difficulty. Currently, there are three difficulties: Easy, Medium, and Hard.

c) Multiple Language Support

To make the game more reachable for players in different countries and regions, Sudoku supports different display languages. Currently, the app supports the two languages English and Vietnamese. The user can toggle the current language of the app via the language toggle in the settings view. By default, the app will use English on the first launch and can be adjusted for future launches. Multiple language is implemented using a file called Localization.strings, which store the defined strings and their translation strings for each language available.



Figure 9: Menu, Game, Popup (Vietnamese)

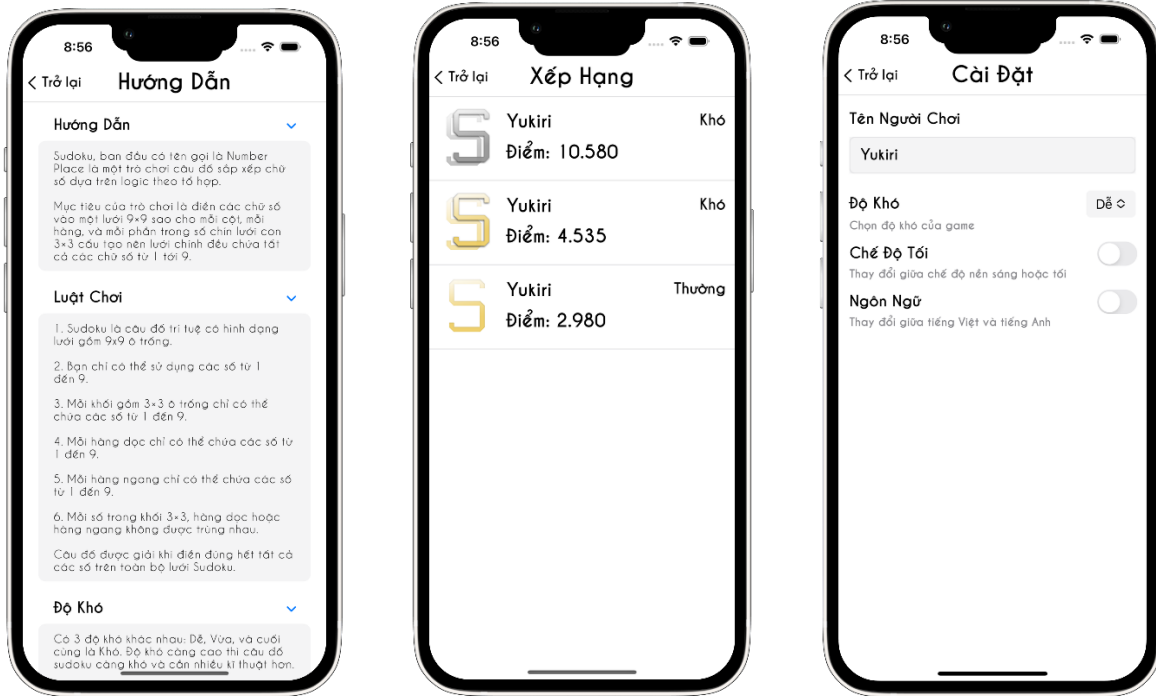


Figure 10: How to Play, Leaderboard, Settings (Vietnamese)

d) Toggle Theme Setting

Since many users nowadays enjoy dark mode, while some also enjoy light mode, the theme toggle is implemented inside the settings view. User can navigate into the settings view to toggle the current theme of the app. The two supported themes are light and dark mode. The default theme of the app when launching for the first time is light mode and can be configured for next time use.

IV. Conclusion

Overall, the app Sudoku provides comfortability and user-friendliness. However, there is still some room for improvement, or alternatives to the app design approach. Firstly, the difficulty range of the puzzles can increase. For example, there can be two more difficulties: Expert and Extreme, to target the top players. Moreover, each difficulty can have a larger puzzle pool. This approach can also be implemented with a feature that allows players to select the puzzle they want to clear. Another approach is to use a sudoku puzzle generator to create randomness of the puzzles. Secondly, the number of languages in this app can be increased. Popular languages such as Japanese, Korean, Chinese, etc. can be implemented, and the language toggle will be changed into a picker instead. Moreover, the leaderboard can be more interactive if users can sort the leaderboard via name, difficulty, or achievement for comparison with other players in the same levels and for creating targets for themselves. Lastly, the Sudoku game can include some other game mode to make the game different from the traditional sudoku by adding more restrictions or abilities for users.

V. References

[1] "What is Sudoku and what are the rules of this game?" Sudoku Rules - Strategies, solving techniques and tricks, <https://sudoku.com/sudoku-rules/> (accessed Aug. 26, 2023).