APP GAME - Connect Four

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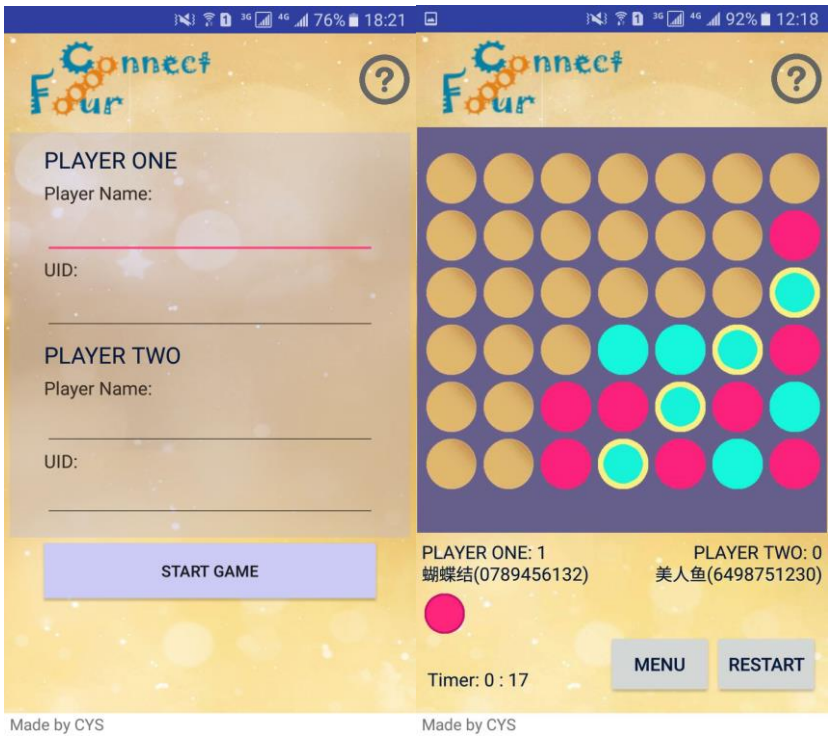
I. Design



Basic Background UI

The whole application contains two main pages and two main activities with the same background, header and footer. It is of sweet style with sweet pinkycolors. Headers on the top of pages display game information with a logo and game instruction with a question-mark button. Footers show the author name.

Menu Activity Content & Layout

The first also the initial page is to input two players' information, like name and UID. There is a typical form lining vertically and a button for starting a new game on the bottom. (More details in activity_menu.xml in folder "layout")

Game Activity Content & Layout

Beside with the header and footer, in the middle part, there is an empty 6(rows) × 7(columns) chess board in purple background with orange hollows in the initial state.

Below the chess board, two players information is shown, including win rounds, names and UID respectively. When a color chess (red or green) shown under the very player information, it means

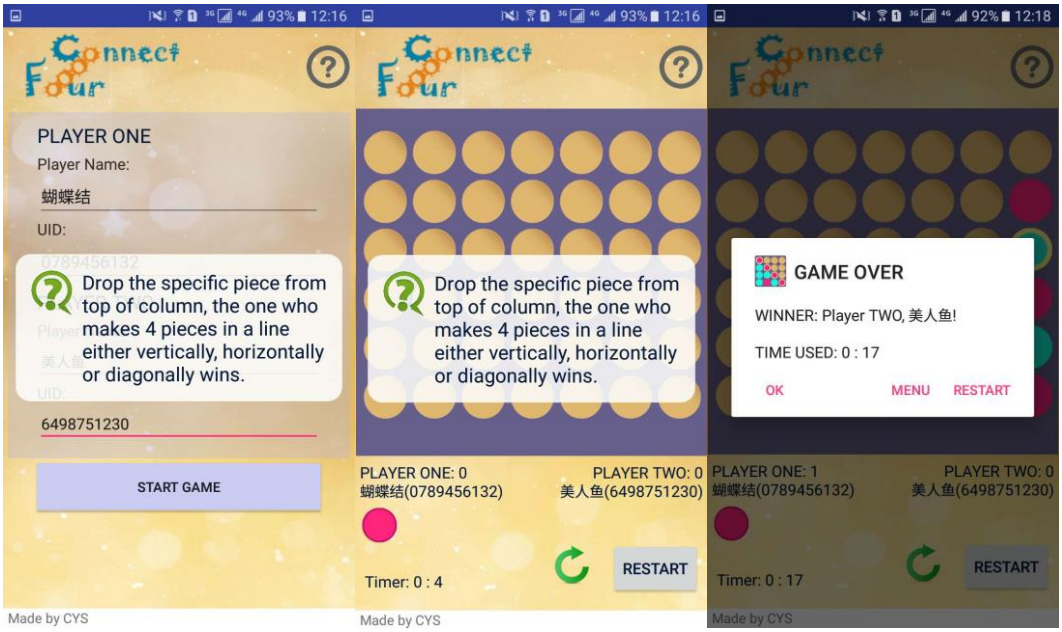
it come to his/her turn to drop a chess. (More details in activity_game.xml in folder “layout”)

Pop-up Dialogs

This application owns two pop-up dialogs, one is for game instruction and the other one appears when the game is over.

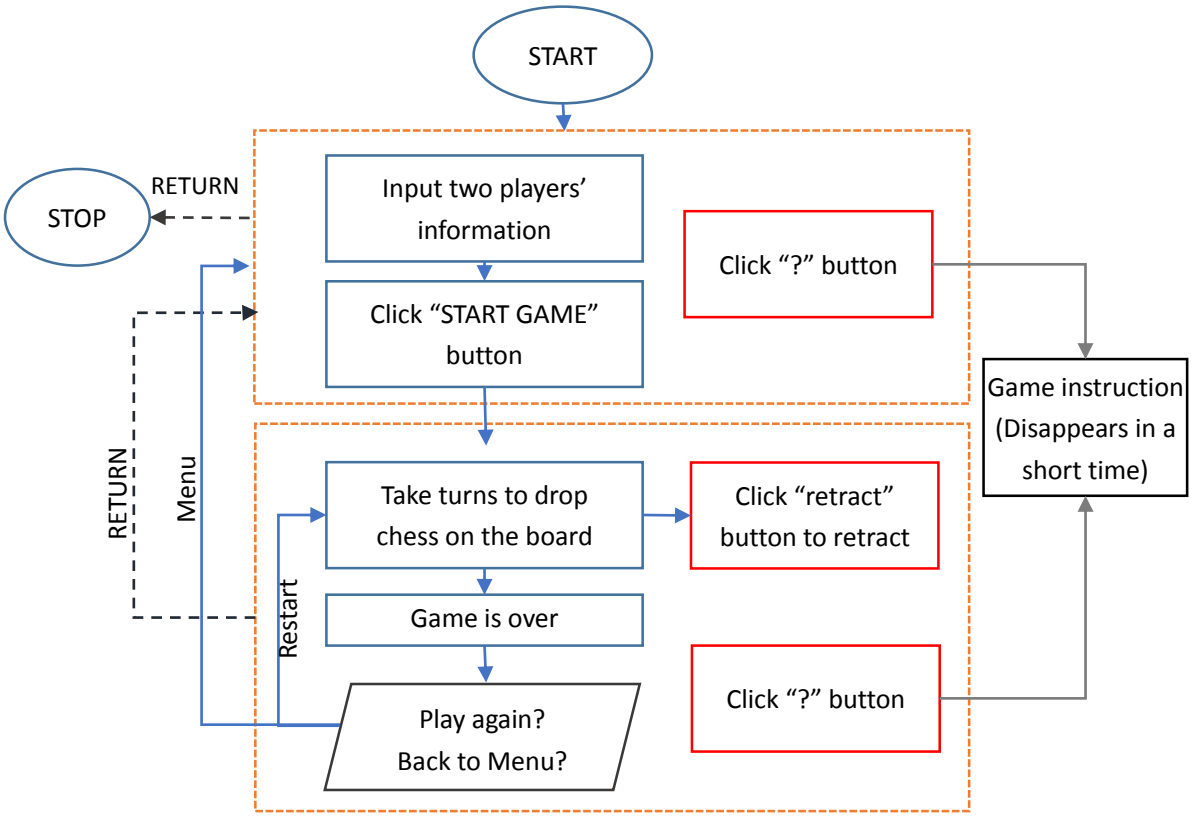
The former may show up in either page depending on when the question-mark button is clicked on the header. The hint dialog would display in the center of screen introducing how to play the game. (More details in info_shape.xml & toast_style.xml in folder “layout”)

The latter dialog shows up when four or more chess are connected in a line. The dialog in the center displays the winner, game time information and some more option buttons like “Restart”.



NOTE: The design layout is tested based on smartphone screen resolution of 1080px × 1920px (with model Nexus 5 convenient for real phone test) and 800px × 480px (with Nexus S).

II. Game Flow



III. Implementation

Layout

Two pages are implemented with "ScrollView + RelativeLayout" in the outmost layout to suit different size of screen. Headers and footers are aligned to the top and bottom of the screen respectively.

As for the main content, in "Menu activity" page (first page), the input form and "START GAME" button is of vertical "LinearLayout". In "Game activity" page, the chess board is of "TableLayout" for convenience of calculating the positions of chess holes. The rest information part is of "RelativeLayout" adding some relative position attributes. (More details in activity_menu.xml and activity_game.xml in folder "layout")

Button and Image Visibility

1. Chess & Chess Board

There are five chess image pieces: full red, full green, full orange (means empty), highlighted red, highlighted green. In the initial state, the chess board is filled with all empty images. As the game processes, the specific chesses will be replaced by red or green ones. When it comes to the end of the game, all the winning pieces will be highlighted being replaced by highlighted red or green

pieces.

The chess piece edge size is calculated equal to one seventh of screen width minus the edge width. The chess position arrangement is calculated in advanced and recorded into an array. (More details in function calBoardPosition() in GameActivity.java)

2. Arrow prompt
There will be an arrow shown under the column the player chosen. There are two types of arrows, one for prompting that this column is chosen and available, the other one for indicating all rows are occupied in this column and there is no place available.

The arrow images are controlled by “Visibility” attribute to show up when pointing down or moving. (More details in function showArrow() in GameActivity.java)

3. Button
There are three functional buttons on the bottom, back to menu, restart the game, and retract the piece. The restart button is available and visible all the time, while retract button is only available during the game and menu button is only available after the game round. (More details in retractButton.setOnClickListener(), menuButton.setOnClickListener() & restartButton.setOnClickListener() in GameActivity.java)

Chess Procedure & Result Judgment

Two players take turns to drop pieces until at least 4-connected pieces commit. The particular red or green piece will be visible under the corresponding player information showing the current turn (red for player one and green for player 2). The two color piece images also are controlled be “Visibility” attribute. (More details in function gameStart() in GameActivity.java)

There are three game results, red piece (player one) wins, green piece (player two) wins or a game draw. To judge the result, in every turn after the player drops the piece, every chess will be checked if it is possible to be the first piece of the at least 4-connected ones. (More details in function checkLine() in GameActivity.java)

A chess board matrix will record the chess board state on all positions. Every turn each chess, red or green, will check its four directions, right upper, straight right, lower right, and straight below if there are at least 4-connected chesses which will be highlighted. After all pieces are checked, if there is at least one line of pieces, the winner will be recorded or no winner but 42 (6×7) pieces have been dropped already, the game is over counting the winning number of times and the winning information will be shown. (More details in functions checkLineForOnePoint() and showWinner() in GameActivity.java)

Two counters will continuously count the winning number of times of two players respectively and show the result during the game.

Additional Features

1. Retract function
Players can retract the pieces they dropped till the initial state (empty state of chess board). This function is realized by replacing the chess image with the empty image. Beforehand, every operation step should be recorded. (More details in retractButton.setOnClickListener() in GameActivity.java)

2. Game instruction
A dialog indicating the game rules information will show up for a period of time when “?” button is clicked on the upper right. It is implemented by using “Toast” widget. (More details in onCreate() in GameActivity.java and MenuActivity.java)

3. Audio and vibration
Audio and vibration warning come out when the column is full or the game round is over. Any button clicked or any chess dropped has its sound effect as well.
“Vibrator” widget and “SoundPool” are used.

4. Timer
There is a timer to record the game time of each round displaying at the left bottom during the game. The game time will stop at the end of the round. Class ”Handler” is used, and time is updated per second.

5. Multi-round game
The same player pair can play as many game rounds as they like and their game results would be recorded and be shown in the player information part.

6. Arrow prompt
A directed arrow as a prompt for player which column he chooses and an error-arrow as a warning prompt when the column is full. (More details in showArrow() in GameActivity.java)

IV. Limitation

1. Only support 2 human players.
2. Only support play board with size 6(rows) × 7(columns).
3. No UID verification mechanism.

V. Reference

[1] http://www.ce.unipr.it/~gbe/cn4rules.html
[2] http://www.connectfour.org/
[3] https://developer.android.com/