Dots and Boxes

Final Project

Group

Jayden Thompson

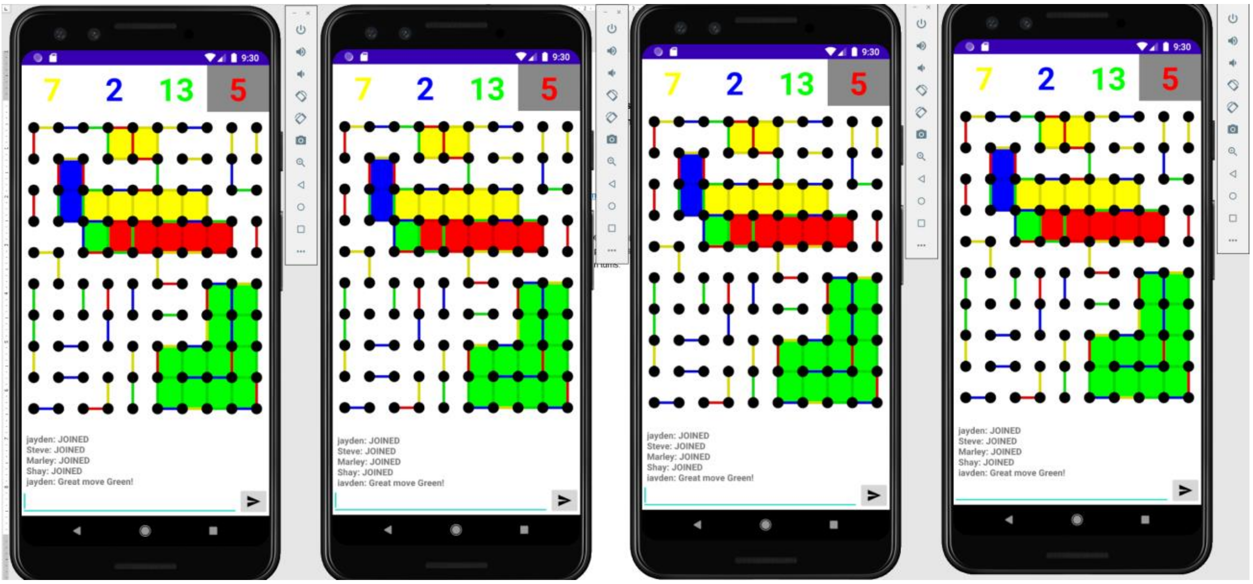
EID: jht865

Email: jaydenhthompson@gmail.com

Description

Dots and Boxes is a classic pen and paper turn based game that has been adapted to a multiplayer online game. The premise is to complete the most boxes by drawing segments on a grid of points in turns.

Screenshot



jayden: JOINED
Steve: JOINED
Marley: JOINED
Shay: JOINED
jayden: Great move Green!

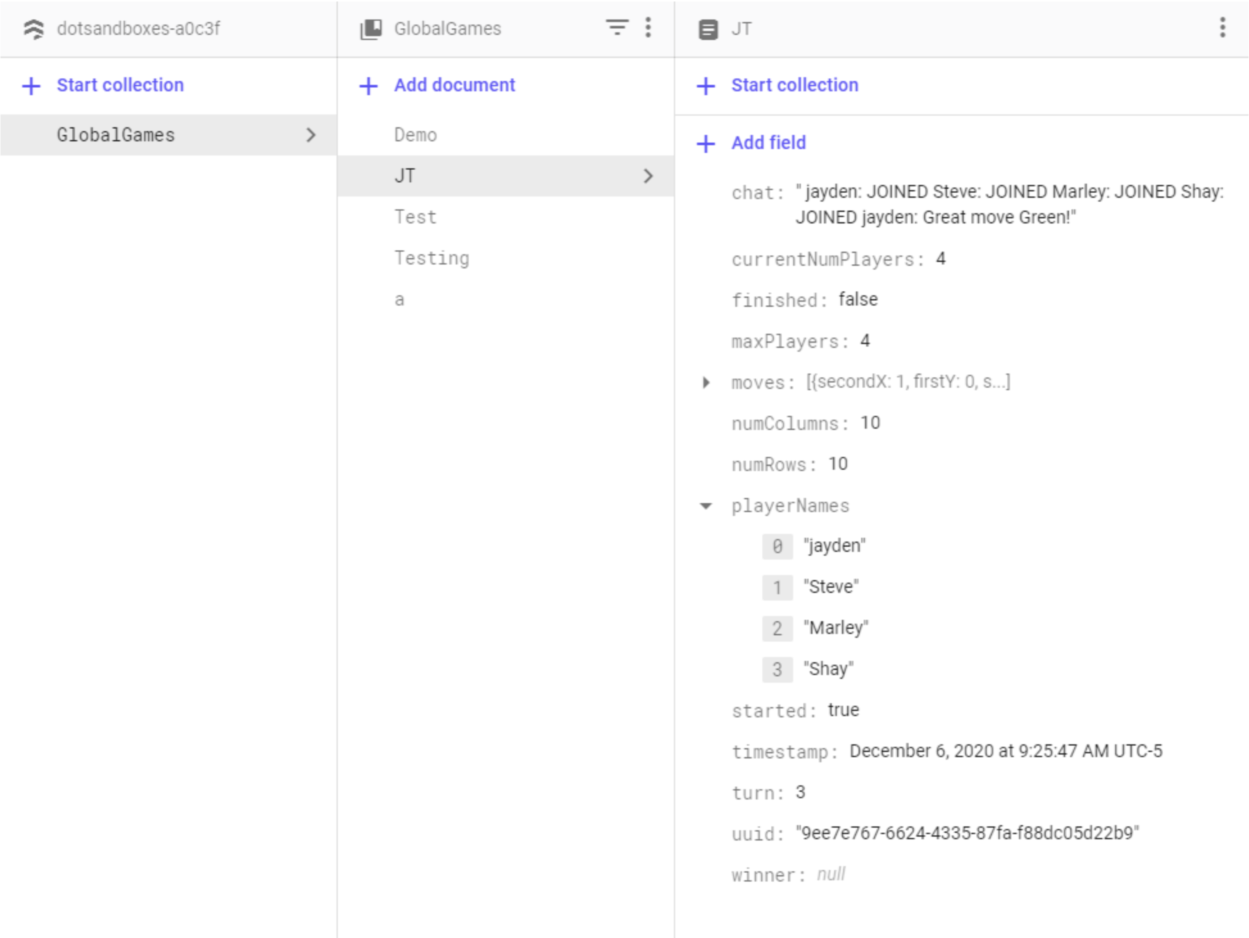
*Four emulators playing dot's and boxes simultaneously on my desktop

API and Android Features

API

The primary API used for Dot's and Boxes was Firestore. The name of the game was used as the document key and all game information was stored in a "GameData" object which also included an array of "MoveData" objects representing individual moves

(Screenshot of the database seen below). If I were to do it again, I would use an active server model to enforce game rules opposed to trusting the clients, which proved to be difficult.



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GlobalGames

Demo
JT
Test
Testing
a

chat: "jayden: JOINED Steve: JOINED Marley: JOINED Shay:
       JOINED jayden: Great move Green!"
currentNumPlayers: 4
finished: false
maxPlayers: 4
moves: [{secondX: 1, firstY: 0, s...]
numColumns: 10
numRows: 10
playerNames
    0 "jayden"
    1 "Steve"
    2 "Marley"
    3 "Shay"
started: true
timestamp: December 6, 2020 at 9:25:47 AM UTC-5
turn: 3
uuid: "9ee7e767-6624-4335-87fa-f88dc05d22b9"
winner: null
```

Android Features

The dominant android feature used for this project was the Canvas element. I used Canvas and Paint objects to create custom bitmaps continuously to produce an animation effect, discussed in further detail below.

UI/UX/Display Code

The game board display for Dots and Boxes was achieved using a singular blank ImageView that was used to display custom bitmap images made in real time. To achieve this, an array of dots with screen coordinates had to be created and then altered depending on the size / position / visibility of the ImageView. Achieving a dynamic effect was a difficult timing issue with the ImageView being resized many times during loading, and several times during gameplay when messages were sent. Segments and Squares were then given the point matrix references to the dots and used their positions to correctly place themselves on the board.

Processing Logic

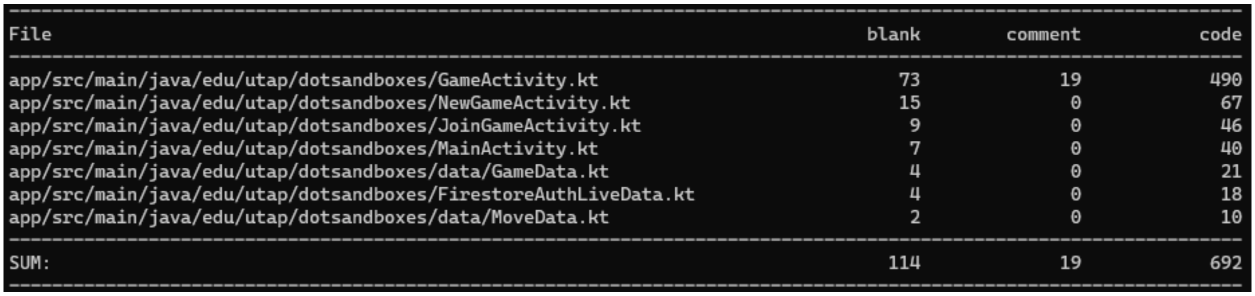
To have four clients connect to a database and play nice without stepping on each other, a specific ordering was coded which allowed the “New Game” player to initialize all game data. Following the game’s database initialization, “Join Game” players must first query the database for initialization variables, and then send back information such as “player number” and “player name”. All clients then begin watching the databases for changes after their initial database updates, timing this logic was among the most difficult aspects of the project.

Most Important / Interesting Thing and Most Difficult Challenge

For this project, the most interesting thing learned, and the most difficult challenge was learning how the timings of the updating Firestore, receiving updates, and view loading interacted. The most difficult challenge I faced while figuring out the timings was player clients that had joined the game instead of creating it would often get a grid that looked smooshed and did not line up with touch commands. This problem caused me to rewrite almost everything to do with calculating how to draw the dot grid several times. Eventually, I found that I had to switch Segments and Squares to base their actual coordinate drawings to the dot matrix and then recompute the matrix at several locations. The locations we recalculate the matrix are 1) when the activity loads 2) when the Game View resizes and 3) when a database update is received. These recalculations were necessary to ensure that the correct grid was drawn for each client. I learned through this just how often the size of views can change and how it’s important when drawing custom objects to account for those changes continuously.

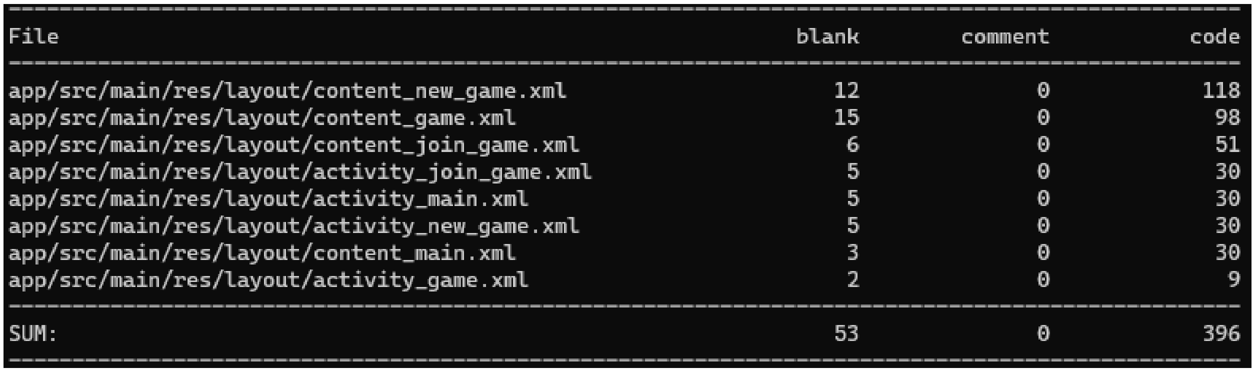
CLOC counts

Kotlin : 692



```
-------------------------------------------------------------------------------------------------------
File                                                                    blank        comment        code
-------------------------------------------------------------------------------------------------------
app/src/main/java/edu/utap/dotsandboxes/GameActivity.kt                    73             19         490
app/src/main/java/edu/utap/dotsandboxes/NewGameActivity.kt                 15              0          67
app/src/main/java/edu/utap/dotsandboxes/JoinGameActivity.kt                 9              0          46
app/src/main/java/edu/utap/dotsandboxes/MainActivity.kt                     7              0          40
app/src/main/java/edu/utap/dotsandboxes/data/GameData.kt                    4              0          21
app/src/main/java/edu/utap/dotsandboxes/FirestoreAuthLiveData.kt            4              0          18
app/src/main/java/edu/utap/dotsandboxes/data/MoveData.kt                    2              0          10
-------------------------------------------------------------------------------------------------------
SUM:                                                                      114             19         692
-------------------------------------------------------------------------------------------------------
```

XML: 396



```
-------------------------------------------------------------------------------------------
File                                                     blank        comment           code
-------------------------------------------------------------------------------------------
app/src/main/res/layout/content_new_game.xml                12              0            118
app/src/main/res/layout/content_game.xml                    15              0             98
app/src/main/res/layout/content_join_game.xml                6              0             51
app/src/main/res/layout/activity_join_game.xml               5              0             30
app/src/main/res/layout/activity_main.xml                    5              0             30
app/src/main/res/layout/activity_new_game.xml                5              0             30
app/src/main/res/layout/content_main.xml                     3              0             30
app/src/main/res/layout/activity_game.xml                    2              0              9
-------------------------------------------------------------------------------------------
SUM:                                                        53              0            396
-------------------------------------------------------------------------------------------
```