INTRODUCTION

This project has been made based on the Python Programming language. Python was developed by Guido Van Rossum in February 1991. It is an easy-to-learn yet powerful object-oriented programming language.

Some advantages of Python are that it is very programmer friendly, requires simpler syntax and fewer lines of code, has various modules in its standard library and is a cross-platform free and open-source language. It is also an interpreted language making it easier to debug your code.

Arcade is a project that has two online multiplayer games. It aims to provide users with an opportunity to enjoy classical games we have all played but in a digital form. We aim to provide a smooth experience with an easy-to-understand interface. The games are supported by a lobby-room system that allows multiple groups to play at the same time. A leaderboard and stats tracker enhances the user experience. The app allows a large degree of customization both in terms of user profile and game settings. One notable feature is the option of light/dark mode. The app also keeps track of login sessions which logs out the user if they have been inactive for too long.

THEORY

This project is an implementation of a multiplayer arcade. We offer two games, *Monopoly* and *Chess*. On opening the app, the starting screen is shown, which has the option to login or register. Every user account has a custom profile picture which can be changed along with the password. On logging in, there are two lobbies, one for each game. Each lobby has the user's stats and a global leaderboard on the sides with the option of joining or creating a room. During room creation, the host can modify the game settings. To join a room the user can choose from the list of public rooms or enter a private room code.

In Chess, the initial sides can be picked along with the duration of the game and the seconds of increment per turn. Along with facilitating normal chess play, it also has the option of requesting a draw or resigning.

In Monopoly, the maximum number of players can be picked initially. The frames on the right side display game and player details which changes as the game progresses. Players can build houses, mortgage and sell their properties. They can also trade properties and money amongst them. The game can be ended by majority vote, forfeiture or until all but one player is bankrupt. An inactivity timer is implemented to automatically end turn if a user doesn't take action in a set time.

The front-end's GUI was implemented through Tkinter and Tcl, while threading enables multiple tasks to run simultaneously. The room and game events are communicated over custom protocol built on top of TCP. The authentication, profile pictures and stats are handled by an API written in Flask. The project uses MySQL to store user information and stats. Despite the variety, this project is written entirely in python.

SYSTEM DESIGN

1. *pillow*: Image Handling
2. *plyer*: Displaying Notifications
3. *pygame*: Playing Audio
4. *pyperclip*: Copying text to system clipboard
5. *requests*: Making Authentication API calls

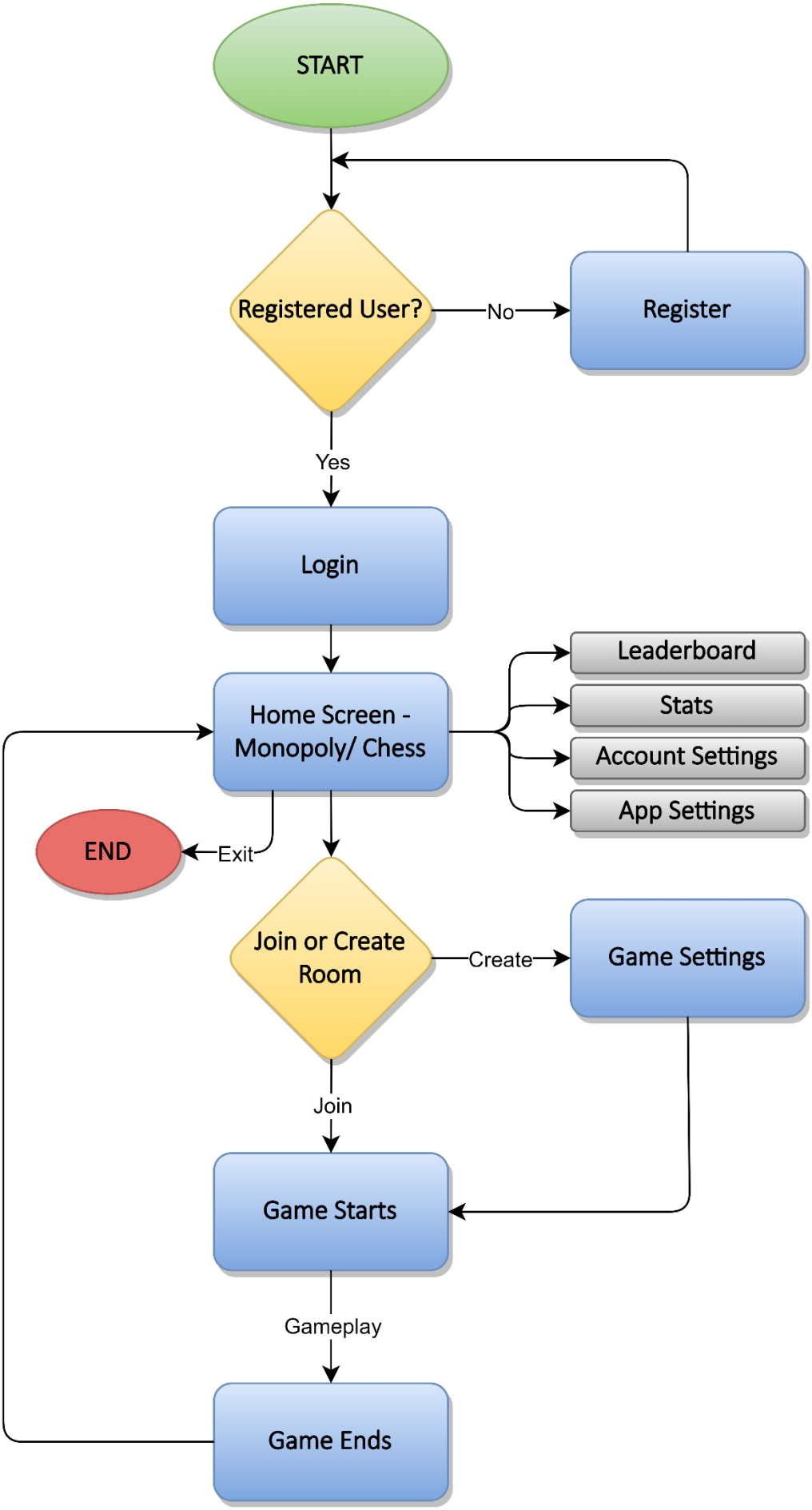
6. tkinter: Graphic User Interface
7. socket: Communicating between Multiple Clients and Server
8. mysql.connector: Accessing Users and Games databases
9. threading: Running multiple processes simultaneously
10. random: Randomising items in various places
11. time: Keeping track of time for in-game timers

12. flask: Implementing the authentication API
13. redis: Local cache for storing users' sessions
14. secrets: Generating string ids for users' sessions
15. datetime: Storing users' date and time joined
16. bcrypt: Hashing the users' passwords to be stored securely

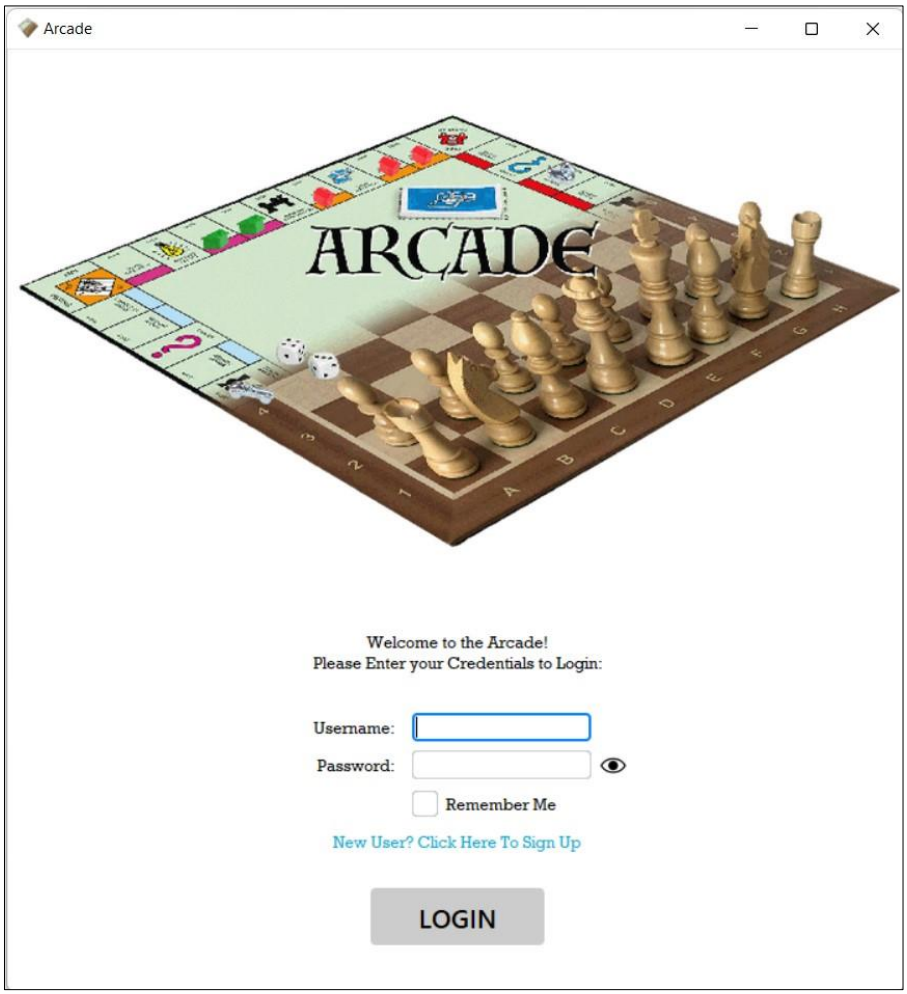
17. pickle: Serializing python objects to be transferred over TCP
18. json: Converting HTTP responses to python objects and vice versa
19. dotenv: Accessing the local environment variables
20. io, base64: Serializing images to transfer between clients
21. copy: Making deep copies of lists and dictionaries
22. os, sys: Managing Files and OS Paths

23. *Arcade*: Driver Class for initialising the app
24. *Chess*: Handling Chess Processes
25. *Monopoly*: Handling Monopoly Processes
26. *Theme*: Changing and Saving Dark/ Light Themes
27. *HTTP*: Wrapping access to the API

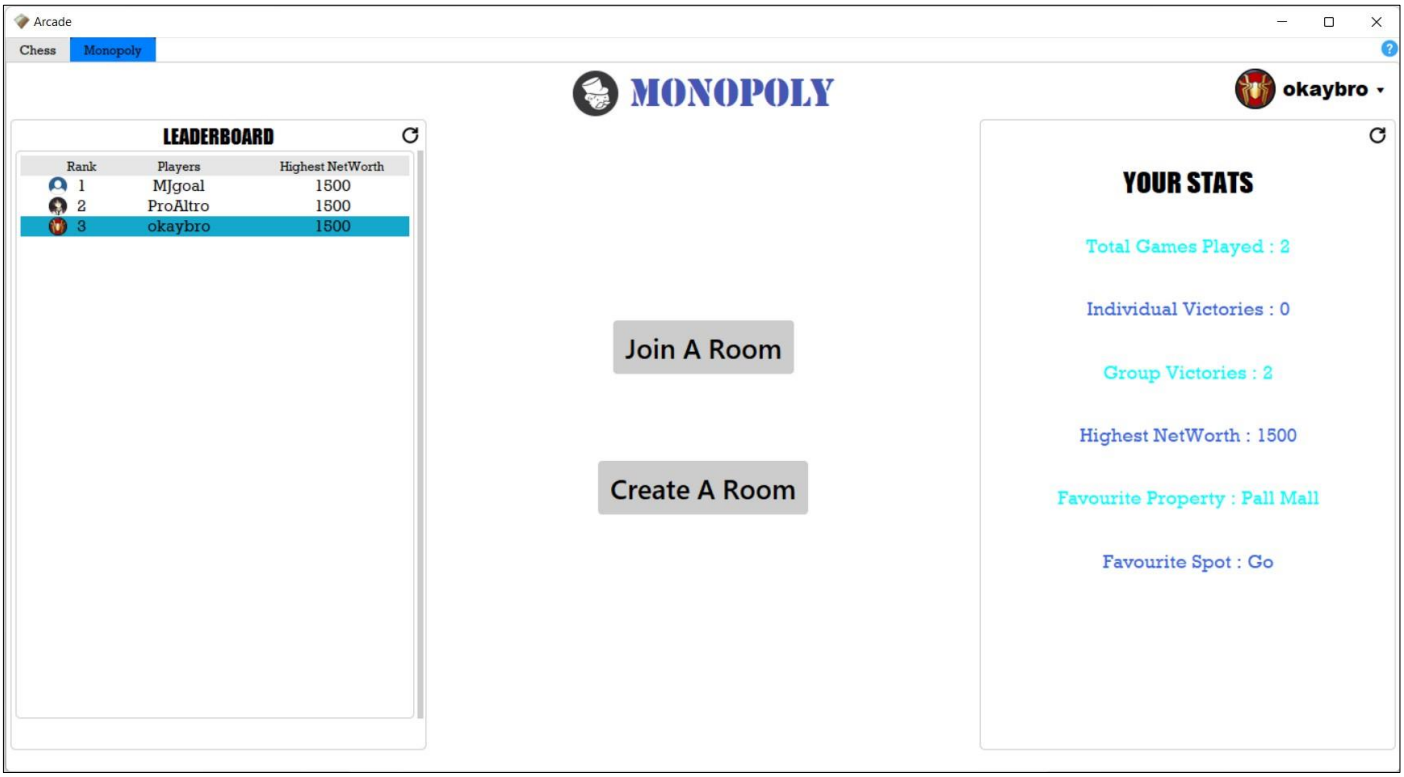
FLOW CHART

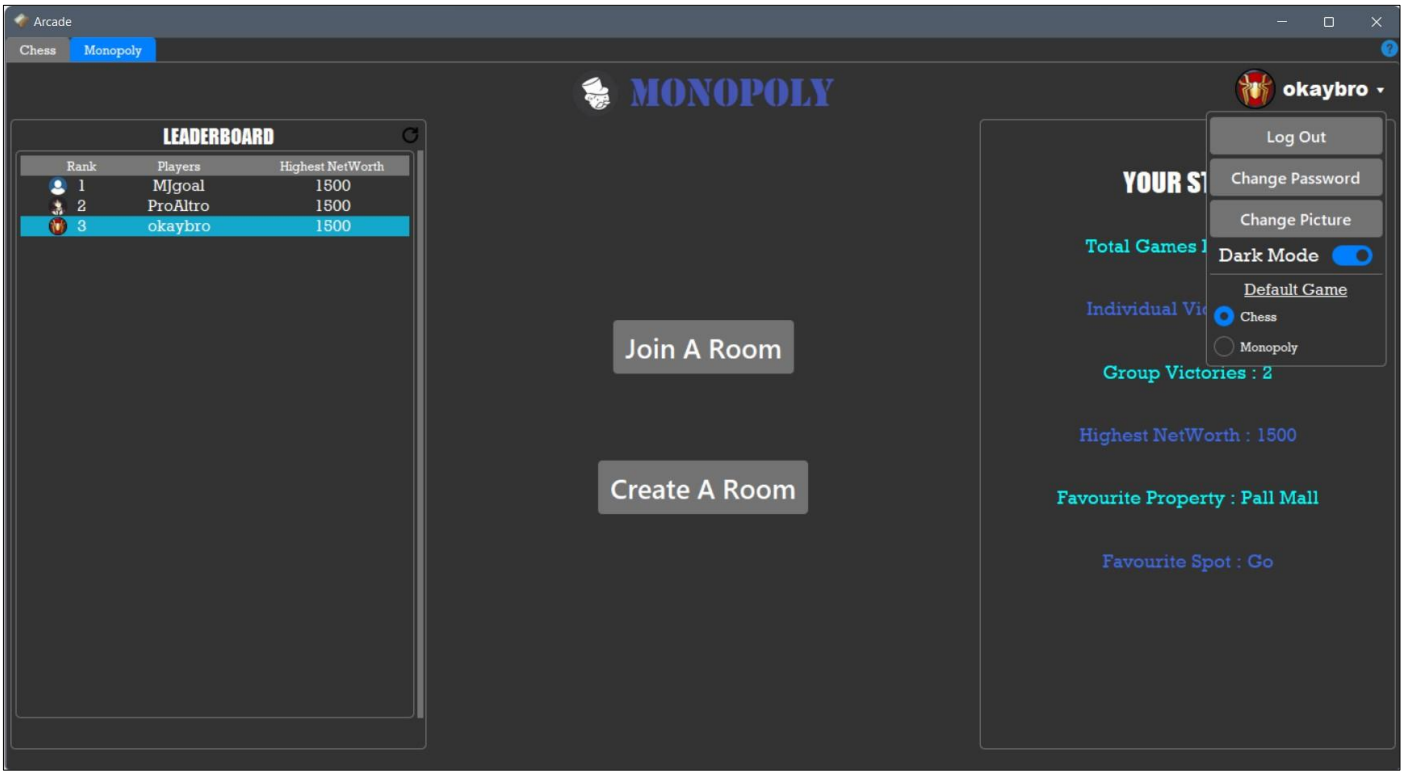

START
Registered User?
No
Register
Yes
Login
Home Screen - Monopoly/ Chess
Leaderboard
Stats
Account Settings
App Settings
END
Exit
Join or Create Room
Create
Game Settings
Join
Game Starts
Gameplay
Game Ends

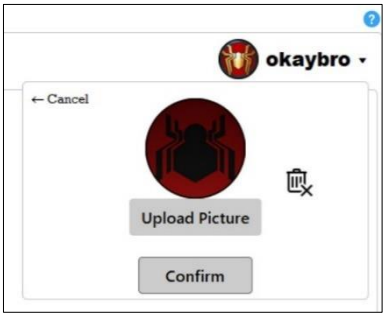
OUTPUT

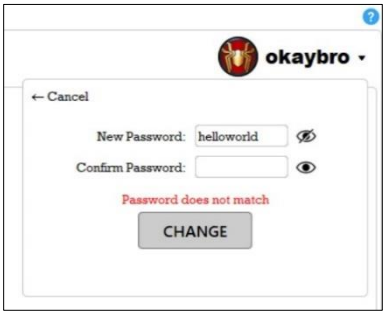

Arcade
ARCADE
Welcome to the Arcade!
Please Enter your Credentials to Login:
Username:
Password:
Remember Me
New User? Click Here To Sign Up
LOGIN

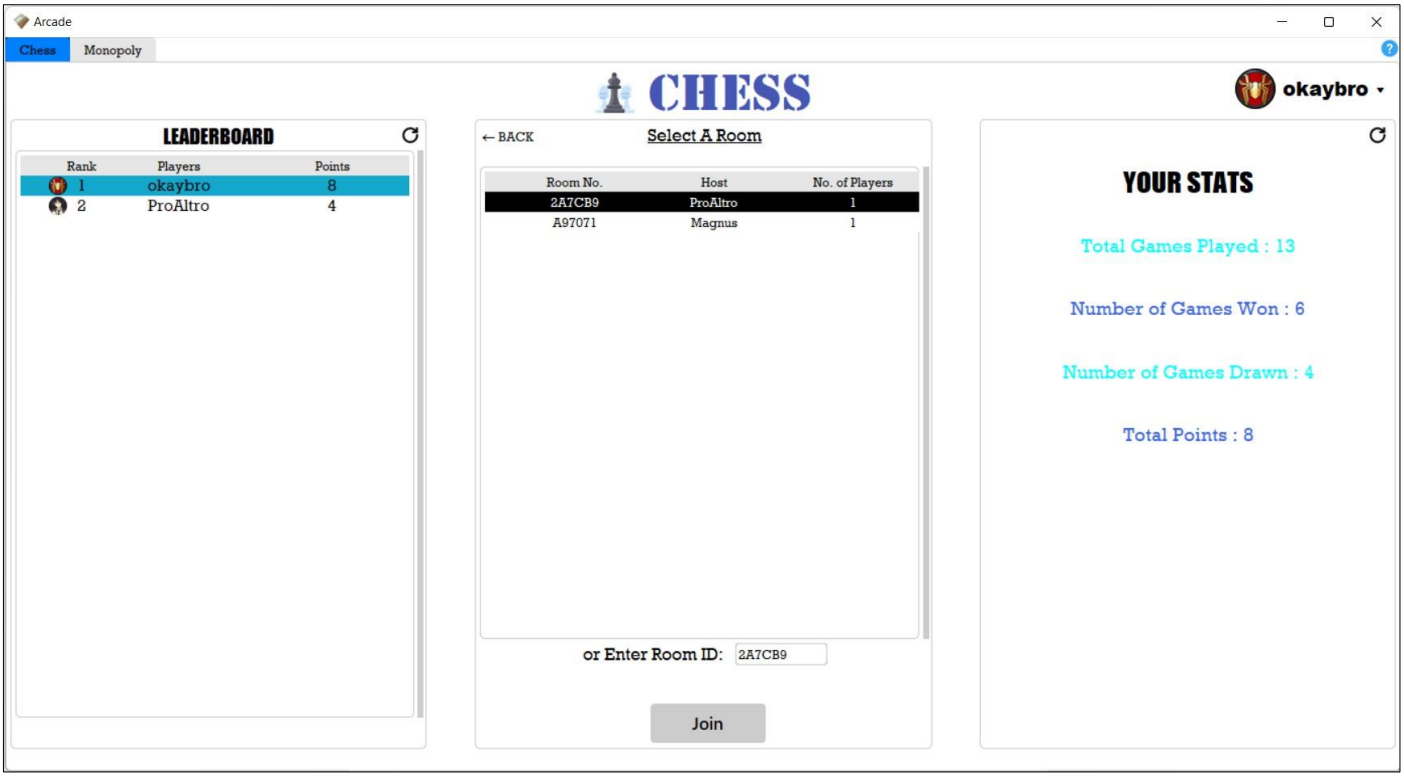
Arcade
ARCADE
← Sign In
Welcome to the Arcade!
Please Enter your Details to Create an Account:
Create Username:
user666
Create Password:
password666
Confirm Password:
****
Upload Picture
REGISTER

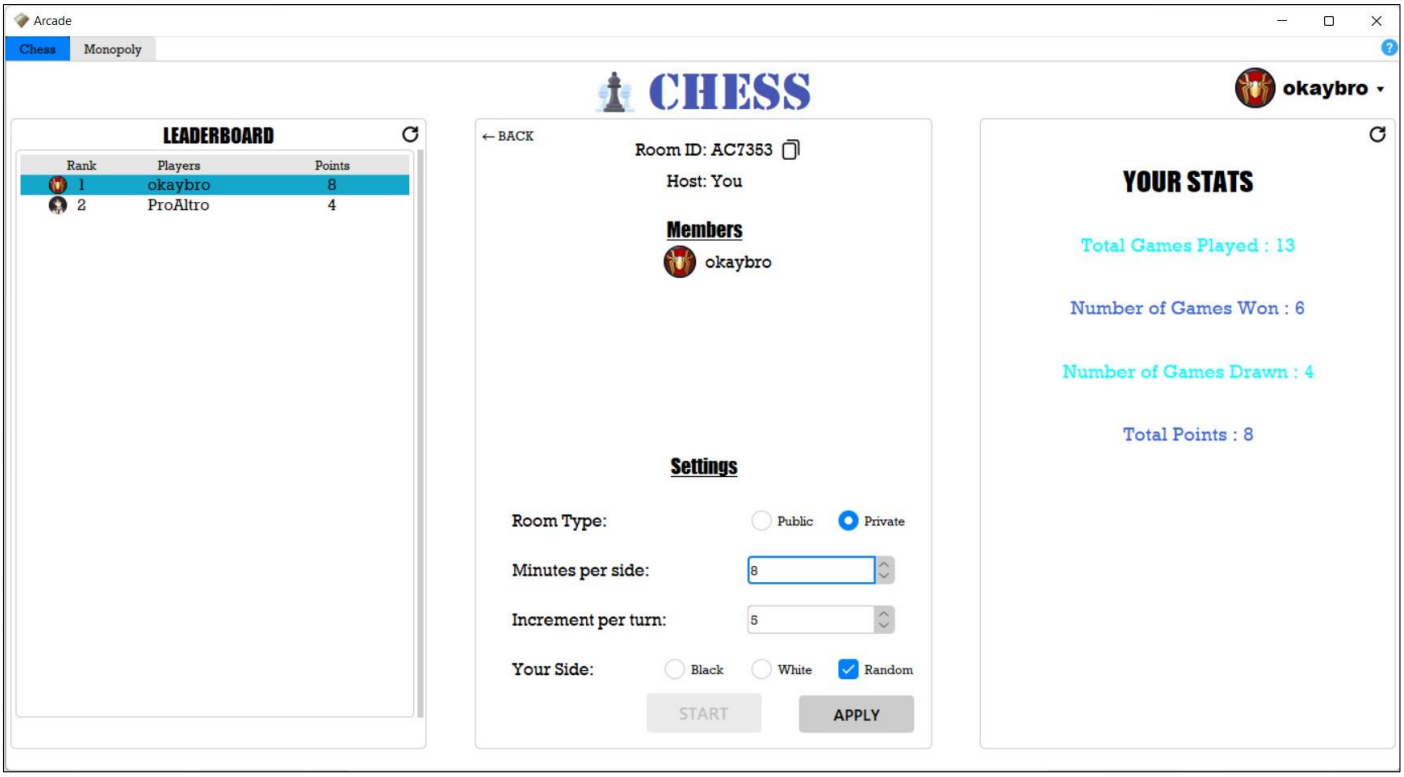

Arcade
Chess
Monopoly
MONOPOLY
okaybro
LEADERBOARD
Rank
Players
Highest NetWorth
1
MJgoal
1500
2
ProAltro
1500
3
okaybro
1500
Join A Room
Create A Room
YOUR STATS
Total Games Played : 2
Individual Victories : 0
Group Victories : 2
Highest NetWorth : 1500
Favourite Property : Pall Mall
Favourite Spot : Go

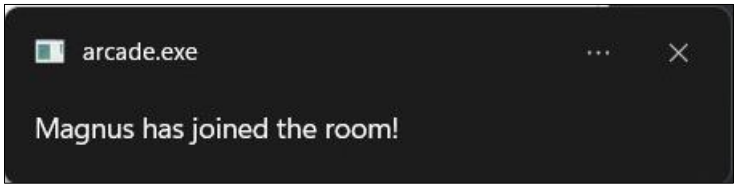

Arcade
Chess
Monopoly
MONOPOLY
okaybro
LEADERBOARD
Rank
Players
Highest NetWorth
1
MJgoal
1500
2
ProAltro
1500
3
okaybro
1500
Log Out
Change Password
Change Picture
Dark Mode
Default Game
Chess
Monopoly
Join A Room
Create A Room
Group Victories : 2
Highest NetWorth : 1500
Favourite Property : Pall Mall
Favourite Spot : Go

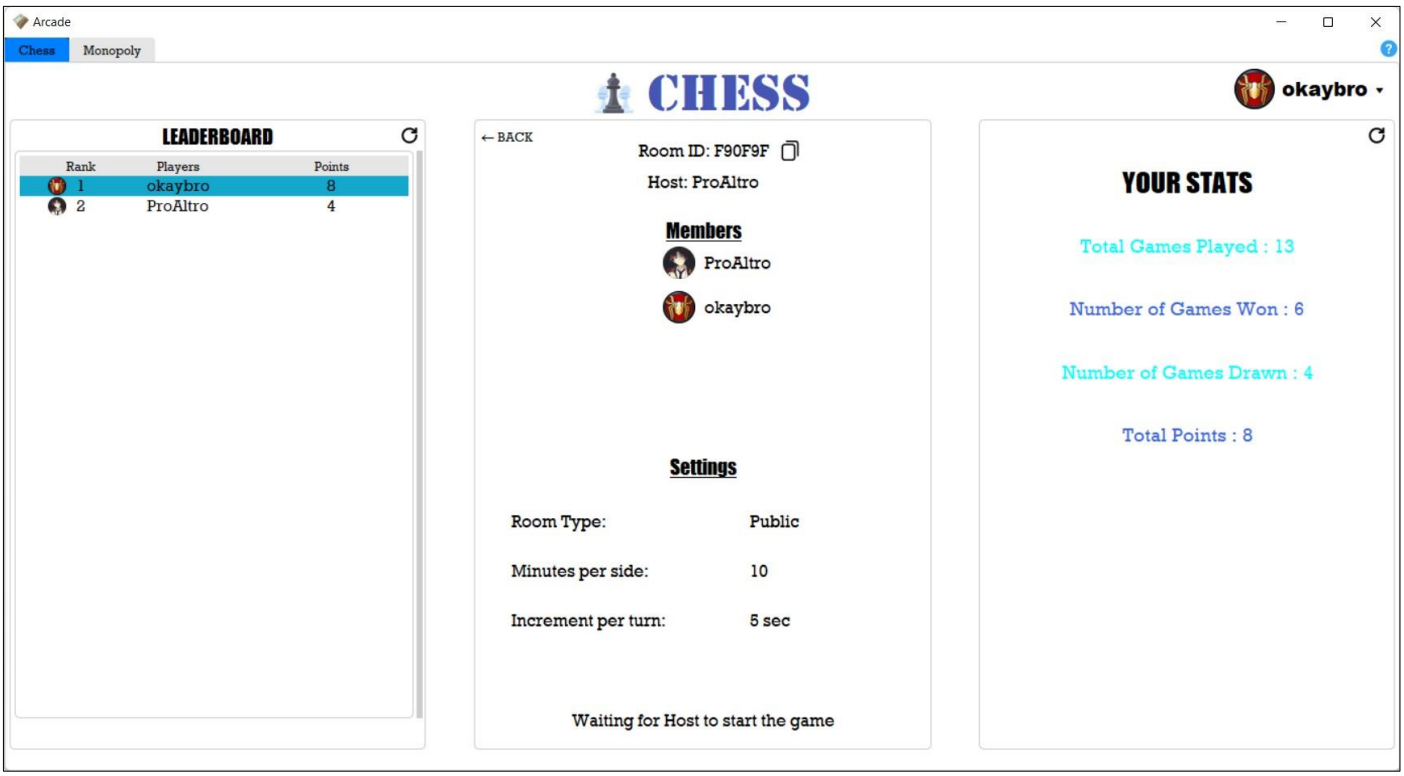

okaybro
← Cancel
Upload Picture
Confirm

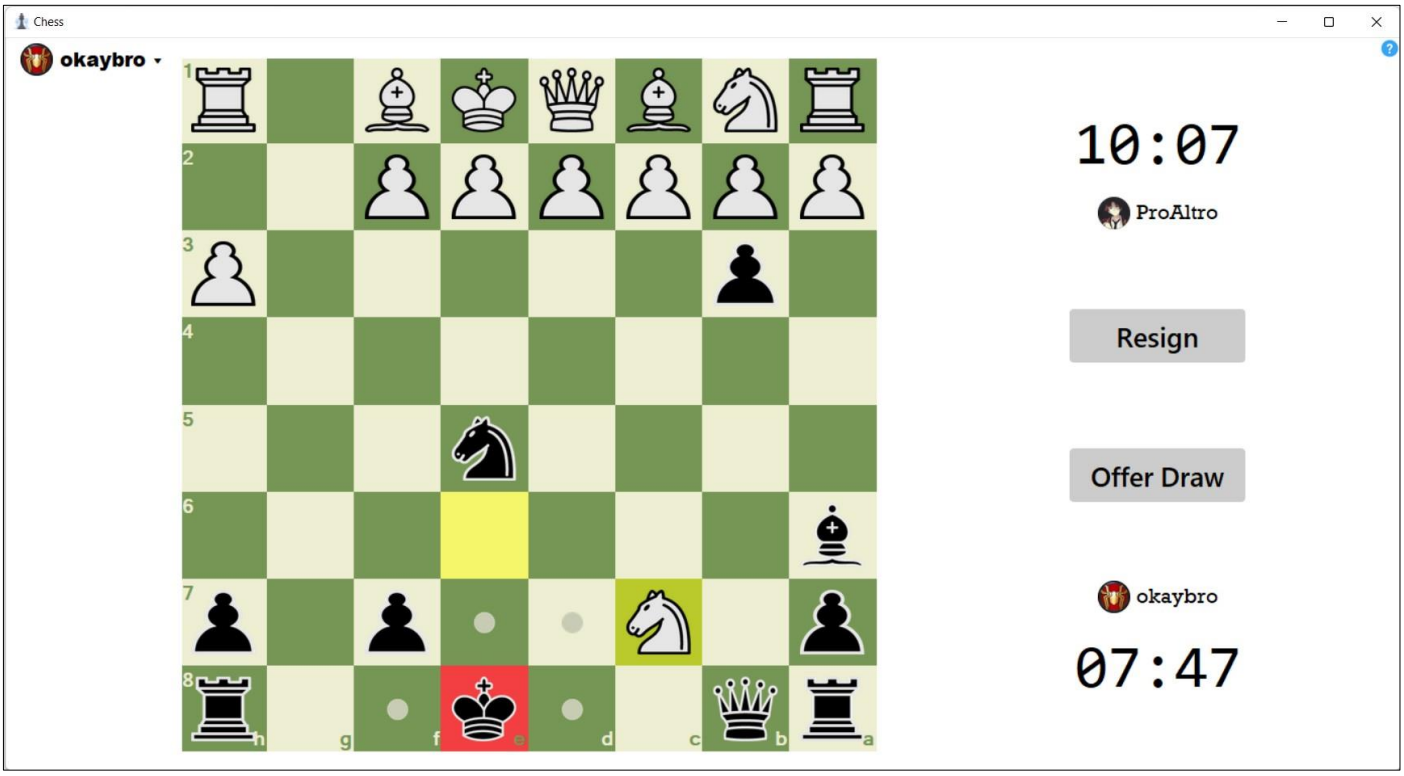

okaybro
← Cancel
New Password:
helloworld
Confirm Password:
Password does not match
CHANGE


Arcade
Chess
Monopoly
CHESS
okaybro
LEADERBOARD
Rank
Players
Points
1
okaybro
8
2
ProAltro
4
← BACK
Select A Room
Room No.
Host
No. of Players
2A7CB9
ProAltro
1
A97071
Magnus
1
or Enter Room ID:
2A7CB9
Join
YOUR STATS
Total Games Played : 13
Number of Games Won : 6
Number of Games Drawn : 4
Total Points : 8


Arcade
Chess
Monopoly
CHESS
okaybro
LEADERBOARD
Rank
Players
Points
1
okaybro
8
2
ProAltro
4
← BACK
Room ID: AC7353
Host: You
Members
okaybro
Settings
Room Type:
Public
Private
Minutes per side:
8
Increment per turn:
5
Your Side:
Black
White
Random
START
APPLY
YOUR STATS
Total Games Played : 13
Number of Games Won : 6
Number of Games Drawn : 4
Total Points : 8

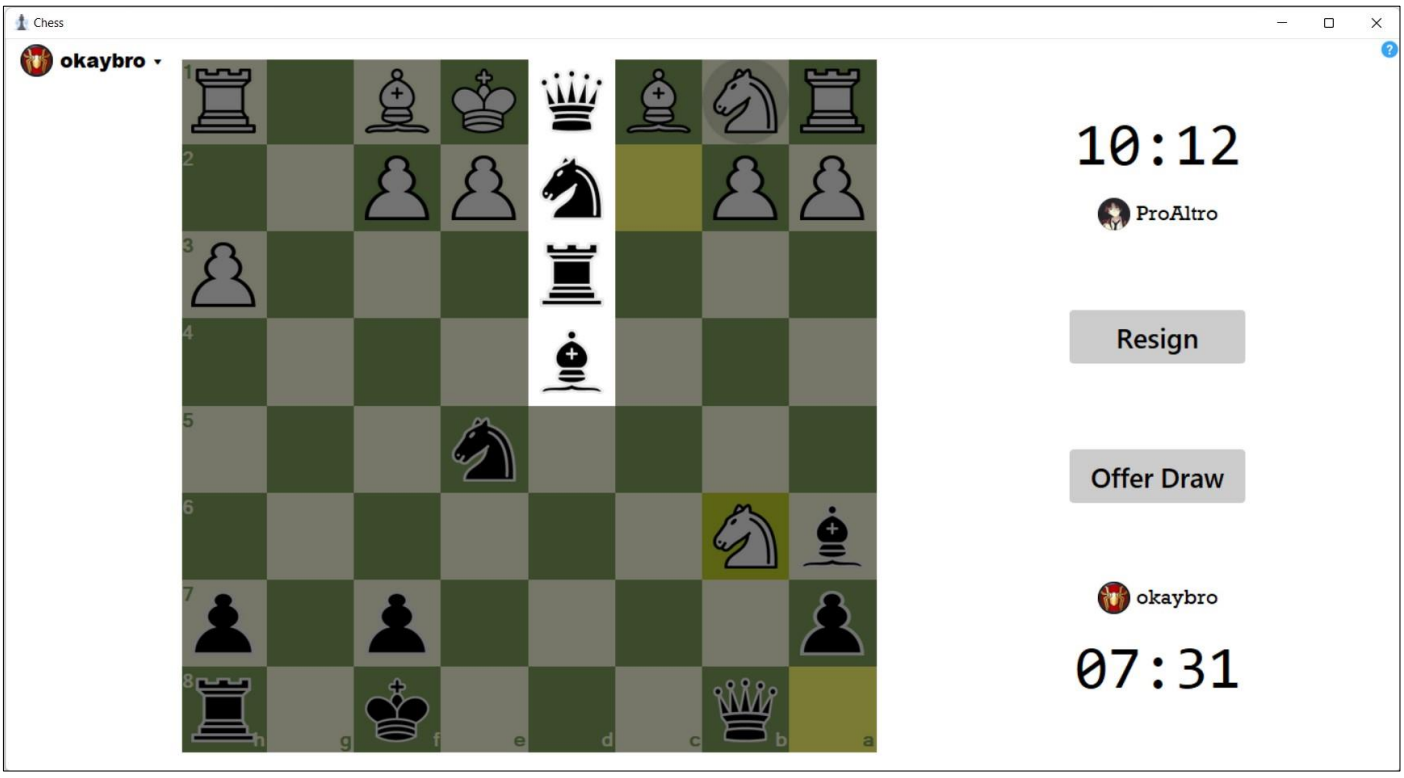

arcade.exe
Magnus has joined the room!


Arcade
Chess
Monopoly
CHESS
okaybro
LEADERBOARD
Rank
Players
Points
1
okaybro
8
2
ProAltro
4
← BACK
Room ID: F90F9F
Host: ProAltro
Members
ProAltro
okaybro
Settings
Room Type:
Public
Minutes per side:
10
Increment per turn:
5 sec
Waiting for Host to start the game
YOUR STATS
Total Games Played : 13
Number of Games Won : 6
Number of Games Drawn : 4
Total Points : 8

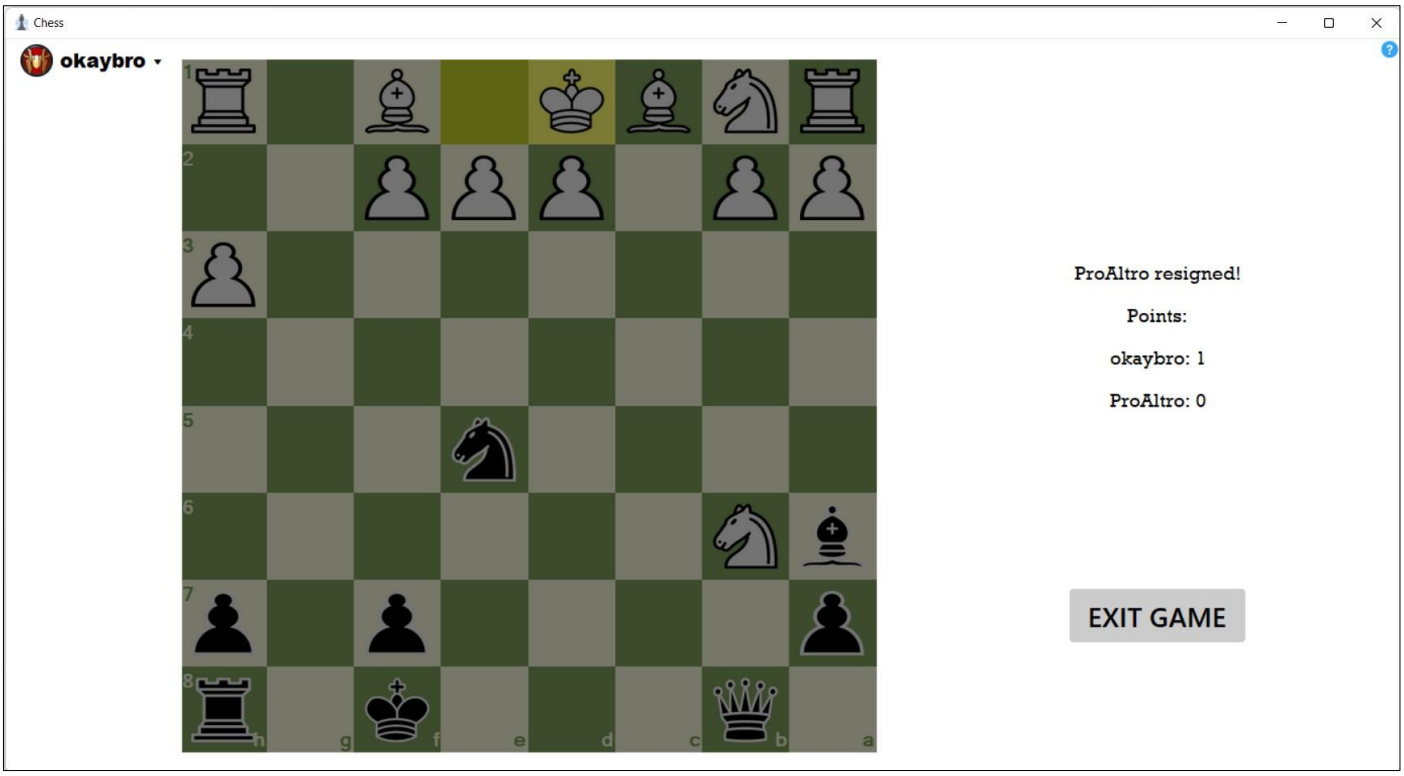

Chess
okaybro
10:07
ProAltro
Resign
Offer Draw
okaybro
07:47

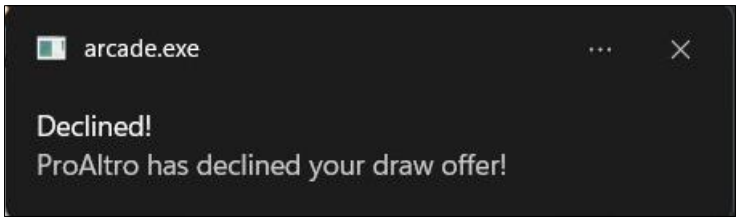
Try Again Later
Unable to connect to the Server at the moment, please try again later!
Things you can do:
1. Check your network connection
2. Restart your system
3. If this issue persists, wait for sometime. The server might be down, We are working on it!
OK

Chess
okaybro
QUIT
Dark Mode
08:48
ProAltro
Resign
Offer Draw
okaybro
09:30

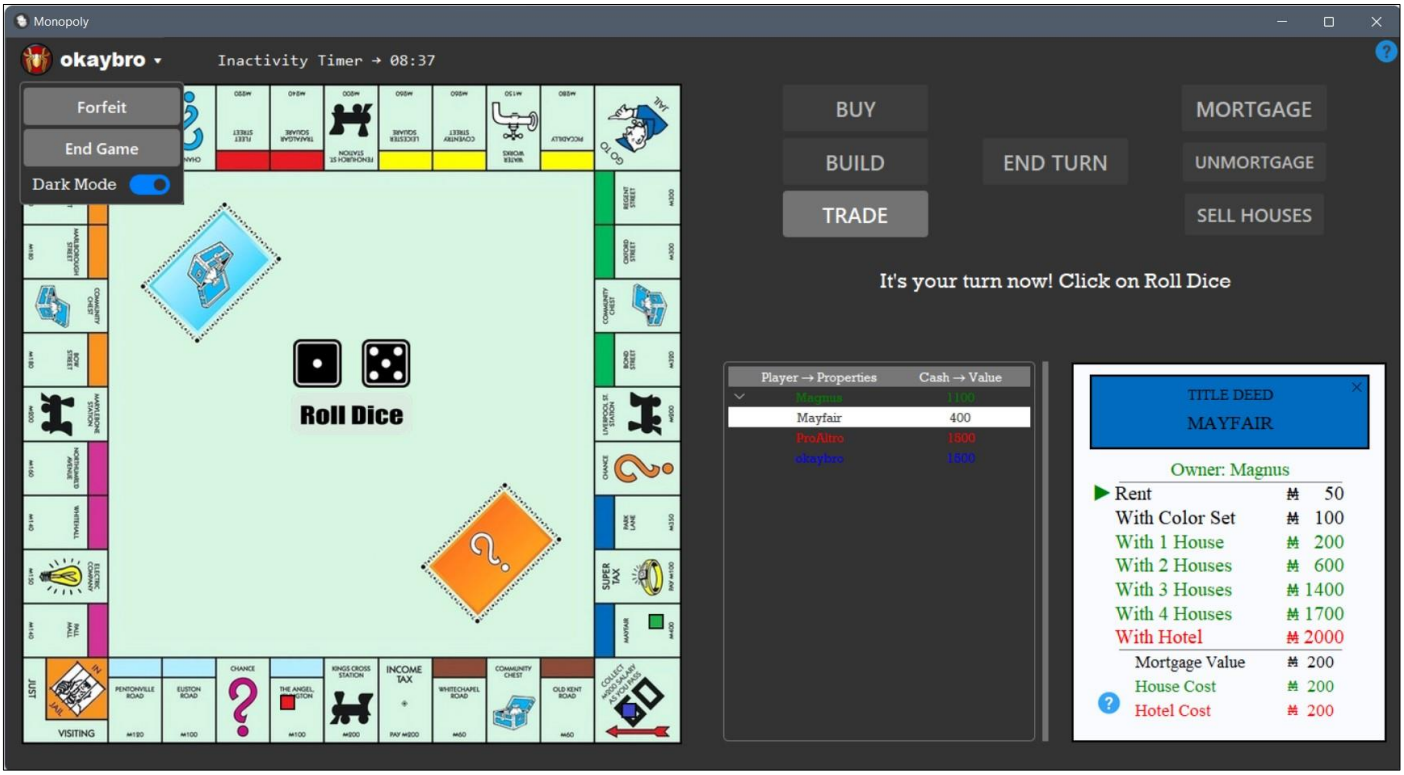

Chess
okaybro
10:12
ProAltro
Resign
Offer Draw
okaybro
07:31

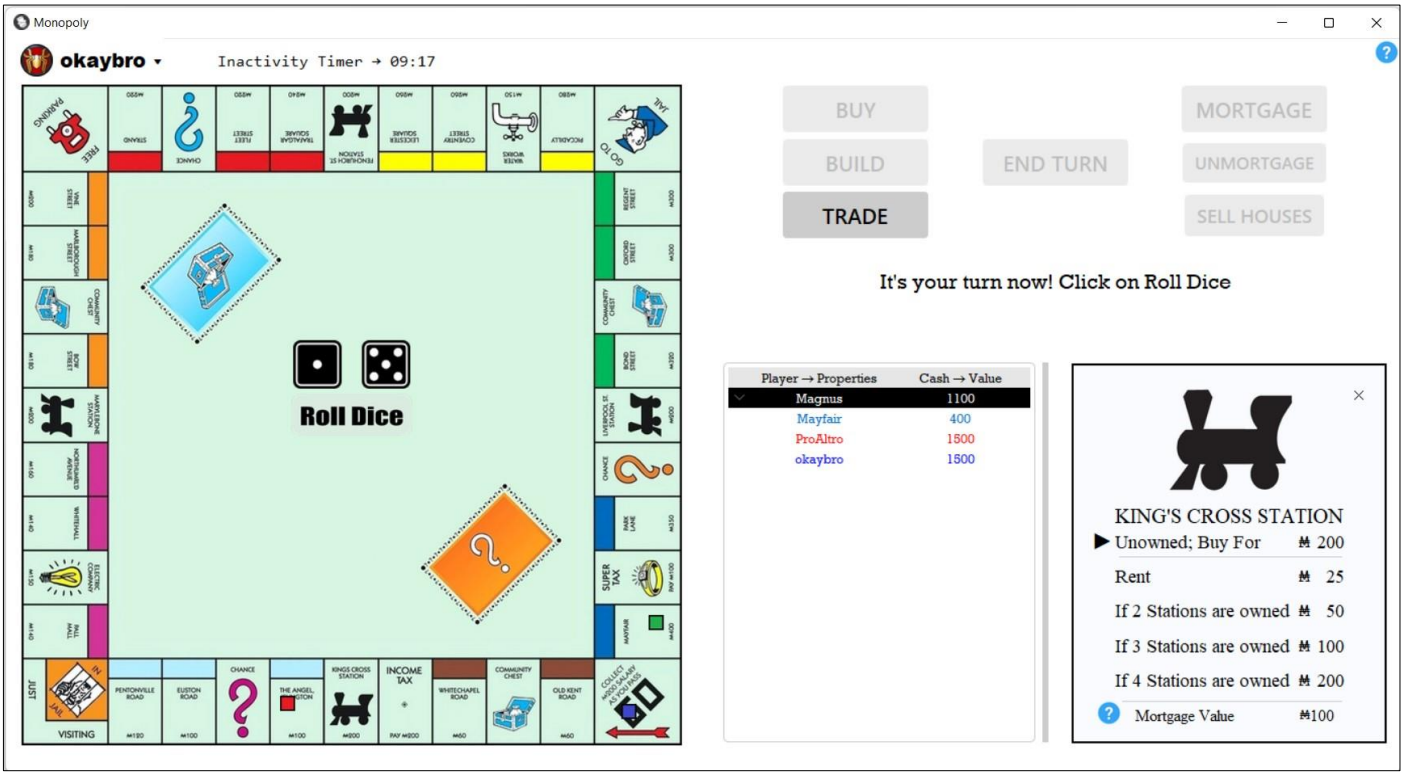
05:51
ProAltro
Opponent wants to draw the match!
Accept
Decline
okaybro
09:30

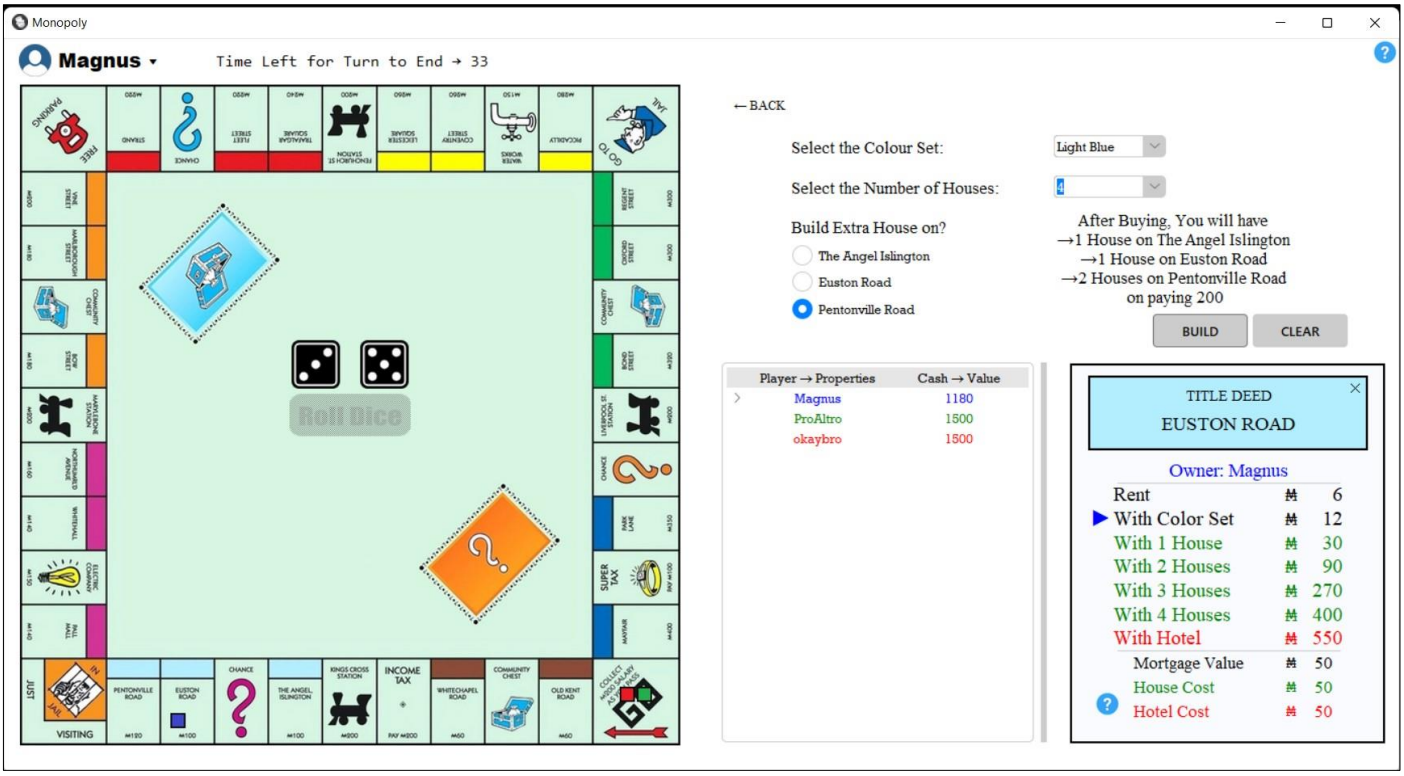

Chess
okaybro
ProAltro resigned!
Points:
okaybro: 1
ProAltro: 0
EXIT GAME

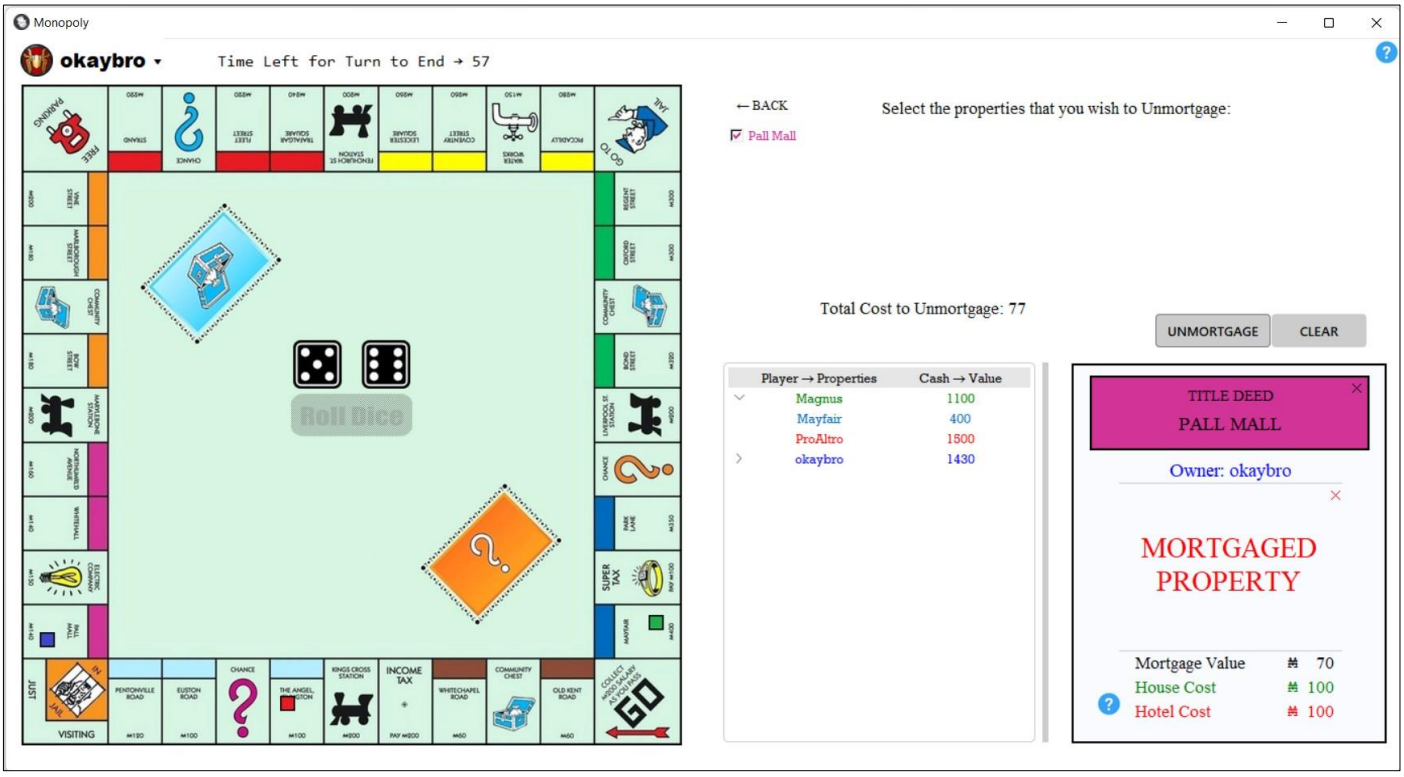

arcade.exe
Declined!
ProAltro has declined your draw offer!

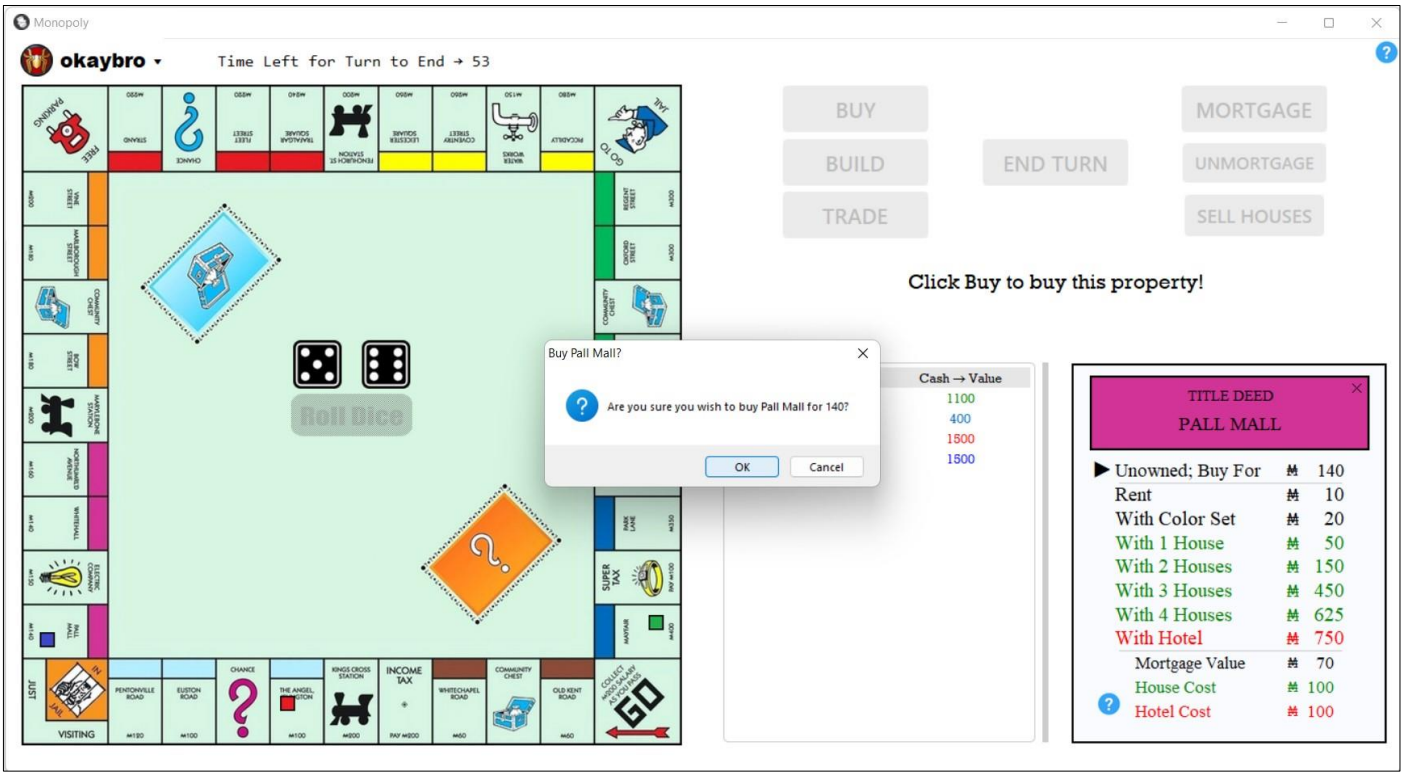
Monopoly
okaybro
Roll Dice
ProAltro is playing!
Player → Properties
Cash → Value
Magnus 1400
Euston Road 100
ProAltro 1700
okaybro 1500

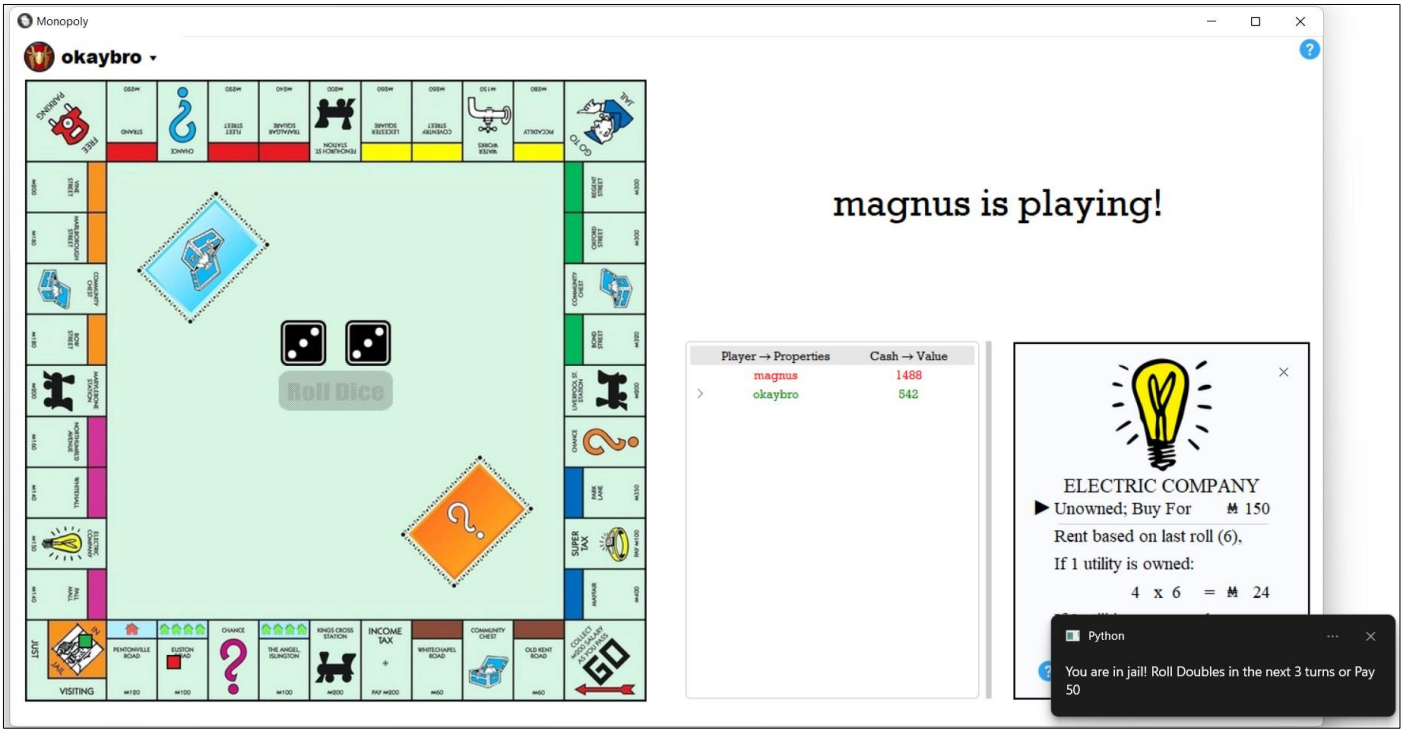

Monopoly
okaybro
Inactivity Timer → 08:37
Forfeit
End Game
Dark Mode
BUY
BUILD
TRADE
END TURN
MORTGAGE
UNMORTGAGE
SELL HOUSES
It's your turn now! Click on Roll Dice
Roll Dice
Player → Properties
Cash → Value
Magnus 1100
Mayfair 400
ProAltro 1800
okaybro 1800
TITLE DEED
MAYFAIR
Owner: Magnus
Rent ₼ 50
With Color Set ₼ 100
With 1 House ₼ 200
With 2 Houses ₼ 600
With 3 Houses ₼ 1400
With 4 Houses ₼ 1700
With Hotel ₼ 2000
Mortgage Value ₼ 200
House Cost ₼ 200
Hotel Cost ₼ 200

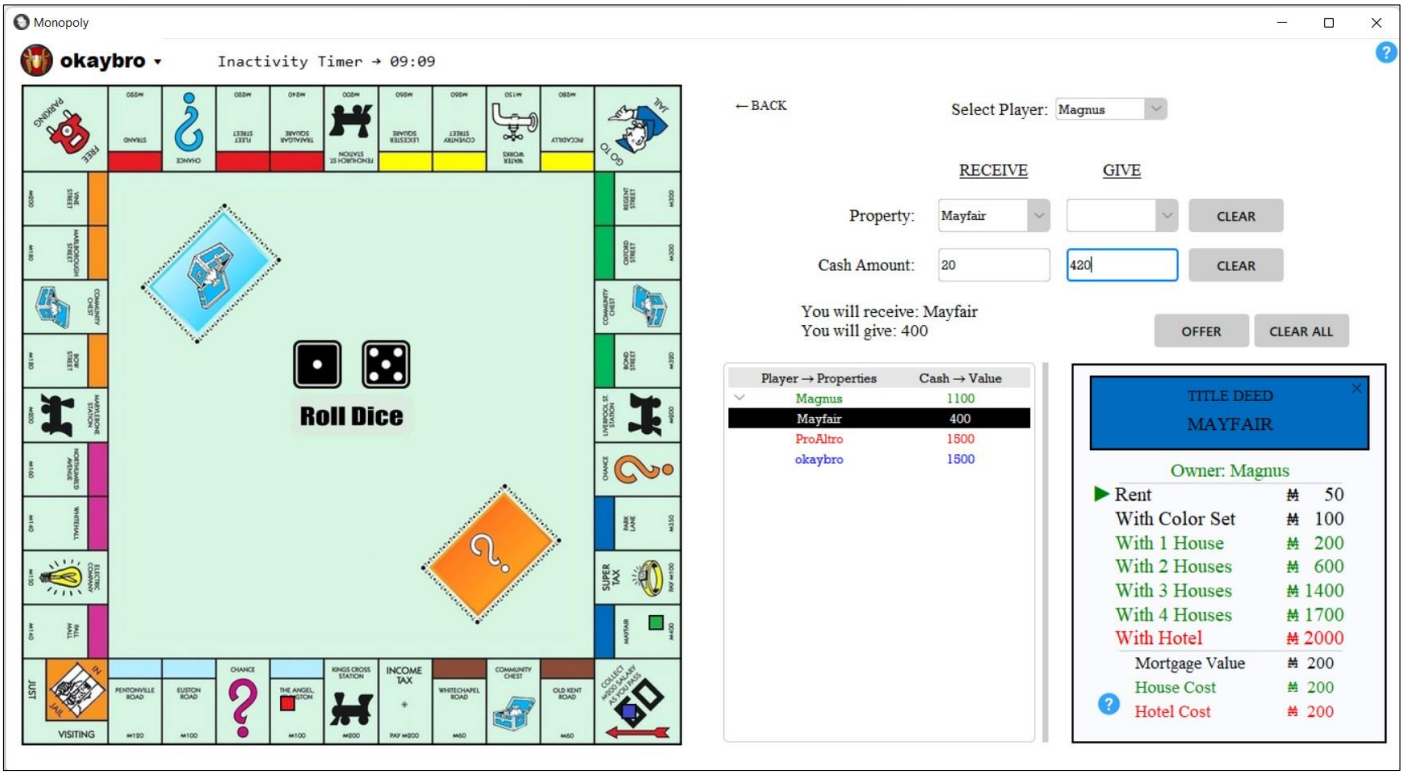

Monopoly
okaybro
Inactivity Timer → 09:17
BUY
BUILD
TRADE
END TURN
MORTGAGE
UNMORTGAGE
SELL HOUSES
It's your turn now! Click on Roll Dice
Roll Dice
Player → Properties
Cash → Value
Magnus 1100
Mayfair 400
ProAltro 1500
okaybro 1500
KING'S CROSS STATION
Unowned; Buy For ₼ 200
Rent ₼ 25
If 2 Stations are owned ₼ 50
If 3 Stations are owned ₼ 100
If 4 Stations are owned ₼ 200
Mortgage Value ₼100

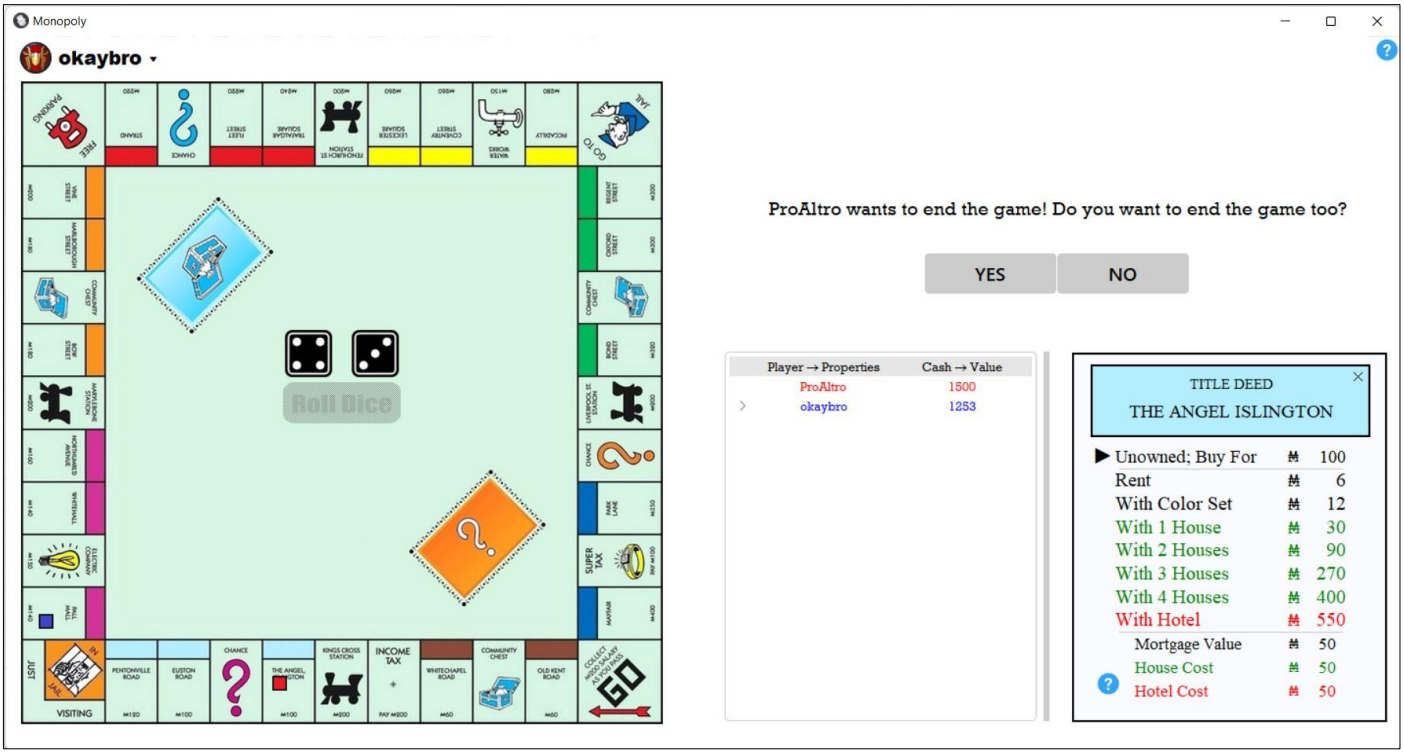

Monopoly
Magnus
Time Left for Turn to End → 33
Roll Dice
←BACK
Select the Colour Set:
Light Blue
Select the Number of Houses:
Build Extra House on?
The Angel Islington
Euston Road
Pentonville Road
After Buying, You will have
→1 House on The Angel Islington
→1 House on Euston Road
→2 Houses on Pentonville Road
on paying 200
BUILD
CLEAR
Player → Properties
Cash → Value
Magnus 1180
ProAltro 1500
okaybro 1500
TITLE DEED
EUSTON ROAD
Owner: Magnus
Rent ₳ 6
With Color Set ₳ 12
With 1 House ₳ 30
With 2 Houses ₳ 90
With 3 Houses ₳ 270
With 4 Houses ₳ 400
With Hotel ₳ 550
Mortgage Value ₳ 50
House Cost ₳ 50
Hotel Cost ₳ 50


Monopoly
okaybro
Time Left for Turn to End → 57
Roll Dice
←BACK
Pall Mall
Select the properties that you wish to Unmortgage:
Total Cost to Unmortgage: 77
UNMORTGAGE
CLEAR
Player → Properties
Cash → Value
Magnus 1100
Mayfair 400
ProAltro 1500
okaybro 1430
TITLE DEED
PALL MALL
Owner: okaybro
MORTGAGED PROPERTY
Mortgage Value ₳ 70
House Cost ₳ 100
Hotel Cost ₳ 100


Monopoly
okaybro
Time Left for Turn to End → 53
BUY
BUILD
TRADE
END TURN
MORTGAGE
UNMORTGAGE
SELL HOUSES
Click Buy to buy this property!
Buy Pall Mall?
Are you sure you wish to buy Pall Mall for 140?
OK
Cancel
Roll Dice
Cash → Value
1100
400
1500
1500
TITLE DEED
PALL MALL
Unowned; Buy For ₼ 140
Rent ₼ 10
With Color Set ₼ 20
With 1 House ₼ 50
With 2 Houses ₼ 150
With 3 Houses ₼ 450
With 4 Houses ₼ 625
With Hotel ₼ 750
Mortgage Value ₼ 70
House Cost ₼ 100
Hotel Cost ₼ 100


Monopoly
okaybro
magnus is playing!
Roll Dice
Player → Properties
Cash → Value
magnus
1488
okaybro
542
ELECTRIC COMPANY
Unowned; Buy For ₼ 150
Rent based on last roll (6),
If 1 utility is owned:
4 x 6 = ₼ 24
Python
You are in jail! Roll Doubles in the next 3 turns or Pay 50


Monopoly
okaybro
Inactivity Timer → 09:09
Roll Dice
←BACK
Select Player: Magnus
RECEIVE
GIVE
Property: Mayfair
CLEAR
Cash Amount: 20
420
CLEAR
You will receive: Mayfair
You will give: 400
OFFER
CLEAR ALL
Player → Properties
Cash → Value
Magnus 1100
Mayfair 400
ProAltro 1500
okaybro 1500
TITLE DEED
MAYFAIR
Owner: Magnus
Rent ₳ 50
With Color Set ₳ 100
With 1 House ₳ 200
With 2 Houses ₳ 600
With 3 Houses ₳ 1400
With 4 Houses ₳ 1700
With Hotel ₳ 2000
Mortgage Value ₳ 200
House Cost ₳ 200
Hotel Cost ₳ 200


Monopoly
okaybro
Roll Dice
ProAltro wants to end the game! Do you want to end the game too?
YES
NO
Player → Properties
Cash → Value
ProAltro 1500
okaybro 1253
TITLE DEED
THE ANGEL ISLINGTON
Unowned; Buy For ₳ 100
Rent ₳ 6
With Color Set ₳ 12
With 1 House ₳ 30
With 2 Houses ₳ 90
With 3 Houses ₳ 270
With 4 Houses ₳ 400
With Hotel ₳ 550
Mortgage Value ₳ 50
House Cost ₳ 50
Hotel Cost ₳ 50

ProAltro has won the game!
Networths:
ProAltro : 1500
Magnus : 1540
okaybro : 1653
EXIT GAME

LIMITATIONS

1. Possible incompatibility with lower versions of python.
2. Low to nil support for other operating systems such as macOS.
3. Tkinter GUI may not be as intended if used on a monitor with a screen width to height ratio different than approx. 1.7.
4. When disconnected, the user cannot return to the ongoing game.

BIBLIOGRAPHY

1. https://github.com/Chaitanya-Keyal/Arcade

2. https://docs.python.org/3/

3. https://anzeljg.github.io/rin2/book2/2405/docs/tkinter/index.html

4. https://www.tcl.tk/man/tcl/TclCmd/contents.html

5. https://stackoverflow.com/questions/

6. https://www.youtube.com/watch?v=yQSEXcf6s2I&list=PLCC34OHNcOtoC6GglhF3ncJ5rLwQrLGnV

7. https://realpython.com/python-sockets/