**Online Pictionary Game With Flask And SocketIO**

**A Comp Sci A-Level NEA Project**

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Contents:

1. Analysis 2
   1. Abstract 2
   2. Research 2
   3. Technical Analysis 5
2. Objectives 7
3. Design 8

3.1) Design Preamble 8

3.2) File Structure 9

3.3) Website Flow 10

3.4) Game Flow 11

3.5) Page Designs 12

3.6) Database 18

4) Technical Solution 20

5) Testing 60

5.1) Group Testing 60

5.2) Manual Testing 61

5.3) Testing Conclusion 78

6) Evaluation 79

**Analysis**

**Abstract**

The project is a web-based implementation of Pictionary, a popular party game in which players take turns drawing things, and other players try to guess what the person is drawing. The aim of the game is to guess what the current artist is drawing. The next player in the room then becomes the drawer and the other players guess the drawing. The project will also include a forum, in which users can create posts and others can reply to them.

The target audience of this project is very wide, as it can be played by most ages, given that they have a basic understanding of how to use a computer and navigate the internet. In terms of interests, the game appeals to people who enjoy drawing or art, and people who are competitive or are just looking for some casual game to kill time with and have an internet connection. The game is also child friendly as there are no inappropriate words in the word list, however the chat is unfiltered, which could possibly harm the experience for younger users.

**Research**

There are already quite a few Pictionary websites, which were perused to find areas in the market that could do with improving, as well as to get some ideas for areas in which the game could differentiate from its competitors.

One of the most popular Pictionary games out right now is <https://skribbl.io/>. Skribblio lets players choose a username and character, then either join a random public game or make a private room for them and their friends. The fact that players could make custom rooms was deemed an important feature, so it was decided to implement it on the website. It was decided that the avatar creation did not add much to the game and was not implemented to the project as to not overwhelm the user with useless features. An area that skribblio was lacking was the username aspect, as on Skribblio users choose a one-time username to play with. To improve on this, a login system will be added which will let players create permanent accounts they can use to play the game and store their high scores to compare with friends. The art style of the website was also very childish, which made the game seem as if it was only designed for children. The website will be designed with a professional style, so as to show the target audience is more than just children.

Graphical user interface, application, website

Description automatically generated

[Figure 1] The page a user is greeted with when they visit skribbl.io, the art style is very childish and the first thing that players see is the avatar creator and username picker.]

Another popular Pictionary website is <https://www.drawize.com>, which was an interesting one as it advertised as an online, multiplayer game however upon testing it seemed that all the other players were bots, with very standardized names and putting unrealistic phrases in chat. This came off as cheesy, and felt very disingenuous, and harmed the user experience to advertise as a multiplayer game then have the players be bots, so even though implementation of bots would be quite simple given the way the game is written, it was decided not to implement that into the program.

Graphical user interface, application

Description automatically generated[Figure 2] The homepage of Drawize. There is a lot of ads, which make the homepage look cluttered and might make the user want to play a different game. The actual UI is also very cluttered and looks very childish.

There is also the Mattel board game Pictionary, which is a physical implementation of the game, in which players roll a die then move their piece on the board, with the colour they land on corresponding to a category that they will draw from. The player then draws a card and draws the word from the category that’s on the card, while the other player guesses what they are drawing. While this is an interesting take on the classic game, there is a lot of unnecessary complexity in the game, so this game was not used for inspiration, as the game is meant to be more casual, for players who are just looking for some fun without thinking too much.

After research was carried out, the follow ing things were identified as to what the game will need. A login system is integral to the game, as one of the main ways the game will stand out is by having leaderboards and user stats. To implement said leaderboards and stats, a database will be created. This will store a user’s username, total score, game score, which games a user is part of, and what users are in a given game. An SQL database will be used for this. It is also important that multiple games can be played in parallel without interfering with each other, as users might want to play with their friends in a small group rather than in a massive game of all players currently on the website. To implement this, SocketIO rooms will be used to send socket events to specific users. A forum will make the game stand out even further, as there were no pictionary websites visited which included a forum. The existing login/ user system will be used for creating the forum along with a few new tables specifically for the forum.

**Basic Functionality**

The game will run off of the concept of rooms, which players are able to connect to with a room code. Upon logging in to the website, the player will see a box asking for a room code. They can either find out a game code from a friend (not on the site, a real life friend) or they can put in their own room code. If the room code doesn’t exist, the game creates a new room with that code and if it does, the player joins the room with that code.

**Gameplay Decisions**

Most of the current games let multiple people guess the word in a single round, with decreasing scores for each subsequent person that guessed the word. In order to make the game faster-paced, only one user will be able to guess the word per round. Hard to draw words would also sometimes ruin the game, as people would either just write the word out and spoil the fun, or not draw anything and hold the game up. To avoid this, a button will be implemented which will randomise the word. The artist can press this button however many times they deem necessary until they find a word they are happy with or are confident they can draw.

Most if not all of them also include a win condition, whether a time limit; round limit or a score limit. While this is very commonplace and helpful in a lot of games, it was found to slow the game down when users were able to communicate through other means (like a voice or video call) by needing the users to create a new game every time someone won. In order to maximise the speed of the game, there will not be a win condition in the game. This means that a group of players who are in a call can play together infinitely until they see fit to end the game. This also means that a group of people can have their own game that they keep returning to, as a room is not reset after everyone leaves.

Diagram

Description automatically generatedFlask will be used for the back end, along with the Flask-SocketIO library to enable use of web sockets. The log in system will make use of the Flask-Login library and SQL databases to store things like user passwords, usernames, scores, etc. These databases will also be used to populate leader boards on the site.

[Figure 3] Flowchart for

what happens when a

user presses the join

button

The forum will also use an SQL database for the backend, reusing the game’s login system for user handling. Upon visiting the forums, users will be greeted with the homepage, which will have a navbar at the top, the posts in the middle of the screen and a sidebar which will remind users of the forum rules, as well as including a button for creating a new forum post. The home page will contain the titles of posts and the author of the post, and upon clicking on the title users will be taken to a separate page for the post, in which the users will be able to read the contents of the post as well as view or post comments. Creating new posts and comments will all be handled with html forms, which the server will receive and save the information from them in the database.

**Technical Analysis**

The main game page will be made of 3 separate systems:

* Game Controls
* Chat
* Drawing

Game Controls:

This will be everything the drawer will see besides the canvas and chat. This will include buttons to select brush colour, 2 input boxes – one for brush width and one for brush colour in hexadecimal. There will also be writing at the top of the page describing what the drawer must draw, as well as a button to change the word in case the current one doesn’t match what the drawer wants. These controls are vital in ensuring that the drawer can use multiple colors and brush widths to make the drawing process easier.

Chat:

The chat will be present on both the drawers and guessers’ screens, and it will be on the right with an input box beneath it. The chat will display a users message with their name next to it, and is necessary to include as this will be the way users guess the word. When someone types the current word in chat, the chat will say “x guessed the word” instead of their actual message and the drawing role will soon be passed on to a different player.

Drawing:

The drawing system will make use of the html canvas, and will be displayed to both the drawer and guessers, however only the drawer will be able to interact with it. The drawer will send the current state of their canvas to the server, which will then forward it to the guessers.

These 3 systems will work in conjunction to make the game page, and will enable players to play the game. The game will run on the concept of rooms, which will be private lobbies accessible via a ‘room code’ – a string set by the first person to create a room. This code can then be given to anyone who the creator wishes to play with. Lots of rooms should be able to co-exist In parallel without impacting the other rooms (Each room should have a different word, chat, canvas, etc.)

The forum will also be made from a number of pages. There will need to be ways to view all forum posts, view individual posts, make new posts, post comments and more.

Main Page:

The main forum page will include a header – like all forum pages -, a table which will hold links to all forum posts along with their authors; a sidebar which will have the rules and a button to make a new post.

Individual Post Pages:

Upon clicking on a post on the forum page, the user will be taken to a dedicated page where they can read the post in its entirety, as well read and post comments to the post. This page will have the same layout as the main page, however the post table will be replaced with the contents of the post and an additional table for comments will be included.

Creating New Posts:

There will be a separate page where users will be able to write posts. There will be text input for both a title and the content of the post. There will also be a sidebar reminding the user of the posting rules.

The last part of the website will be a leaderboard, which will be a table of users’ names and their scores, sorted descending by score. There will also be a button to refresh the leaderboard to allow users to look at the most up to date scores without having to refresh the whole page.

**Objectives**

1. Accounts
   1. Users can log in with a username and password
   2. Leader boards showing user’s scores will be implemented
   3. Users’ scores will be saved to a database
   4. Encrypt users’ passwords for security
2. Game
   1. Users can join rooms using a room code
   2. Users can draw by clicking and dragging on the canvas
   3. Users can chat by writing a message in the chat input box and either pressing the send button or pressing enter
   4. Users can see the current drawer’s drawings
   5. Users can type in chat to guess what the drawer is currently drawing
   6. Multiple games can be played in parallel without affecting each other
3. Forum
   1. There is a forum that will let users discuss various topics
   2. Users can write posts
   3. Users can write comments to posts
   4. All posts and comments will be stored in an SQL database
   5. Users can view posts in their entirety by clicking on a post in the main forum page
   6. The post page displays comments to the post underneath it

**Design**

**File Structure**

The website’s files will be organized as such:

[Figure 4] File structure diagram

Flask needs the JavaScript and CSS files to be organised into static and HTML files into templates folders. The database (.sql filetype) and words list (.json filetype) could be in a separate folder but it was deemed unnecessary as there weren’t many files out of folders anyways.

**Website Flow**

**Diagram

Description automatically generated**

[Figure 5] This shows how the pages will be navigated. Each arrow represents a way to navigate from one page to another. Some arrows are bidirectional, showing that you can navigate from one page to the other and vice versa . The columns represent which part of the website each page belongs to.

The main way of navigating pages is through buttons that tell you where they will take you, however there are some exceptions, for example the game pages. You are automatically taken to either the game page or the spectate page whenever a round starts. The login page is only specifically navigated to from the register page, through a button that says “login”, all the other ways to reach the page are through clicking a button that says “logout”.

**Game Flow**

The game loop of the game consists of 2 basic actions: drawing and guessing. This is pretty basic by design, as stated previously that the aim of the game is to be fast-paced, with as little distractions or unnecessary time wasted as possible.

Diagram

Description automatically generated

[Figure 6] Flow chart for the game

The start a new round process was condensed into one process in the flow chart as it is explained later in the technical implementation (Technical Implementation Reference 6)

**Page Designs**

**Login Page**

The login page will be the first page a user sees when they visit the website. It will consist of a title, two entry fields (username and password), a login button and a button prompting users to visit the register page if they do not have an account.

Graphical user interface, application, Teams

Description automatically generated

The entry fields and login button will be implemented using a html form.

When the user presses the login button, the website will first check if the username and password fields have been filled. If they have, the server will search the user SQL table to check if there is a user with the entered username. If the user exists, the server will compare the entered password with the encrypted password stored on the database using sha256. If the username and password are correct, the server will log the user in and they will be redirected to the index page.

[Figure 7] Mock-up of the login page

**Register Page**

The register page will have 3 input fields: one for username, one for password and one for confirm password. This page will make use of a html form for these inputs, to allow easy data transfer to the server. Once the user fills all of the fields, they can press the register button. This will send the form to the server, which will check if the passwords match and there isn’t a user with that password already, and if both of these checks are passed the server will create a new SQL entry in the user table with the user’s username and password, which will be encrypted with sha256. There will also be a button which will redirect the user to the login page if a user already has an account.

Graphical user interface, application, Teams

Description automatically generated

[Figure 8] Mock-up of the register page

**Index Page**

Once the user has logged in, they will be taken to the index page. Non-logged-in users will not be able to view this page. There will be an input field for a room code, a button to join a room with the given code, a button to redirect the user to the leaderboards and a button to log out the user.

When the user enters a room code, the server will check if the room with that code already exists. If it does, the server will redirect the user to that room, and if not the server will create the room before redirecting the user to it.

There will not be a list of room codes or any other in-website way for users to find room codes, instead, users are expected to share their room codes with the people they wish to play with through alternative means, such as a voice call or a messaging service.

Graphical user interface, application, Teams

Description automatically generated

[Figure 9] Mock-up of the index page

**Leaderboard Page**

The leader board page will be made using bootstrap’s table class. It will have 2 columns, one for username and one for score. It will also include a button that can refresh the leaderboard, and a button to go back to the index page.

Upon opening the leaderboard page, the client will send a request to the server for the data to populate the leaderboard with. The server will carry out a SQL query (technical implementation reference) which will return every user’s username and their score, sorted in descending order of score. The client will receive this data and dynamically generate the table using the data.

Pressing the refresh button will send another request to the server for the data, and will generate the leaderboard again with the new data.

Graphical user interface, application

Description automatically generated

[Figure 10] Mock-up of the leaderboard page

**Drawing Page**

The drawing page will consist of multiple elements: the canvas, input fields for brush colour and size, buttons for selecting one of the default brush colours, a title, a new word button, a chat box and an input for chat messages.

Canvas – The canvas will be what the drawer uses to draw. It will be made with a HTML canvas element and will use the canvas’ context attribute for drawing. (technical implementation reference) When a user presses their mouse button, the position of their cursor will be noted, then while the mouse button is pressed the position will be updated, with a line being created between their previous and current positions. This implementation sacrifices accuracy of drawing for speed and efficiency, as lines that are drawn by moving the mouse more slowly will appear smoother than quickly dragging the mouse across the canvas.

The canvas of the drawer will be sent to the server every 250ms. This will be achieved by sending a ‘canvas URL’ - obtained by using the toDataURL canvas method - to the server. The server will send the URL to all of the spectators, who’s client will use the URL to display the image of what the drawer was drawing on the spectator’s screen. This method does have some drawbacks, as the URL could be sent more frequently than 250ms to appear more smooth on the spectators’ screens and make sure that the spectators are seeing a more up-to-date drawing, however reducing the delay would have negative effects on the performance of the server if many games are being played at once. Because of this, 250ms is being used as a good middle ground between efficiency and smoothness.

Brush – The line that is drawn between the mouse positions will be defined by two attributes: colour and width. There will be default values for these (black and 1px) however the user can change both of these. The brush colour can be changed by either inputting the hex code of the desired colour into the input box, or by clicking on one of the buttons on the side to set the brush colour to the colour of the button. The brush width can only be changed by changing the value in the width input box, which will have a minimum value of 1 and a maximum value of 100.

Drawing Word – The current word the user has to draw will be displayed at the top of the page. When the game page is first visited, the client will make a request to the server for a new word. The server will choose a word randomly from a list of words stored on the server as a json file. This request can be made again by the user by pressing the new word button, which will pick a new word from the list if the drawer is unhappy with the current word.

Chat – The chat box on the left-hand side of the screen will be made with an unordered list element. It will be used to display other users’ and the player’s messages. When a user enters their message into the input box then presses the send button, this will send their message to the server, which will distribute the message to the other users in the current room. Upon receipt of a chat message, the client will create a new list element then populate it with the message. When there are too many messages to fit in the chat box, scrolling will be enabled on the chat to see new messages.

The chat will be the way that players guess what the drawer is drawing. If a chat message is the correct word, instead of sending the message to other users the server will instead send a message to the chat that a user has guessed the word, and what the word was. The server will then wait a few seconds for everyone to read the announcement and start a new round, with a new drawer and will also add one score to the person who guessed the word in the user table.

Graphical user interface

Description automatically generated

[Figure 11] Mock-up of the drawing page

**Spectating Page**

The spectator page will be a simplified version of the drawing page, it will include the canvas and chat directly from the drawing page, however it will not include any brush controls and the title will prompt the user to guess the word instead of drawing a word.

As previously explained, the spectator’s client will receive a ‘canvas URL’ every 250ms from the server, which will be used to display the drawing on the spectator’s screen.

Due to the limitations of the toDataURL method, the spectator’s version of the drawing will be slightly more pixelated, as the URL can only store so much information about the canvas. Because of this, the canvas size was limited to 1000 \* 680 pixels, to allow more data to be stored about the drawing, albeit at a lower resolution than if the canvas was allowed to be bigger. The slightly more pixelated appearance of the drawing on the spectator’s canvas does not impact the game in a major way, as all drawings are still clearly visible – albeit at a lower visual quality.

The chat will be implemented in the same way as it is on the drawing page, with users being able to write their messages in the input box, sending them, then the server sending them to the other users.

Graphical user interface

Description automatically generated

[Figure 12] Mock-up of the spectator page

**Main Forum Page**

This page will display all of the posts made on the forum and the username of the person who wrote the post. These will be stored in an unordered list element. There will also be an aside which will show the user the rules of the forum and a button to make a new post.

Table

Description automatically generated

[Figure 13] Mock-up of the forum page

**Post Page**

This page will be shown to the user when they click on a post in the forum page. It will display the title of the post, as well as the post content beneath it. Under the post, there will be an input box to add a comment and an unordered list showing all of the post’s comments and the username of the person who authored the comment. The aside will also be present on this page, showing the rules and a button to make a new post.

Graphical user interface, table

Description automatically generated with medium confidence

[Figure 14] Mock-up of the post page

**New Post Page**

This page will be shown to the user when they click the new post button in the aside. It will consist of 2 input boxes. One small one for the title, and one large one for the post content. There will also be a button to submit the post and an aside reminding the user of the rules before posting.

A picture containing table

Description automatically generated

[Figure 15] Mock-up of the new post page

Diagram

Description automatically generated**Database**

[Figure 16] Entity Relationship Diagram for the database

The database for the website is made up of 5 tables. A user table (Technical Implementation Reference 1), a game table (Technical Implementation Reference 2), a linking table (Technical Implementation Reference 3) - used to set up a many to many relationship between user and game -, a comment table (Technical Implementation Reference 4), and a post table (Technical Implementation Reference 5).

The user table will contain a user id primary key, a username, password – encrypted in sha256, and a score. The score contained in the user table will be the total score the user has gathered over the lifetime of their account. The game table will contain a room id primary key and a room code. The room code stored with the room id will be the room code that users will use to connect to the rooms, and the room id will be used to identify each game in the database easily. It also avoids repeating the relatively long room code in the link table compared to the room id. The linking table will have 4 columns: link id (primary key), user id (foreign key pointing, to a user), game id (foreign key pointing to a game) and a score. The score in the linking table will be the user’s score for the current game, as opposed to the total score stored in the user table. These 3 tables will be what enables the game to run.

The database is designed to allow games to contain many users, and users to be in many games. It’s important to be able to check both what games a user is in *and* what users are in a game. This means that the relationship between user and game is many to many bidirectional. This relationship is harder to create, however it was necessary for the application.

The post table will store forum posts. The post id will be a primary key, the post title will be the title which the user chooses, and the author will be a foreign key pointing to a user id. The user id to which this points to will be the user who wrote the post. The post content field will store the writing of the post. The comment table will be used in conjunction with the post table to create the forum. The comment id will be a primary key, and the content the actual text contained in the comment. Each comment will also have 2 foreign keys. One pointing to the id of the post under which the comment was made, and one pointing to the user id of the user who wrote the comment. These 2 tables, along with the aforementioned user table will be the backend for the forum.

Upon a user visiting the forum page, the server will run a query to return every post title and the username of the author of the post, which will be sent to the client to be displayed in the forum page.

When a user clicks on a post title, they will be taken to a separate page for the post. The server will run a query to return the content of the post, as well as a query to return every comment under the post and the username of the author to each of the comments.

On the new post page, users will be able to write and post posts. Upon posting a post, the server will store the title and content of the post in the post table, along with the id of the user who wrote it.

When a user writes a comment, the server will store the content of the comment, the user id of the author and the id of the post that the comment was posted under in the comment table.

**Technical Solution**

Server.py

from flask import Flask, render\_template, request, flash, redirect, session

from flask.globals import session

from flask.helpers import url\_for

from flask\_login.utils import login\_required

from flask\_socketio import SocketIO, join\_room

from flask\_login import (

    LoginManager,

    UserMixin,

    login\_user,

    login\_required,

    current\_user,

    logout\_user,

)

from flask\_sqlalchemy import SQLAlchemy

from werkzeug.security import generate\_password\_hash, check\_password\_hash

import random

import json

import time

import re

db = SQLAlchemy()

app = Flask(\_\_name\_\_)

app.config["SECRET\_KEY"] = "HNz898OEWw3qdq8tpkeatPC8GqvExMdw"

app.config["SQLALCHEMY\_DATABASE\_URI"] = "sqlite:///./database.db"

app.config[

    "SEND\_FILE\_MAX\_AGE\_DEFAULT"

] = 0  # This line makes the browser not cache any files, which is very useful for testing and also going to be kept like this as it allows for very easy deployment of any updates to the website.

socketio = SocketIO(app, async\_handlers=True)

db.init\_app(app)

sessions = (

    {}

)  # A dictionary of sessions, so that each room is easily accessible by its room code

sids = (

    {}

)  # A dictionary of session ids, so that each user's session id is easily accessible with their username.

login\_manager = LoginManager()

login\_manager.init\_app(app)

login\_manager.login\_view = "/login"

class User(

    UserMixin, db.Model

):  # This class is an sqlalechemy class, which creates the User SQL table. UserMixin is a flask\_login object that lets the user table be used to login users.

    \_\_tablename\_\_ = "user"  # This sets the name of the table to user

    id = db.Column(

        db.Integer, primary\_key=True

    )  # The primary key for a user. This variable has to be called id for flask-login to work properly

    username = db.Column(

        db.String(14)

    )  # The username of a user. This cannot be longer than 14 characters for storage space purposes.

    password = db.Column(

        db.String(100)

    )  # A user's password. This is going to be encrypted with sha256 for security.

    score = db.Column(

        db.Integer

    )  # This will be the total score that the user has acquired over their account lifetime.

    games = db.relationship(

        "LinkingTable", back\_populates="user"

    )  # This creates a relationship object between the user and the linking table, which will be used to create a many to many relationship between games and users.

class Game(

    db.Model

):  # This class is an SQLAlchemy class, which creates an SQL table called Game.

    \_\_tablename\_\_ = "game"  # This line just sets the name of the table

    game\_id = db.Column(

        db.Integer(), primary\_key=True, unique=True

    )  # This is the primary key of the table, every game will have an integer id used to identify it in the database.

    game\_code = db.Column(

        db.String

    )  # This game code will be the room code that users use to connect to the room. Storing it with the game id makes it easy to query the databse with the room code.

    users = db.relationship(

        "LinkingTable", back\_populates="game"

    )  # This creates a relationship object to the linking table, which then links the game to the users in a many to many relationship.

class LinkingTable(

    db.Model

):  # This is an SQLAlchemy class that creates an SQL table called Linking Table.

    \_\_tablename\_\_ = "link"  # This sets the name of the table to "link"

    link\_id = db.Column(

        db.Integer(), primary\_key=True, unique=True

    )  # This is the primary key of the table, every link between game and user will have na integer id to make it easy to identify.

    game\_id = db.Column(

        db.Integer(), db.ForeignKey("game.game\_id")

    )  # This foreign key will match a game id in the game table, and will be used along with the user id to create a many to many link between the user and the game.

    user\_id = db.Column(

        db.Integer(), db.ForeignKey("user.id")

    )  # This foreign key will match a user id in the user table, and will be used along with the game id to create a many to many relationship between user and game

    score = db.Column(

        db.Integer()

    )  # This stores a users score for the specifiedd game. This is different to the score that is stored in the User table, which is a total of all the score that user has gotten.

    user = db.relationship(

        "User", back\_populates="games"

    )  # This creates a relationship between the link table and user table, back\_poulates tells the database that the relationship will be used to link the user to a game.

    game = db.relationship(

        "Game", back\_populates="users"

    )  # This createsa  relationship between the link table and game table, the back\_populates parameter tells the database that the game will be linked to a user.

db.create\_all(app=app)  # This line creates the database, using the Flask app object.

@login\_manager.user\_loader  # This is the user loader, flask-login uses this to find the correct user to login when login is called.

def load\_user(id):

    return User.query.get(

        int(id)

    )  # This queries the user database by id, then returns the user with that id.

@app.route("/")  # This is the default route that users are taken to.

@login\_required  # This makes it so this page is inaccessible unless a user is logged in with flask-login.

def connect():

    user = User.query.filter\_by(

        username=current\_user.username

    ).first()  # The user database is queried using the current username, then the user with that username is returned to this variable.

    db.session.commit()  # This saves all the pending changes to the SQL database.

    session[

        "username"

    ] = (

        current\_user.username

    )  # The session object is a cookie that stores various data about the user and can be easily accessed by the server. Here, the username is stored in the session cookie.

    return render\_template(

        "index.html", username=user.username

    )  # This sends the client the index html page, with the username. The username is added to the page with jinja.

@app.route(

    "/register"

)  # This is the route that users are taken to to register a new account.

def register():

    return render\_template(

        "register.html"

    )  # This send the user the register html page.

@app.route(

    "/register", methods=["POST"]

)  # This is the registration route, that takes in the username and password from a html form as a POST body.

def register\_post():

    username = request.form.get(

        "username"

    )  # Makes the username from the form into a variable

    password = request.form.get(

        "password"

    )  # Makes the password from the form into a variable

    if re.fullmatch(

        " \*", password

    ):  # This is regex to make sure the password isnt empty. The " \*" means that if the password is made up of any number of spaces, it will be rejected.

        flash(

            "Please enter a password"

        )  # Flash lets you run code in html using jinja, this runs the code on the register.html page and passes the message "please enter a password".

        return redirect("/register")

    elif (

        len(password) < 8

    ):  # This makes sure that the password the user enters is at least 8 characters long.

        flash(

            "Your password has to be at least 8 characters long"

        )  # Flashes the message if the password is less than 8 characters

        return redirect("/register")

    user = User.query.filter\_by(

        username=username

    ).first()  # If all of the password checks are completed, this queries the sql user database to check if a user with that username already exists.

    if (

        user

    ):  # If the query returns a user, this code is run to let the user know the username is taken.

        flash("That Username Is Taken")

        return redirect("/register")

    new\_user = User(

        username=username,

        password=generate\_password\_hash(password, method=("sha256")),

        score=0,

    )  # This creates a new user object, with the entered username and the password encrypted with sha256. It also adds a score to the user and sets it to 0.

    db.session.add(

        new\_user

    )  # This makes a new entry in the user table using the new\_user object to populate it.

    db.session.commit()  # This commits the sql session.

    return redirect(

        "/login"

    )  # Once a user has finished logging in, they are redirected to the login page to login.

@app.route(

    "/login"

)  # This is the route that users are taken to to login, and whenever they access a page that needs to have a user logged in to be accessed.

def login():

    return render\_template("login.html")  # Sends the login page to the user.

@app.route(

    "/login", methods=["POST"]

)  # This is the login route, that takes in the username and password from a html form as a POST body.

def login\_post():

    username = request.form.get(

        "username"

    )  # Makes the username from the form into a variable

    password = request.form.get(

        "password"

    )  # Makes the password from the form into a variable

    user = User.query.filter\_by(

        username=username

    ).first()  # This queries the user table to see if a user with the same username as the one entered exists.

    if not user or not check\_password\_hash(

        user.password, password

    ):  # This checks if the user with the username exists, and if it does it checks the password entered with the one saved in the database using sha256

        flash(

            "Your username/password is incorrect"

        )  # If the login is unsuccessful, this message is flashed onto the screen to let the user know that their username/ password is incorrect.

        return redirect("/login")  # This redirects the user back to the login page.

    session[

        "id"

    ] = (

        user.id

    )  # This saves the user's id in the session cookie for easy access by the server

    login\_user(

        user

    )  # Once everything else is done flask-login logs in the user with the user object from sqlalchemy

    return redirect("/")  # The user is then redirected to the index page.

@app.route(

    "/logout"

)  # When the user presses the logout button or types the address into the address bar, this code is run.

@login\_required  # The user needs to be logged in in order to log out

def logout():

    logout\_user()  # This is a flask-login method to logout the currently logged in user.

    return redirect(

        "/login"

    )  # After the user is logged out, they are taken to the login page.

@socketio.on(

    "drawing"

)  # This runs whenever the server receives a drawing event, which the artist sends every 0.5 seconds.

def handle\_drawing(args):

    for key in sessions:  # This runs through all of the sessions

        if (

            session["username"] in sessions[key].clients

        ):  # If the person who sent the drawing is in the current session this activates

            for i in sessions[

                key

            ].clients:  # This runs through every client in the session

                socketio.emit(

                    "drawreceive", args, room=sids[i]

                )  # This then sends every client in the session the drawing that was sent to the server

        break  # This stops the sessions being iterated once the correct one has been found

@socketio.on("chatsubmit")  # This runs whenever a user sends a chat message

def handle\_chat(message):

    for key in sessions:  # This iterates through all of the sessions

        if (

            session["username"] in sessions[key].clients

        ):  # If the user who sent the message is in the current session, it saves the room key of the current session then breaks the loop so as to not keep iterating through the sessions needlessly

            goodkey = key

            break

    if (

        message.upper() == sessions[goodkey].word.upper()

    ):  # This checks if the message that has been sent is the word that is the current word that is meant to be guessed.

        message = (

            session["username"]

            + " Has Guessed The Word. The Word Was: "

            + sessions[goodkey].word

        )  # If this is the case, a chat message is sent telling the other players who guessed the word and what it was.

        userrow = (

            db.session.query(User).filter\_by(id=session["id"]).first()

        )  # The user table is queried using the user id, then the row corresponding to the current user is returned to the variable.

        userrow.score += 1  # The user's score is incremented by one

        gamerow = (

            db.session.query(Game).filter\_by(game\_code=goodkey).first()

        )  # The game table is queried using the game code, then the row corresponding to the room with that room code is returned to the variable. This will allow the game id to be read from the variable.

        assocrow = (

            db.session.query(LinkingTable)

            .filter\_by(user\_id=session["id"], game\_id=gamerow.game\_id)

            .first()

        )  # This queries the LinkingTable table by the user id and game id, then returns the link between the game and the user to the variable. This lets the user's game score be incremented.

        assocrow.score += 1  # The user's game score is incremented by one

        db.session.commit()  # The changes are then commited to the database

        for i in sessions[

            goodkey

        ].clients:  # This iterates through all the users in the current session

            socketio.emit(

                "chatprint", message, room=sids[i]

            )  # This sends the chat message to every user in the session

        time.sleep(

            3

        )  # The program waits for 3 seconds before starting a new round in order to let everyone realise that the word was guessed, and to let them prepare for a the next round

        if session["username"] in sessions[goodkey].clients:

            new\_round(

                goodkey

            )  # Starts a new round in the room specified by the good key.

    else:

        message = (

            session["username"] + ":" + str(message)

        )  # If the message wasnt a correct guess, the message becomes the user's who sent the message username, followed by a colon then their message.

        for i in sessions[

            goodkey

        ].clients:  # Iterates through all the clients in the current session

            socketio.emit(

                "chatprint", message, room=sids[i]

            )  # Sends the message to all the clients in the current session

@socketio.on(

    "changeword"

)  # This runs whenever a user pressed the new word button, which sends a "changeword" event.

def handle\_word\_change():

    with open("words.json") as f:  # This opens the json file of all the possible words.

        data = json.loads(

            f.read()

        )  # This reads the json file and puts its contents into the data variable

        randomint = random.randint(

            0, 66

        )  # This picks a random number between 0 and 62 (the number of words in the json), which will be used to decide which word to use

        for key in sessions:  # This iterates through all the sessions

            if (

                session["username"] in sessions[key].clients

            ):  # If the user who requested the word change is in the current session, the word becomes a random word chosen from the data variable.

                sessions[key].word = data["words"][randomint]

                break  # This breaks the loop so as to not needlessly iterate through all the sessions

        socketio.emit(

            "wordchanged", sessions[key].word, room=sids[session["username"]]

        )  # This emits the new word to the user who requested it, which upon being received will be displayed at the top of their screen.

class Session:  # This is a session (also known as a room) class, it stores a list of clients, the code for the room, the index of the current drawer, wether the game has started, and the current word.

    def \_\_init\_\_(self, roomcode) -> None:

        self.clients = []

        self.code = roomcode

        self.drawer = 0

        self.started = False

        self.word = "Square"

Technical Implementation Reference 6

@socketio.on(

    "newRound"

)  # This is called whenever a word is guessed or when a game starts

def new\_round(

    room\_code,

):  # The room code decides which room the new round is started in

    current\_room = sessions[

        room\_code

    ]  # This just makes the room code easily accessible with a variable

    if (

        len(sessions[room\_code].clients) == 1

    ):  # If theres only one person in the room, then they become the drawer.

        current\_room.drawer = 0

    else:

        current\_room.drawer += 1  # Increment the drawer index by one.

        current\_room.drawer = current\_room.drawer % len(

            current\_room.clients

        )  # This mods the drawer index with the amount of people in the room, so that the index cycles through each of the clients without going out of range.

        for i in current\_room.clients:

            socketio.emit(

                "refresh", room=sids[i]

            )  # Sends a refresh socket event to each user in the room so that their pages are refreshed and they get the correct gui for their role (drawer/spectator)

@socketio.on("join")  # This runs whenever someone joins a room

def handle\_joining(room\_code):

    if room\_code in sessions:  # If the room already exists, the following code runs

        join\_room(room\_code)  # Adds the user to the socketio room

        gamerow = (

            db.session.query(Game).filter\_by(game\_code=room\_code).first()

        )  # When a user joins a room, the Game table is queried using the room code to find the room row with that room code.

        newassoc = LinkingTable(

            user\_id=session["id"], score=0, game\_id=gamerow.game\_id

        )  # This creates a new entry in the linking table, with the current user id, the current game id and the users score, which is currently 0.

        db.session.add(newassoc)  # This adds the new entry to the database

        db.session.commit()  # This commits the pending changes to the database.

        sessions[room\_code].clients.append(

            session["username"]

        )  # Adds the user to the clients list of the session

        sessions[room\_code].started = True  # Marks the session as started

        sids[

            session["username"]

        ] = (

            request.sid

        )  # This saves the user's session id in the sids dictionary so its easy to find the sid using the username

        socketio.emit(

            "redirect",

            {"url": url\_for(".gameconnect", r\_code=room\_code)},

            room=sids[session["username"]],

        )  # Redirects the user to the url for their current game

    else:

        print(

            "Creating room ", room\_code

        )  # If the room doesnt already exist, it creates a new room

        newgamerow = Game(

            game\_code=room\_code

        )  # This creates a new entry in the Game table with the room code specified by the user.

        db.session.add(newgamerow)  # This adds the new game entry to the database.

        db.session.commit()  # This commits all the pending changes to the database.

        gamerow = (

            db.session.query(Game).filter\_by(game\_code=room\_code).first()

        )  # This queries the game table with the room code to find the game id.

        newassoc = LinkingTable(

            user\_id=session["id"], score=0, game\_id=gamerow.game\_id

        )  # This creates a new entry in the linking table with the game id and user id, as well as a score for the game, which is set to 0.

        db.session.add(newassoc)  # This adds the entry to the database

        db.session.commit()  # This commits all pending changes to the database.

        sessions[room\_code] = Session(

            room\_code

        )  # Create a new session and add it to the sessions dictionary so its easily accessible with its room code

        sessions[room\_code].clients.append(

            session["username"]

        )  # Adds the current user to the new room's clients list

        join\_room(room\_code)  # Adds the user to the socketio room

        sids[

            session["username"]

        ] = (

            request.sid

        )  # This saves the user's session id in the sids dictionary so its easy to find the sid using the username

        socketio.emit(

            "redirect",

            {"url": url\_for(".gameconnect", r\_code=room\_code)},

            room=sids[session["username"]],

        )  # Redirects the user to the url for their current game

@app.route(

    "/game/<r\_code>"

)  # The route for games, <r\_code> makes it so that any room code can be used and it will still lead to this route

@login\_required  # You need to be logged in to be in a game room

def gameconnect(r\_code):

    if (

        session["username"] == sessions[r\_code].clients[sessions[r\_code].drawer]

    ):  # If the client is a drawer in the current game, it sends them the game.html

        return render\_template("game.html")

    else:

        return render\_template(

            "spectate.html"

        )  # If a client is a spectator, it sends them the spectate.html

@socketio.on(

    "syncSID"

)  # Whenever a client emits a syncsid event (Every 30 seconds) this gets run

def handle\_sids():

    sids[

        session["username"]

    ] = (

        request.sid

    )  # This saves the user's session id in the sids dictionary for easy access to their sid

@app.route(

    "/leaderboard"

)  # This is the route that users will visit to see the leaderboards, they dont need to be logged in to view it as its not very important.

def handle\_leaderboards():

    return render\_template("leaderboard.html")

@socketio.on(

    "requestleader"

)  # Whenever a client requests a leaderboard update, this code is run.

def send\_leader():  # This SQL queries the User table, and returns all of the usernames and their corresponding scores, in descending order so that the client doesn't have to sort it. This is an example of thin-client computing.

    table = db.engine.execute(

        """

    SELECT user.username, user.score

    FROM user

    WHERE user.score IS NOT NULL

    ORDER BY user.score DESC

    """

    )

    score = []

    for row in table:  # This iterate through every row returned by the query

        newrow = [

            row[0],

            row[1],

        ]  # This creates an array with each entry of a username along with their scores so that the score array can be emitted on the socket

        score.append(

            newrow

        )  # This adds the newrow array into the score 2d array so that its ready to be sent by the server

    socketio.emit(

        "sendleader", score, room=request.sid

    )  # This emits the score array to the user who requested it.

@app.route("/forum")

@login\_required

def handle\_forum():

    return render\_template("forum.html", username=session["username"])

@app.route("/newpost", methods=("GET", "POST"))

@login\_required

def newpost():

    if request.method == "POST":

        title = request.form["title\_input"]

        content = request.form["content\_input"]

        if not title:

            flash("Please Include A Title")

        elif not content:

            flash("Please Include Content To Your Post")

        else:

            db.engine.execute(

                "INSERT INTO post (post\_title, post\_content, post\_author) VALUES (:post\_title, :post\_content, :post\_author)",

                post\_title=title,

                post\_content=content,

                post\_author=session["id"],

            )

            return redirect("/forum")

    return render\_template("newpost.html")

@socketio.on("requestforumpage")

def send\_forumpage():

    poststuple = db.engine.execute(

        """

    SELECT post.post\_title, post.post\_author, user.username, post.post\_id

    FROM post, user

    WHERE user.id = post.post\_author

    ORDER BY post.post\_id DESC"""

    )

    posts = []

    for i in poststuple:

        posts.append(list(i))

    socketio.emit("sendforumpage", posts, room=request.sid)

"""need to add functionality for deleting, making admin functionality,

adding comments, editing posts etc. """

@app.route("/post/<id>", methods=("GET", "POST"))

@login\_required

def viewpost(id):

    if request.method == "POST":

        comment = request.form["comment\_input"]

        if not comment:

            flash("Please Include A Title")

        else:

            db.engine.execute(

                "INSERT INTO comment (comment\_content, comment\_post, comment\_author) VALUES (:comment\_content, :comment\_post, :comment\_author)",

                comment\_content=comment,

                comment\_post=id,

                comment\_author=session["id"],

            )

            return redirect("/post/" + str(id))

    else:

        post = db.engine.execute(

            """

            SELECT post.post\_title, post.post\_content

            FROM post

            WHERE :post\_id = post.post\_id

            """,

            post\_id=id,

        )

        post = list(post)

        return render\_template("post.html", title=post[0][0], content=post[0][1])

@socketio.on("requestcomm")

def sendcomments(id):

    print("comments requested")

    commentstuple = db.engine.execute(

        """

            SELECT comment.comment\_content, user.username

            FROM comment, user

            WHERE user.id = comment.comment\_author AND comment.comment\_post = :post\_id

            ORDER BY comment.comment\_id DESC

            """,

        post\_id=id,

    )

    commentslist = []

    for i in commentstuple:

        commentslist.append(list(i))

    socketio.emit("sendcomments", commentslist, room=request.sid)

if \_\_name\_\_ == "\_\_main\_\_":

    socketio.run(

        app, debug=True, host="0.0.0.0", port=5000

    )  # This runs the flask server to enable clients to connect to it.

Gameapp.js

const canvas = document.getElementById("drawcanvas");

const socket = io.connect('http://' + document.domain + ':' + location.port); //This creates a socket connection with the flask server

socket.emit("syncSID") //This synchronises the socket id with the server so that the server can contact this user directly.

socket.emit("changeword") //This emits a change word event so that the user can get a word to draw as fast as possible.

const ctx = canvas.getContext("2d");

const todraw = document.getElementById("title");

ctx.canvas.width = 1000;

ctx.canvas.height = 680;

document.getElementById("title").innerHTML = ("Draw: Something"); //Sets the default title to say draw: if the client hasnt yet received a word from the server

const hex = document.getElementById("hex");

const chatinput = document.getElementById("chatinput");

const pos = { x: 0, y: 0 };

function setPosition(e) { //Gets mouse position relative to the canvas position

  const rect = canvas.getBoundingClientRect();

  pos.x = e.clientX - rect.left;

  pos.y = e.clientY - rect.top;

};

document.getElementById("chatinput").addEventListener("keyup", function(event) { //This function lets the user send chat messages by pressing the enter button on their keyboard, without having to pres the send message button with their mouse.

  if (event.key === "Enter") {

    chatsubmit();

  };

});

function chatsubmit() { //This function reads the current text in the chat input field, if its empty the function doesnt run

  if (chatinput.value != ""){

    socket.emit('chatsubmit', chatinput.value); //This emits a chatsubmit socket event, along with the message that the user wrote.

    chatinput.value = ''; //This empties the chat input field.

  }

};

socket.on('chatprint', function(message){ //When a message comes in, create a new list element then populate it with the message received

  const node = document.createElement("li"); //Creates a list element

  const textnode = document.createTextNode(message); //Creates a text node and populates it with the message

  node.appendChild(textnode); //adds the text node to the list element

  document.getElementById("chat").appendChild(node); //Adds the list element to the chat, which is an unordered list.

  document.getElementById("chat").scrollTop = document.getElementById("chat").scrollHeight; //Lets the chat box be scrolled properly whenever a message is added to it

});

function draw(e) { //This is the function used to enable drawing on the canvas by the user.

  if (e.buttons !== 1) return; //If the mouse button isnt pressed, the function doesn't run.

  const color = document.getElementById("hex").value; //This gets the value of the hex input field on the drawing page then sets the brush color to the color corresponding to the hex code.

  ctx.beginPath(); //This begins a brush path at the current mouse position.

  const width = document.getElementById("brush").value; //This gets the value of the width input field then sets the brush width to said value.

  ctx.lineWidth = width;

  ctx.lineCap = "round"; //This makes the brush circular

  ctx.strokeStyle = color;

  ctx.moveTo(pos.x, pos.y); //This moves the context variable to the current mouse position relative to the canvas.

  setPosition(e); //This updates the mouse position relative to the canvas.

  ctx.lineTo(pos.x, pos.y); //This makes a line from the position created by beginPath()

  ctx.stroke(); //This colors in the line created by lineTo()

};

function changeWord() { //This function sends out a changeword socket event, which the server receives, chooses a random word then sends it back to the user with a word changed event

  socket.emit('changeword');

};

socket.on('wordchanged', function(newword){ //This function changes the word that appears on top of the drawer's screen that they have to draw whenever the server sends out a word changed event

  todraw.innerHTML = ("Draw: " + newword)

})

socket.on("refresh", function(){ //This function refreshes the page every time the server sends a refresh message.

  location.reload()

})

colors = { red: '#F00', green: '#0F0', blue: '#00F', yellow: '#FF0', orange: '#F80', purple: '#B0F', lightblue:'#0FF', black: '#000', white: '#FFF' }; //Dictionary of colors used to set the brush color so that a new function doesnt have to be written for each button and its color.

function changecolor(color) { //This function sets the color that the brush will be set to on click of the button given the color of the button.

  hex.value = colors[color];

}

setInterval(function() {   //This function emits a drawing socket message, along with a representation of the current canvas to the server every 0.5 seconds.

  const newUrl = document.getElementById('drawcanvas').toDataURL();

  socket.emit("drawing", newUrl);

}, 250);

setInterval(function() {  //This function emits a syncSID socket message to the server every 30 seconds. This technically isnt 100% necessary as every time a user joins a game or a new round starts, the sids are updated. This is only here as a precaution incase somehow the sids change.

  socket.emit("syncSID");

}, 30000);

document.addEventListener("mouseenter", setPosition); //These event listeners are here so that the drawing works. Every time the cursor enters the area of the canvas, clicks or moves it updates its position.

document.addEventListener("mousedown", setPosition);

document.addEventListener("mousemove", draw);

Game.html

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <link href="/static/drawstyle.css" rel="stylesheet">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1">

    </head>

    <h1 id="title" class="display-1" style="text-align: center; color: #3354AA;"></h1>

    <div class="container" style="width: 100vw; margin: 0; display: fixed;">

        <div class="row" style="width: 100vw; align-content: center;">

            <div class="col" style="margin: 5px; width: 12vw; max-width: 145px; max-height: 240px; flex-direction: column; align-content: center; padding: 12px;">

                <input id="hex" style="font-size: 90%;" class="form-control" placeholder="Brush Colour"></input>

                <input id="brush" style="font-size: 90%;" class="form-control" placeholder="Brush Width" type="number" min="1" max="100"></input>

                <div class="col" style="align-content: center; width: 100%; flex-direction: column; align-items: center; margin-left: 4px;">

                    <button id="red" type="button" onclick="changecolor('red')" class="btn colorButton" style="background-color: #F00; width: 25px;"></button>

                    <button id="green" type="button" onclick="changecolor('green')" class="btn colorButton" style="background-color: #0F0; width: 25px;"></button>

                    <button id="blue" type="button" onclick="changecolor('blue')" class="btn colorButton" style="background-color: #00F; width: 25px;"></button>

                    <button id="yellow" type="button" onclick="changecolor('yellow')" class="btn colorButton" style="background-color: #FF0; width: 25px;"></button>

                    <button id="orange" type="button" onclick="changecolor('orange')" class="btn colorButton" style="background-color: #F80; width: 25px;"></button>

                    <button id="purple" type="button" onclick="changecolor('purple')" class="btn colorButton" style="background-color: #F0F; width: 25px;"></button>

                    <button id="lightblue" type="button" onclick="changecolor('lightblue')" class="btn colorButton" style="background-color: #0FF; width: 25px; height: 25px;"></button>

                    <button id="black" type="button" onclick="changecolor('black')" class="btn colorButton" style="background-color: #000; width: 25px;"></button>

                    <button id="white" type="button" onclick="changecolor('white')" class="btn colorButton" style="background-color: #FFF; width: 25px;"></button>

                </div>

                <button id = "word" type="button" onclick="changeWord()" class="btn" style="background-color: #3354AA; height: 30px; width: 120px; padding: 0;">New Word</button>

            </div>

            <div class="col" style="margin: 0;">

                <canvas id="drawcanvas"></canvas>

            </div>

            <div class="col" style="margin: 5px;">

                <ul id="chat">

                    <li style="text-align: center; font-weight: bold;">Chat Messages Will Appear Here</li>

                </ul>

                <div class="row" style="margin-left: 0px; margin-top: 5px;">

                    <input id ="chatinput" placeholder="Message" type="text" class="form-control" style="background-color: #C4C4C4; color: #000;"></input>

                    <button id="chatsubmit" type="button" onclick="chatsubmit()" class="btn" style="padding: 0; margin: 0; background-color: #3354AA; margin-left: 5px; ">Send</button>

                </div>

            </div>

        </div>

    </div>

    <script src= "/static/gameapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Spectateapp.js

const canvas = document.getElementById("spectatecanvas");

const socket = io.connect('http://' + document.domain + ':' + location.port); //This creates a socket connection with the flask server

const chatinput = document.getElementById("chatinput");

const ctx = canvas.getContext("2d");

ctx.canvas.width = 1000;

ctx.canvas.height = 680;

socket.emit("syncSID") //This synchronises the socket id with the server so that the server can contact this user directly.

document.getElementById("chatinput").addEventListener("keyup", function(event) { //This function lets the user send chat messages by pressing the enter button on their keyboard, without having to pres the send message button with their mouse.

  if (event.key === "Enter") {

    chatsubmit();

  };

});

function chatsubmit() { //This function reads the current text in the chat input field, if its empty the function doesnt run

  if (chatinput.value != ""){

    socket.emit('chatsubmit', chatinput.value); //This emits a chatsubmit socket event, along with the message that the user wrote.

    chatinput.value = ''; //This empties the chat input field.

  }

};

socket.on('chatprint', function(message){ //When a message comes in, create a new list element then populate it with the message received

  const node = document.createElement("li"); //Creates a list element

  const textnode = document.createTextNode(message); //Creates a text node and populates it with the message

  node.appendChild(textnode); //adds the text node to the list element

  document.getElementById("chat").appendChild(node); //Adds the list element to the chat, which is an unordered list.

  document.getElementById("chat").scrollTop = document.getElementById("chat").scrollHeight; //Lets the chat box be scrolled properly whenever a message is added to it

});

socket.on("refresh", function(){ //This function refreshes the page every time the server sends a refresh message.

  location.reload()

});

setInterval(function() { //This function emits a syncSID socket message to the server every 30 seconds. This technically isnt 100% necessary as every time a user joins a game or a new round starts, the sids are updated. This is only here as a precaution incase somehow the sids change.

  socket.emit("syncSID");

}, 30000);

socket.on('drawreceive', function(canvasReceived){ //This function runs whenver the client receives a canvas from the server.

  const receivedImage = new Image(1000,680); //This creates a new Image element with width of 1000 pixels and height 680 pixels.

  receivedImage.src = canvasReceived; //This makes the source of the image element the encoded string received by the client.

  ctx.drawImage(receivedImage, 0, 0); //This draws the received image on the context element of the canvas, the 0,0 means it draws the image starting from the top left corner of the canvas.

});

Spectate.html

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <link href="/static/spectatestyle.css" rel="stylesheet">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1">

    </head>

    <h1 id="title" class="display-1" style="text-align: center; color: #3354AA;">Guess The Word!</h1>

    <div class="container" style="width: 100vw; margin: 0; display: fixed;">

        <div class="row" style="width: 100vw; align-content: center;">

            <div class="col" style="margin: 5px; width: 10vw; max-width: 145px; max-height: 240px; flex-direction: column; align-content: center; padding: 12px;">

            </div>

            <div class="col" style="margin: 0;">

                <canvas id="spectatecanvas"></canvas>

            </div>

            <div class="col" style="margin: 5px;">

                <ul id="chat">

                    <li style="text-align: center; font-weight: bold;">Chat Messages Will Appear Here</li>

                </ul>

                <div class="row" style="margin-left: 0px; margin-top: 5px;">

                    <input id ="chatinput" placeholder="Message" type="text" class="form-control" style="background-color: #C4C4C4; color: #000;"></input>

                    <button id="chatsubmit" type="button" onclick="chatsubmit()" class="btn" style="padding: 0; margin: 0; background-color: #3354AA; margin-left: 5px; ">Send</button>

                </div>

            </div>

        </div>

    </div>

    <script src= "/static/spectateapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Loginapp.js

var socket = io.connect('http://' + document.domain + ':' + location.port);//This creates a socket connection with the flask server

function goToRegister(){ //This function takes the user to the register route when they press the login button

    location.href = "/register";

}

Login.hmtl

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1">

    </head>

    <body style="background-color: #DDD;">

        <div>

            <form action="login" method="POST">

                <div class="container">

                    <div class="d-flex justify-content-center">

                        <div class="row g-2">

                            <div class="col-">

                                <div class="row justify-content-center">

                                    <h1 class="display-1" style="text-align: center; color: #3455AA;">Login</h1>

                                </div>

                                {% with alert = get\_flashed\_messages() %}

                                {% if alert %}

                                    <h3 class="display-20"> {{alert[0]}} </h3>

                                {% endif %}

                                {% endwith %}

                            </div>

                            <div class="col-lg-">

                                <input type="text" name="username" placeholder="Username" class="form-control" style="background-color: #C4C4C4; color: #000;">

                            </div>

                            <div class="col-lg-">

                                <input type="password" name="password" placeholder="Password" class="form-control" style="background-color: #C4C4C4; color: #000;">

                            </div>

                            <div class="col-">

                                <div class="row justify-content-center">

                                    <button class="btn btn-primary" style="width:10vw; background-color: #3354AA;">Login</button>

                                </div>

                            </div>

                        </div>

                    </div>

                </div>

            </form>

            <div style="margin-top: 50px;">

                <div class="col-">

                    <div class="row justify-content-center" style="font-size: 15pt;">

                        Don't Have An Account?

                    </div>

                </div>

                <div class="col-">

                    <div class="row justify-content-center">

                        <button class="btn btn-primary" style="width:10vw; background-color: #3354AA;" onclick="goToRegister() ">Register</button>

                    </div>

                </div>

            </div>

        </div>

    </body>

    <script src= "/static/loginapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Registerapp.js

var socket = io.connect('http://' + document.domain + ':' + location.port); //This creates a socket connection with the flask server

function goToLogin(){ //This function takes the user to the login route when they press the login button.

    location.href = "/login";

}

Register.html

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1">

    </head>

    <body style="background-color: #DDD;">

        <div>

            <form action="register" method="POST">

                <div class="container">

                    <div class="d-flex justify-content-center">

                        <div class="row g-2">

                            <div class="col-">

                                <div class="row justify-content-center">

                                    <h1 class="display-1" style="text-align: center; color: #3455AA;">Register</h1>

                                </div>

                                {% with alert = get\_flashed\_messages() %}

                                {% if alert %}

                                    <h3 class="display-20"> {{alert[0]}} </h3>

                                {% endif %}

                                {% endwith %}

                            </div>

                            <div class="col-lg-">

                                <input type="text" name="username" placeholder="Username" class="form-control" style="background-color: #C4C4C4">

                            </div>

                            <div class="col-lg-">

                                <input type="password" name="password" placeholder="Password" class="form-control" style="background-color:  #C4C4C4;">

                            </div>

                            <div class="col-">

                                <div class="row justify-content-center">

                                    <button class="btn btn-primary" style="width: 10vw; background-color: #3455AA">Register</button>

                                </div>

                            </div>

                        </div>

                    </div>

                </div>

            </form>

            <div style="margin-top: 50px;">

                <div class="col-">

                    <div class="row justify-content-center" style="font-size: 15pt;">

                        Already Have An Account?

                    </div>

                </div>

                <div class="col-">

                    <div class="row justify-content-center">

                        <button class="btn btn-primary" style="width:20%; background-color: #3455AA;" id="goToRegister" onclick="goToLogin()">Login</button>

                    </div>

                </div>

        </div>

    </body>

    <script src= "/static/registerapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Indexapp.js

var socket = io.connect('http://' + document.domain + ':' + location.port); //This creates a socket connection with the flask server

function joinroom(){

    room\_code = document.getElementById("room\_code").value //This function sends a join socket event along with the room code that the user entered to the server

    socket.emit('join', room\_code);

}

document.getElementById("room\_code").addEventListener("keyup", function(event) { //This function allows the user to press enter to join a room, so that they dont have to press the join room button with their mouse every time.

    if (event.key === "Enter") {

        joinroom();

    };

});

function logout(){ //This function takes the user to the logout route when they press the logout button on the page

    location.href = "/logout"

}

function forum(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/forum"

}

socket.on('redirect', function(data) { //This function redirects the user to the address specified by the event, the server will send the request to redirect along with the address to redirect to any time it needs the user to be redirected

    window.location = data.url;

});

function leaderboard(){ //This function takes the user to the leaderboard route when they press the leaderboard button on the page

    location.href = "/leaderboard"

}

Index.html

<!doctype html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1">

    </head>

    <body style="background-color: #DDD;">

        <div class="container">

            <h1 class="display-1" style="margin: 10px; text-align: center; color: #3455AA;">Welcome, {{ username }}</h1>

            <div class="d-flex justify-content-center">

                <div class="col">

                    <div class="row" style="justify-content: center; margin: 10px;">

                        <input id ="room\_code" type="text" placeholder="Room Code" class="form-control" style="width: 30%;">

                        <button id="joinroom" type="button" onclick="joinroom()" class="btn btn-primary" style="background-color: #3455AA; width: 10%;">Join</button>

                    </div>

                    <div class="row" style="justify-content: center; margin: 10px;">

                        <button class="btn btn-primary" id="epic" style="background-color: #3455AA; width: 30%;" type="button" onclick="leaderboard()">Leaderboards</button>

                    </div>

                    <div class="row" style="justify-content: center; margin: 10px;">

                        <button id="forum" type="button" onclick="forum()" class=" btn btn-primary" style="background-color: #3455AA; width: 30%;">Forums</button>

                    </div>

                    <div class="row" style="justify-content: center; margin: 10px;">

                        <button id="logout" type="button" onclick="logout()" class=" btn btn-primary" style="background-color: #3455AA; width: 30%;">Logout</button>

                    </div>

                </div>

            </div>

        </div>

    </body>

    <script src= "/static/indexapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Leaderboard.html

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <link href="/static/leaderstyle.css" rel="stylesheet">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1">

    </head>

    <body style="background-color: #DDD;">

        <div class = "container" style="align-content: center;">

            <h1 style="text-align: center; color: #3354AA;" class="display-1">Leaderboard</h1>

        </div>

        <div id="leaderboard" class="container" style="align-content: center; background-color: #C4C4C4; width: 60%;">

            <div id="title" class="row epicclassno1">

                <div id="nametitle" class="title epicclassno2 table" style="font-family: var(--bs-body-font-family);">Name</div>

                <div id="scoretitle" class="title epicclassno2 table">Score</div>

            </div>

        </div>

        <div class="centerdiv">

            <button id="update" type="button" onclick="updateLeaderboard()" style="background-color: #3354AA; color: #FFF; font-family: var(--bs-body-font-family); margin: 10px;" class="btn">Refresh Leaderboard</button>

        </div>

        <div class="centerdiv">

            <button id="update" type="button" onclick="goBack()" style="background-color: #3354AA; color: #FFF; font-family: var(--bs-body-font-family);" class="btn">Back To Home</button>

        </div>

        <script src= "/static/leaderapp.js"></script>

        <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

    </body>

</html>

Leaderapp.js

const socket = io.connect('http://' + document.domain + ':' + location.port); //This creates a socket connection with the flask server

socket.on('sendleader', function(scores) { //This function runs whenever the client receives a sendleader event from the server, along with the scores the server sends.

    let leaderboard = document.getElementById("leaderboard"); //This gets the leaderboard div element and puts it into a variable so it's easily accessible

    leaderboard.innerHTML = `<div id="title" class="row epicclassno1">

    <div id="nametitle" class="title epicclassno2 table">Name</div>

    <div id="scoretitle" class="title epicclassno2 table">Score</div>

</div>`; //This html creates a div element which functions as a row in the table, then creates the Name div and Score div inside the row, which both function as titles for the leaderboard columns.

    for(let i=0; i < scores.length; i++) { //This for loop iterates through the received scores until it reaches the last one.

        let name = document.createElement("div"); //This creates a div element that will be used to store the name from the currently iterated row.

        let score = document.createElement("div"); //This creates a div element that will be used to store the score from the currently iterated row.

        name.classList.add("name", "epicclassno2"); //This adds the name and epicclassno2 classes to the div that will hold the username.

        score.classList.add("score", "epicclassno2"); //This adds the score and epicclassno2 classes to the div that will hold the score.

        name.innerText = scores[i][1]; //This takes the username from the currently iterated row in the received scores then puts it into the name div

        score.innerText = scores[i][0]; //This takes the score from the currently iterated row in the received scores then puts it into the score div.

        let scoreRow = document.createElement("div"); //This creates a div that will contain the name div and score div, it will function as a row for the table.

        scoreRow.classList.add("row","epicclassno1"); //This adds the row and epicclassno1 classes to the scoreRow div. This makes it so the row is properly centered

        scoreRow.appendChild(score); //This puts the score div into the scoreRow div

        scoreRow.appendChild(name); //This puts the name div into the scoreRow div

        leaderboard.appendChild(scoreRow); //This puts the scoreRow div into the leaderboard div, which makes it display on the user's screen.

    };

});

function updateLeaderboard(){ //This function is run to request an updated leaderboard from the server.

    socket.emit("requestleader");

};

function goBack(){ //This function takes the user to the index route when they press the leaderboard button on the page

    location.href = "/"

}

updateLeaderboard() //This is called to request an updated leaderboard from the server. Without this the user would manually have to press the update leaderboard button to get a leaderboard.

Forumapp.js

var socket = io.connect('http://' + document.domain + ':' + location.port); //This creates a socket connection with the flask server

function requestforum(){

    socket.emit("requestforumpage")

}

function new\_post(){

    location.href = "/newpost"

}

function game(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/"

}

function leaderboard(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/leaderboard"

}

function logout(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/logout"

}

socket.on('redirect', function(data) { //This function redirects the user to the address specified by the event, the server will send the request to redirect along with the address to redirect to any time it needs the user to be redirected

    window.location = data.url;

});

socket.on('sendforumpage', function(posts) {

    let table = document.getElementById("tablebody");

    for(let i=0; i < posts.length; i++) {

        let title = document.createElement("a");

        title.href = "/post/" + posts[i][3];

        let author = document.createElement("p");

        title.innerText = posts[i][0];

        author.innerText = posts[i][2];

        titleheading = document.createElement("h3");

        titleheading.classList.add("display-6");

        titleheading.appendChild(title);

        let titlecell = document.createElement("td");

        titlecell.appendChild(titleheading);

        let authorcell = document.createElement("td");

        authorcell.appendChild(author);

        let tablerow = document.createElement("tr");

        tablerow.appendChild(titlecell);

        tablerow.appendChild(authorcell);

        table.appendChild(tablerow);

    };

});

Forum.html

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <link href="/static/forumstyle.css" rel="stylesheet">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

    </head>

    <body onload="requestforum()">

        <nav class="navbar">

            <div class="col">

                <h1 class="display-6" style="margin-left: 3vw;">Paint + Guess Forum</h1>

            </div>

            <div class="col" style="display: flex; justify-content: flex-end; gap: 1vw;">

                <button class="btn btn-primary" onclick="game()">Game</button>

                <button class="btn btn-primary" onclick="leaderboard()">Leaderboards</button>

                <button class="btn btn-primary" onclick="logout()" style="margin-right: 3vw;">Logout</button>

            </div>

        </nav>

        <div class="container my-2">

            <div class="row">

                <div class="col-8 col-xl-9">

                    <h2 class="rounded-top p-4" style="background-color: #DDD;">Posts</h2>

                    <table class="table table-responsive table-bordered table-striped">

                        <thead class="thead">

                            <tr>

                                <th scope="col">Post Title</th>

                                <th scope="col">Author</th>

                            </tr>

                        </thead>

                        <tbody class="tbody" id="tablebody">

                        </tbody>

                    </table>

                </div>

                <div class="col-5 col-xl-3">

                    <aside>

                        <div class="row">

                            <div class="col-12 col-sm-6 col-xl-12" style="min-width: 256px";>

                                <div class="card mb-1 mb-sm-0 mb-xl-2">

                                    <div class="card-body">

                                        <h2 class="card-title">Rules</h2>

                                        <ul class="list mb-2">

                                            <li>Be respectful</li>

                                            <li>Use descriptive post titles</li>

                                            <li>Racism will not be tolerated</li>

                                            <li>Keep discussion related to the post</li>

                                        </ul>

                                        <button class="btn btn-primary m" onclick="new\_post()">Make New Post</button>

                                    </div>

                                </div>

                            </div>

                        </div>

                    </aside>

                </div>

            </div>

        </div>

    </body>

    <script src= "/static/forumapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Newpostapp.js

function game(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/"

}

function leaderboard(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/leaderboard"

}

function logout(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/logout"

}

Newpost.html

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <link href="/static/newpoststyle.css" rel="stylesheet">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

    </head>

    <body>

        <nav class="navbar">

            <div class="col">

                <h1 class="display-6" style="margin-left: 3vw;">Paint + Guess Forum</h1>

            </div>

            <div class="col" style="display: flex; justify-content: flex-end; gap: 1vw;">

                <button class="btn btn-primary" onclick="game()">Game</button>

                <button class="btn btn-primary" onclick="leaderboard()">Leaderboards</button>

                <button class="btn btn-primary" onclick="logout()" style="margin-right: 3vw;">Logout</button>

            </div>

        </nav>

        <div class="container my-2">

            <div class="row">

                <div class="col-8 col-xl-9">

                    <form method="post">

                        <div class="row mb-2" >

                            <input class="form-control" type="text" placeholder="Post Title" name="title\_input" id="title\_input" value="{{ request.form['title\_input'] }}">

                        </div>

                        <div class="row">

                            <textarea class="form-control" placeholder="Content" rows="20" name="content\_input" id="content\_input">{{ request.form['content\_input'] }}</textarea>

                        </div>

                        <div class="row my-2">

                            <button class="btn btn-primary" style="background-color: #3354AA;" type="submit">Submit</button>

                        </div>

                    </form>

                </div>

                <div class="col-5 col-xl-3">

                    <aside>

                        <div class="row">

                            <div class="col-12 col-sm-6 col-xl-12" style="min-width: 256px";>

                                <div class="card mb-1 mb-sm-0 mb-xl-2">

                                    <div class="card-body">

                                        <h2 class="card-title">Please remember the forum rules when posting</h2>

                                        <ul class="list mb-2">

                                            <li>Be respectful</li>

                                            <li>Use descriptive post titles</li>

                                            <li>Racism will not be tolerated</li>

                                            <li>Keep discussion related to the post</li>

                                        </ul>

                                    </div>

                                </div>

                            </div>

                        </div>

                    </aside>

                </div>

            </div>

        </div>

    </body>

    <script src= "/static/newpostapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Postapp.js

var socket = io.connect('http://' + document.domain + ':' + location.port); //This creates a socket connection with the flask server

function new\_post(){

    location.href = "/newpost"

}

function game(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/"

}

function leaderboard(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/leaderboard"

}

function logout(){ //This function takes the user to the forum route when they press the forum button on the page

    location.href = "/logout"

}

function requestcomments(){

    let postno = (window.location.href.charAt(window.location.href.length -1))

    console.log(postno)

    socket.emit("requestcomm", postno)

}

socket.on("sendcomments", function(commentslist) {

    let table = document.getElementById("commentstable");

    for(let i=0; i < commentslist.length; i++) {

        let comment = document.createElement("p");

        let author = document.createElement("p");

        comment.innerText = commentslist[i][0];

        author.innerText = commentslist[i][1];

        let commentcell = document.createElement("td");

        commentcell.appendChild(comment);

        let authorcell = document.createElement("td");

        authorcell.appendChild(author);

        let tablerow = document.createElement("tr");

        tablerow.appendChild(commentcell);

        tablerow.appendChild(authorcell);

        table.appendChild(tablerow);

    };

});

Post.html

<!DOCTYPE html>

<html lang="en">

    <head>

        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3" crossorigin="anonymous">

        <script src="https://cdn.socket.io/4.1.2/socket.io.min.js" integrity="sha384-toS6mmwu70G0fw54EGlWWeA4z3dyJ+dlXBtSURSKN4vyRFOcxd3Bzjj/AoOwY+Rg" crossorigin="anonymous"></script>

        <script src="https://code.jquery.com/jquery-3.6.0.min.js" integrity="sha256-/xUj+3OJU5yExlq6GSYGSHk7tPXikynS7ogEvDej/m4=" crossorigin="anonymous"></script>

        <meta charset="utf-8">

        <link href="/static/poststyle.css" rel="stylesheet">

        <title>

            Paint + Guess

        </title>

        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

    </head>

    <body onload="requestcomments()">

        <nav class="navbar">

            <div class="col">

                <h1 class="display-6" style="margin-left: 3vw;">Paint + Guess Forum</h1>

            </div>

            <div class="col" style="display: flex; justify-content: flex-end; gap: 1vw;">

                <button class="btn btn-primary" onclick="game()">Game</button>

                <button class="btn btn-primary" onclick="leaderboard()">Leaderboards</button>

                <button class="btn btn-primary" onclick="logout()" style="margin-right: 3vw;">Logout</button>

            </div>

        </nav>

        <div class="container my-2">

            <div class="row">

                <div class="col-8 col-xl-9">

                    <h2 class="rounded-top p-4 mb-0" style="background-color: #999;">{{ title }}</h2>

                    <p class="rounded-bottom p-4" style="background-color: #ddd;">{{ content }}</p>

                    <form method="post">

                        <div class="row mb-2" style="margin: auto;">

                            <input class="form-control" type="text" placeholder="Add your Comment" name="comment\_input" id="comment\_input" value="{{ request.form['comment\_input'] }}">

                        </div>

                        <div class="row my-2" style="margin: auto; justify-content: center;">

                            <button style="width: 33%" class="btn btn-primary" style="background-color: #3354AA;" type="submit">Submit</button>

                        </div>

                    </form>

                    <table class="table table-responsive" id="commentstable">

                        <thead class="thead">

                            <tr>

                                <th scope="col">Comment</th>

                                <th scope="col">Author</th>

                            </tr>

                        </thead>

                    </table>

                </div>

                <div class="col-5 col-xl-3">

                    <aside>

                        <div class="row">

                            <div class="col-12 col-sm-6 col-xl-12" style="min-width: 256px";>

                                <div class="card mb-1 mb-sm-0 mb-xl-2">

                                    <div class="card-body">

                                        <h2 class="card-title">Rules</h2>

                                        <ul class="list mb-2">

                                            <li>Be respectful</li>

                                            <li>Use descriptive post titles</li>

                                            <li>Racism will not be tolerated</li>

                                            <li>Keep discussion related to the post</li>

                                        </ul>

                                        <button class="btn btn-primary m" onclick="new\_post()">Make New Post</button>

                                    </div>

                                </div>

                            </div>

                        </div>

                    </aside>

                </div>

            </div>

        </div>

    </body>

    <script src= "/static/postapp.js"></script>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/js/bootstrap.bundle.min.js" integrity="sha384-ka7Sk0Gln4gmtz2MlQnikT1wXgYsOg+OMhuP+IlRH9sENBO0LRn5q+8nbTov4+1p" crossorigin="anonymous"></script>

</html>

Spectatestyle.css

body {

    background-color: #DDD;

}

#spectatecanvas {

    display:block;

    width: 1000px;

    height: 680px;

    background-color: white;

}

#chatinput {

    width: 205px;

}

#chat {

    width: 300px;

    height: 600px;

    list-style: none;

    background-color: #C4C4C4;

    text-align: left;

    overflow-wrap: break-word;

    overflow-y: auto;

    margin: 0;

    padding: 5px;

}

#chatsubmit {

    background-color: #C4C4C4;

    color: black;

    width: 90px;

    height: 38px;

}

#title {

    display: block;

    font-size: 23pt;

    font-weight: bolder;

    font-family: 'Segoe UI', Tahoma, Geneva, Verdana, sans-serif;

}

Leaderstyle.css

.epicclassno1 {

    flex-wrap: nowrap;

    left: 5px;

    display: flex;

    align-items: center;

    justify-content: center;

    margin: auto;

}

.epicclassno2 {

    width: 30vw;

    display: flex;

    align-items: center;

    justify-content: center;

}

.title {

    font-size: large;

    font-family: Verdana, Geneva, Tahoma, sans-serif;

    font-weight: bold;

}

.centerdiv {

    display: flex;

    align-items: center;

    justify-content: center;

}

.table {

    border-color: black;

    border-width: 1px;

}

Drawstyle.css

#hex {

    width: 120px;

}

#brush {

    width: 120px;

}

body {

    background-color: #DDD;

}

#drawcanvas {

    display:block;

    width: 1000px;

    height: 680px;

    background-color: white;

}

#title {

    display: block;

    font-size: 23pt;

    font-weight: bolder;

    font-family: 'Segoe UI', Tahoma, Geneva, Verdana, sans-serif;

}

#chatinput {

    width: 205px;

}

#chat {

    width: 300px;

    height: 600px;

    list-style: none;

    background-color: #C4C4C4;

    text-align: left;

    overflow-wrap: break-word;

    overflow-y: auto;

    margin: 0;

    padding: 5px;

}

#chatsubmit {

    background-color: #C4C4C4;

    color: black;

    width: 90px;

    height: 38px;

}

#word {

    color: black;

}

.colorButton {

    height: 25px;

    width: 20px;

    margin: 4px;

  }

Newpoststyle.css

.navbar {

    background-color: #3354AA;

}

Poststyle.css

.navbar {

    background-color: #3354AA;

}

Words.json

{

  "words": [

    "House",

    "Phil Collins",

    "Skateboard",

    "Craig David",

    "Charlie Chaplin",

    "Balloon",

    "Armour",

    "Catholicism",

    "Chihuahua",

    "Christianity",

    "Easter",

    "Frenchman",

    "Pharaoh",

    "Rodeo",

    "Sister",

    "Brother",

    "Phone",

    "Bingo",

    "Peat Bog",

    "Afro",

    "Rotary Engine",

    "Felix Wankle",

    "Nissan Silvia S13 (1989)",

    "Cheese",

    "Fart",

    "Instagram",

    "Thumb",

    "Music",

    "Piano",

    "Rock And Roll",

    "Guitar",

    "Oasis",

    "Bow",

    "Tie",

    "Eyeball",

    "Ice Cream",

    "Prapor",

    "Angle",

    "Angel",

    "Camera",

    "Pizza",

    "Brain",

    "Magnet",

    "Snowflake",

    "Attic",

    "Mr Potato Head",

    "Pirate",

    "Zombie",

    "Stork",

    "Koala",

    "Solar Eclipse",

    "Cinema",

    "Drive Thru",

    "McDonalds",

    "Swimming",

    "Chandelier",

    "Google",

    "Hockey Stick",

    "Wireless Fidelity",

    "Playground",

    "Mechanic",

    "Cruise Ship",

    "Apple",

    "Computer",

    "Television",

    "Eric Andre",

    "Android"

  ]

}

Game Table SQL

CREATE TABLE "game" (

Technical Implementation Reference 1

"game\_id" INTEGER NOT NULL,

"game\_code" VARCHAR,

UNIQUE("game\_id"),

PRIMARY KEY("game\_id")

);

User Table SQL

CREATE TABLE "user" (

Technical Implementation Reference 2

"id" INTEGER NOT NULL,

"username" VARCHAR(14),

"password" VARCHAR(100),

"score" INTEGER,

PRIMARY KEY("id")

);

Link Table SQL

CREATE TABLE "link" (

"link\_id" INTEGER NOT NULL,

Technical Implementation Reference 3

"game\_id" INTEGER,

"user\_id" INTEGER,

"score" INTEGER,

FOREIGN KEY("user\_id") REFERENCES "user"("id"),

FOREIGN KEY("game\_id") REFERENCES "game"("game\_id"),

PRIMARY KEY("link\_id"),

UNIQUE("link\_id")

);

Comment Table SQL

CREATE TABLE "comment" (

"comment\_id" INTEGER NOT NULL,

Technical Implementation Reference 4

"comment\_content" TEXT NOT NULL,

"comment\_post" INTEGER NOT NULL,

"comment\_author" INTEGER NOT NULL,

FOREIGN KEY("comment\_post") REFERENCES "post"("post\_id") ON UPDATE CASCADE ON DELETE CASCADE,

FOREIGN KEY("comment\_author") REFERENCES "user"("id") ON UPDATE CASCADE ON DELETE RESTRICT,

PRIMARY KEY("comment\_id" AUTOINCREMENT)

);

Post Table SQL

CREATE TABLE "post" (

"post\_id" INTEGER NOT NULL,

Technical Implementation Reference 5

"post\_title" TEXT NOT NULL,

"post\_content" TEXT NOT NULL,

"post\_author" INTEGER NOT NULL,

PRIMARY KEY("post\_id" AUTOINCREMENT),

FOREIGN KEY("post\_author") REFERENCES "user"("id") ON UPDATE CASCADE ON DELETE RESTRICT

);

**Testing**

**Group Testing**

Multiple games were hosted in a group of people representative of the target audience in order to gather feedback on the game and to find bugs, the following are the testing sessions and the feedback gathered from them.

|  |  |  |
| --- | --- | --- |
| **Test Date** | **Feedback** | **Action** |
| 27/01/2022 | “The website is hard to navigate” | Added buttons to the login, register and join game pages to navigate to other pages. |
| 27/01/2022 | “The game is very confusing as to who is drawing, who guessed the word, etc” | Added a period after someone guesses the word where chat displays who guessed the word before switching artists. |
| 27/01/2022 | “The spacing on the game page looks bad” | Amended the margins of the different elements on the game pages to make them look better |
| 27/01/2022 | “You can register with an empty password” | Implemented regex for password isn’t empty or lots of spaces |
| 27/01/2022 | “You cannot send chat messages by pressing the enter button” | Added functionality that lets users send messages by pressing enter. |
| 31/01/2022 | “When there are multiple games running, one game can influence another” | The bug was fixed, now actions in one room don’t affect a different room. |
| 31/01/2022 | “You can’t do SQL injection on the register page” | This is a good thing, and therefore there was no change made to this. |
| 31/01/2022 | “There aren’t very many words” | Added a larger number of words. |
| 07/03/2022 | “Truly excellent, flawlessly implemented” | Thanked the play tester for their time |
| 07/03/2022 | “The drawings have a lot of latency before appearing on the other user’s screens.” | Reduced the time between the drawer’s client sending the canvas to the other players |
| 07/03/2022 | “The colour picker buttons don’t look very good” | Replaced the placeholder buttons with better looking bootstrap buttons and removed the text from them, leaving just the colour. Also arranged them into a grid. |

**Manual Testing**

Test 1 – Registration

Test Objective: Check whether a user can create an account

Starting conditions: Visit registration page

Test input: “testinguser” into username field, “testingpass” into password field, click submit button

Expected Output: A new user is registered, user is taken to login page

Graphical user interface, application, Teams

Description automatically generated

[Figure 18] Username and password input into the registration page

Graphical user interface, application

Description automatically generated

[Figure 19] User is taken to the login page

Table

Description automatically generated

[Figure 20] New user created in database

Graphical user interface, application

Description automatically generated

[Figure 21] The user has successfully been logged in

Test 2 – Logging In

Test Objective: Check whether a user can log in

Starting conditions: A user has an account, user is on the login page

Test Input: “testinguser” into username field, “testingpass” into password field, then the login button is pressed

Expected Output: The user is logged in and taken to the index page

Graphical user interface, application, website, Teams

Description automatically generated

[Figure 22] Entering login details into the form

Graphical user interface

Description automatically generated

[Figure 23] User is logged in and taken to the index page

Test 3 – Joining A Room

Test Objective: Check whether users can join rooms using a room code

Starting conditions: The user is on the logged in on the index page

Test Input: “testroom” into the room code box, then clicking the join button

Expected Output: The User is taken to the drawing page in a room

Graphical user interface

Description automatically generated

[Figure 24] Entering “testroom” into the roomcode box

Graphical user interface, text, application

Description automatically generated

[Figure 25] The room has been successfully joined

Test 4 – Drawing

Test Objective: Check whether users can use the canvas and brush buttons to draw

Starting Conditions: The user has logged in and joined a room

Test Input: Use the colour and width selectors and clicked and dragged mouse on canvas to draw a human face with a moustache

Expected Output: The face appears on the user’s canvas

Graphical user interface, application, Teams

Description automatically generated

[Figure 26] The face has successfully been displayed on the user’s canvas

Test 5 – Chatting

Test Objective: Check whether users can use the chat to send messages

Starting Conditions: The user has logged in and joined a room

Test Input: Input “test message into the chat box then press the send button

Expected Output: “test message” is displayed in the chat along with the username of the logged in user, “passwordwadw32aaaw adaawawawdwwaadww wd a32 d dw adw aw ” and the chat box is cleared

Graphical user interface, application, Word

Description automatically generated

[Figure 27] Inputting “test message” into the chat box

Graphical user interface, application, Word

Description automatically generated

[Figure 28] After pressing send, the chat box is cleared and the message is successfully displayed in the chat along with the username

Test 6 – Spectating

Test Objective: Check whether users can see the drawings of the drawer in their room

Starting Conditions: The drawer is logged in, has joined a room and has drawn something. The spectator is logged in on a separate client and has joined the same room

Test Input: Drawing on the drawer’s canvas

Expected Output: The drawing shows up on the spectator’s screen

Graphical user interface, text, application

Description automatically generatedGraphical user interface, application, Teams

Description automatically generated[Figure 29] The drawer’s screen, with a drawing on the canvas

[Figure 30] The spectator’s screen. The drawing has successfully showed up.

Test 7 – Using Chat To Guess

Test Objective: Check whether users can type the current word of a room in the chat to guess what they think is being drawn and whether this triggers the game to start a new round

Starting Conditions: The drawer has logged in, joined a room and drew the word they have been assigned. The spectator has logged in and joined the same room.

Test Input: “ice cream” into the spectator’s chat box then clicking the send button

Expected Output: Chat displays that the spectator (“testinguser”) has guessed the word, what the word was (“ice cream”) and the drawer is then switched to a spectator and the spectator is switched to a drawer

Chart, funnel chart

Description automatically generated

[Figure 31] The drawer’s screen. The word to draw is “ice cream” and the drawer has drawn their picture

Chart, funnel chart

Description automatically generated

[Figure 32] The spectator has entered their guess into the chat box

Chart, funnel chart

Description automatically generated

[Figure 33] The spectator pressed the send button, the chat on the drawer’s screen now says that testinguser has guessed the word

Graphical user interface, application, Word

Description automatically generated

[Figure 34] The previous spectator is now the drawer and is being displayed the drawing screen

Graphical user interface, application, Word

Description automatically generated

[Figure 35] The previous drawer is now the spectator and is being shown the spectating screen

Test 8 – Multiple Games Being Played In Parallel

Test Objective: Check whether multiple games can be played at the same time without having an effect on any other rooms

Starting Conditions: 3 users have logged in. User 1 and 2 have joined one room and the user 3 has joined a separate room.

Test Input: User 1 draws their word on their canvas and sends a message in chat saying that they are in room 1. The user 2 sends a message in chat saying that they are in room 1. User 3 draws their word on their canvas and sends a message in chat saying they’re in room 2.

Expected Output: User 1 and user 2 can both see the same drawing on their screens, and can both see each other’s messages in the chat. User 3 can see their own drawing on their canvas and their own message in chat. User 1 and user 2 cannot see user 3’s drawing or message, and user 3 cannot see user 1’s or 2’s drawing or messages.

A picture containing graphical user interface

Description automatically generated

[Figure 36] User 1 has drawn a solar eclipse and sent a message saying they are in room 1. They can see their own drawing, their own message as well as user 2’s message. They cannot see user 3’s drawing or message.

A picture containing graphical user interface

Description automatically generated

[Figure 37] User 2 has sent a message saying they are in room 1. They can see User 1’s drawing and message, as well as their own message. They cannot see user 3’s message or drawing.

Icon

Description automatically generated

[Figure 38] User 3 has drawn a picture of a stick figure swimming and sent a message in chat saying they are in room 2. They can see their own drawing and message, however they cannot see the messages or drawing of users 1 and 2.

Test 9: Leaderboard

Test Objective: Check whether users can navigate to the leaderboard page and if the scores and usernames are displayed correctly

Starting Conditions: A user has logged in and is at the index page

Test Input: The user clicks the leaderboard button

Expected Output: The user is taken to the leaderboard page, where they are met with a list of usernames ordered in descending order by their scores.

Text

Description automatically generated with medium confidence

[Figure 39] Upon clicking the leaderboard button, the user is successfully taken to the leaderboard page and all scores are displayed properly.

Test 10 – Main Forum Page

Test Objective: Check whether the user can navigate to the forum page and whether the forum posts are being fetched correctly

Starting Conditions: The user has logged in and is on the index page

Test Input: Clicking the forum button

Expected Output: The user is redirected to the forum page, where they can see a list of all forum posts and their authors

Graphical user interface, application

Description automatically generated

[Figure 40] The user can see the forum page, and all of the posts are shown correctly

Test 11 – Making New Posts

Test Objective: Check whether users can create posts and if they are saved

Starting Conditions: The user has logged in and navigated to the forum page

Test Input: Press the “make new post” button, then input a post title and post content, then click the submit button

Expected Output: The user is taken back to the forum page, and their new post is now visible in the listGraphical user interface, application, Word

Description automatically generated

[Figure 41] The user was taken to the new post page, and has filled out the title and content of the post.

Graphical user interface, application

Description automatically generated

[Figure 42] After pressing the submit button, the user was taken back to the forum page and their post is now visible in the list.

Test 12 - Reading Posts

Test Objectives: Check whether users can view the contents of a post and whether the comments are fetched properly from the database

Starting Conditions: The user has signed in, navigated to the forum page and made at least one forum post

Test Input: Click on the title of one of the posts in the list

Expected Output: The user is taken to a dedicated page for the post, where the title of the post is displayed along with the contents of the post. The comments to the post and the authors of the comments are also displayed

Graphical user interface, application

Description automatically generated

[Figure 43] After clicking the “nea is stupid” post, the user was redirected to the post and the title, contents and comments are displayed correctly

Test 13 – Posting Comments

Test Objectives: Check whether users can make comments on posts and whether they are saved properly

Starting Conditions: The user has logged in and navigated to the page of a specific post

Test Input: “I like this post, it is very good” in the “add your comment” box, then click submit button

Expected Output: The new comment appears in the comments list along with the username of the current user, the input box is cleared

Graphical user interface, application

Description automatically generated

[Figure 44] The user has input their comment into the input box

Graphical user interface, application

Description automatically generated

[Figure 45] After pressing submit, the input box was cleared and the comment appeared in the comment section with the username

**Testing Conclusion**

|  |  |
| --- | --- |
| Test Name | Test Status |
| 1 - Registration | Success |
| 2 – Logging In | Success |
| 3 – Joining a room | Success |
| 4 – Drawing | Success |
| 5 – Chatting | Success |
| 6 – Spectating | Success |
| 7 – Using Chat To Guess | Success |
| 8 – Multiple Games Being Played In Parallel | Success |
| 9 – Main Forum Page | Success |
| 10 – Making New Posts | Success |
| 12 – Reading Posts | Success |
| 13 – Posting Comments | Success |

**Evaluation**

Overall, the project was a success. All of the objectives have been achieved to a good standard, as well as a few little things that could not have been a good objective on their own. The project could be improved on, however. A major way this could be done is through more statistics being added to the game. For example, how many games the user has played, or average score per game. These could be displayed to the user given the information currently stored in the database, however they were not added due to time constraints. Another feature that could be added given more time is chat filtering. This could be either done simply but in a limited way through a list of disallowed words that aren’t allowed in the chat, however depending on the way this is implemented it could prove ineffective as users could find ways around it. A better, though harder to implement way to filter the chat would be through an algorithm that can recognize words even if the user tries to obscure them through putting spaces into the words or other means. It could also be beneficial to add an algorithm that would check the similarity of some words to words that would need to be filtered out, but this could come with the side effect of filtering out words that shouldn’t be filtered.