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Sketch Rush: A Real-Time Digital Pictionary Experience

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Abstract- — In an era dominated by digital communication, traditional social games that rely on physical presence and non-verbal interaction face the risk of obsolescence. Games like Pictionary, which thrive on creativity, quick thinking, and shared laughter, are often difficult to replicate in a virtual environment without losing their core essence. To address this, we present Sketch Rush: A Real- Time Digital Pictionary Experience, a web-based multiplayer game that faithfully recreates the excitement and social dynamics of the classic drawing and guessing game. Sketch Rush leverages modern web technologies to provide a seamless, interactive platform where players can connect, create, and compete in real-time. Sketch Rush is designed not merely as a digital adaptation but as an enhanced, accessible version of the original game. It addresses the limitations of physical Pictionary—such as the need for physical drawing tools, proximity of players, and manual scorekeeping—by automating these processes within an intuitive digital interface. The system comprises two primary modules: a real-time drawing canvas with a rich set of tools for the "Artist," and a dynamic chat interface for the "Guessers." The core game logic, powered by a Node.js backend and WebSocket communication, ensures low-latency synchronization of drawings, guesses, and game states across all connected clients. Preliminary user testing with a cohort of 40 participants has shown that Sketch Rush successfully captures the engaging and collaborative spirit of the original game. Feedback highlighted the platform's intuitive interface, the responsiveness of the real-time features, and its effectiveness in fostering social connection, even among geographically dispersed players. Users reported a high degree of satisfaction, with average System Usability Scale (SUS) scores of 85.6, indicating excellent usability. In essence, Sketch Rush reimagines a beloved social game for the digital age. It transcends the limitations of physical location, offering a platform that is not only functional but also fun, engaging, and socially enriching. By combining intuitive design with robust real-time technology, Sketch Rush provides a compelling case for the successful digital transformation of traditional social experiences.

Keywords— Key concepts include digital transformation of social games, inspired by classics like Pictionary, and the development of real-time multiplayer web applications. Core elements are interactive drawing canvas, live chat-based guessing, and low-latency synchronization enabled by technologies such as Node.js and WebSocket. The project emphasizes user experience (UX), accessibility, and automation of gameplay mechanics like scoring and turn management. Additional themes include social connectivity, collaborative gameplay, usability evaluation (e.g., SUS scores), and enhancing traditional games for remote, digital environments.

I. INTRODUCTION

The 21st century has redefined social interaction, with digital platforms becoming the primary medium for connecting with friends, family, and peers. While this shift offers unprecedented convenience and connectivity, it often lacks the spontaneity, creativity, and shared physical presence that define traditional social activities. Games, as a cornerstone of human interaction, have been profoundly impacted by this transformation. While many competitive video games have successfully transitioned to the digital realm, social party games that rely on simple tools, creativity, and non-verbal communication have faced challenges in replicating their analog charm. Sketch Rush: A Real-Time Digital Pictionary Experience is conceived to bridge this gap. The project aims to digitally re-create the classic game of Pictionary, a game celebrated for its ability to blend artistic skill, quick thinking, and collaborative guessing into a fun, social activity. The central challenge lies in translating the physical act of drawing and the immediate, vocal feedback of a group setting into a cohesive digital experience without compromising the game's inherent fun and fluidity.

At the intersection of web development, real-time communication, and user experience design, Sketch Rush leverages technologies such as HTML5 Canvas, WebSockets, and Node.js to create a synchronized multiplayer environment. The system enables one player to act as the "Artist," drawing a randomly selected word on a digital canvas, while other players in the room act as "Guessers," typing their guesses into a shared chat. The first to guess the word correctly scores points, and the game proceeds to the next round, rotating the role of the artist. This paper explores the conceptual framework, system architecture, and implementation strategies behind Sketch Rush, alongside a critical analysis of its efficacy in providing an engaging, user-friendly, and socially connective experience. Through this research, we seek to contribute to the broader

discourse on the digital adaptation of social games, proposing that with thoughtful design and robust technology, the essence of analog play can not only be preserved but also enhanced in the digital sphere

II. LITERATUREREVIEW

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III. PROPOSEDSYSTEM

Th The proposed system, Sketch Rush, is a real- time multiplayer web application designed to replicate and enhance the experience of playing the classic Pictionary game. It is built on a client- server architecture using Node.js and WebSockets to ensure synchronized, low-latency interaction. The system is designed to be accessible, requiring no installation or specialized hardware beyond a standard web browser and an internet connection. System Architecture The architecture of Sketch Rush is divided into two main components: the Client-Side Application and the Server-Side Application. The client is responsible for rendering the user interface, capturing user input (drawing and text), and displaying the game state. The server manages game logic, session state, and real-time communication between clients.

Core Modules

Real-Time Communication Engine: This module, built on the Socket.IO library (which uses WebSockets), forms the communication backbone of Sketch Rush. It manages the creation, joining, and synchronization of game rooms. It handles the broadcasting of drawing strokes, chat messages, and game state updates (e.g., "round started," "correct guess," "time's up") to all participants in a room with minimal latency. Drawing and Rendering Module: This module is the artistic interface for the "Artist." It utilizes the HTML5 Canvas element and JavaScript to capture mouse or touch events (mousedown, mousemove, mouseup) and convert them into drawing strokes. This module includes a set of drawing tools: Brush: With adjustable size and color.m Eraser: To correct mistakes. Clear Canvas: To start over. Color Picker: A standard color palette. The captured drawing data is then serialized and transmitted via the communication engine to all other players in the room, where it is rendered in real-time.

Game Logic and State Manager: This server-side module is the "brain" of Sketch Rush. It is responsible for:

- Word Selection: Randomly selecting a word from a pre-defined dictionary for the artist to draw.
- Round Management: Starting and ending rounds based on a timer.
- Scorekeeping: Tracking and broadcasting scores for each player. Points are awarded to the first player to guess correctly, and also to the artist if a correct guess is made.

- Role Rotation: Automatically rotating the artist role after each round, ensuring all players get a turn.

- Game Flow: Managing the sequence of rounds to determine the overall winner.

Chat and Guessing Module: This module provides the interface for the "Guessers." It features a simple text input box and a message history area. When a player submits a guess, it is transmitted to the server. The server checks the guess against the current round's word. If correct, it broadcasts a "correct guess" message, awards points, and ends the round. All guesses (correct and incorrect) are displayed in the chat for all to see, replicating the social dynamics of the original game.

- User Interface and Experience Layer: The front- end is designed for clarity and ease of use. The interface is divided into distinct sections:

- Drawing Canvas: The main area, taking up most of the screen for the artist. Canvas Replay Area: For guessers, a read-only canvas displays the live drawing.

- Chat & Guessing Area: Located on the side, showing the conversation history and an input box for guesses. Game Information Panel: Displays the current round timer, scores for all players, and the current word (hidden from guessers, visible only to the artist).

Workflow and Functionality

- Lobby Creation: A user hosts a new game room. The server generates a unique room ID.

- Joining a Game: Other users join by entering the room ID. The server synchronizes the player list and notifies all participants.
- Round Start: The server selects a random word for the first artist and initializes the round timer.

- Drawing and Guessing: The artist sees the word and begins drawing. Their strokes are broadcast to all guessers in real-time. Guessers type their guesses in the chat. The server evaluates each guess.

- If a guess is correct, the server awards points, broadcasts a "correct" message, and ends the round.

- If the timer expires, the server broadcasts the correct answer and ends the round.

- Round End and Rotation: After a round ends, the server updates the scores, displays a brief summary, and then rotates the artist role to the next player.

- Game Conclusion: The game continues for a pre-determined number of rounds or until a player reaches a target score. The server then declares the winner.

- **Key Features**
- Real-Time Synchronization: Drawing strokes and guesses are shared instantly, replicating the immediacy of the physical game.

- Automated Game Management: Handles scoring, word selection, and role rotation, allowing players to focus purely on the game.

- Intuitive Drawing Tools: A simple yet effective set of tools makes drawing accessible to all skill levels.

- Multi-Platform Accessibility: As a web application, it works on any device with a modern browser, including desktops, tablets, and some mobile devices.

- Social Chat: The integrated chat log not only serves as a guessing interface but also recreates the social banter of the game.

Technological Innovation

Sketch Rush is not a complex AI system, but its innovation lies in the cohesive integration of several web technologies to create a fluid, social experience. The key technological achievement is the low-latency synchronization of drawing data. This is accomplished by capturing strokes as a series of points and broadcasting them as small, optimized data packets over WebSockets, rather than sending full image frames. This approach minimizes bandwidth usage while maintaining visual fidelity and real-time responsiveness, a critical factor for user engagement.

Use Case Scenarios

Scenario 1: Friends Reuniting Virtually: Four friends, living in different cities, want to have a fun, social evening. They create a private room in Sketch Rush. The platform provides a shared activity that allows them to interact, laugh at each other's drawings, and feel connected despite the physical distance.
Scenario 2: A Casual Classroom Icebreaker: A teacher wants a fun, engaging activity for the first day of an online class. They

create a Sketch Rush room and share the code with students. The game encourages participation, teamwork, and a lighthearted atmosphere, helping to build rapport within the class.

Ethical Considerations

Sketch Rush is designed as a casual game and, a such, has minimal ethical risks. The main considerations are:

- Privacy: No personal data is stored permanently.
- Game rooms are ephemeral, and all data is Deleted once the room is empty.
- Content Moderation: The game uses a pre defined, curated list of words to prevent inappropriate prompts. A chat filter is also planned to prevent abusive language in the guessing chat.
- Accessibility: Future work will focus on enhancing accessibility, such as providing alternative input methods for drawing and ensuring screen reader compatibility.

Future Enhancements

Planned advancements include:

- Custom Word Packs: Allowing users to create or import their own word lists.
- Spectator Mode: Allowing users to watch a game without participating.
- Enhanced Drawing Tools: Adding features like shapes, an undo/redo function, and layer support. Voice Chat: Integrating audio to allow for the spontaneous shouting and conversation that is a hallmark of the physical game.
- Mobile App: Creating native mobile applications for better performance on smartphones and tablets.

IV. METHODOLOGY

The methodological framework adopted for the development and evaluation of Sketch Rush is a blend of agile software development and user- centered design. The project was executed in iterative sprints, with each phase focusing on building, testing, and refining a core feature set.

- Requirements Gathering**:** The foundation of Sketch Rush's design was established through:
- Comparative Analysis: Existing digital drawing games were analyzed to identify their strengths and weaknesses, particularly regarding user interface, game flow, and feature set.

Informal User Feedback: Informaldiscussionswith potential users helped identify the most valued aspects of the original Pictionary game, such as simplicity, spontaneity, and the social element, which became core design goals.

SystemDesign

Based on the requirements, the system was architected with a focus on performance and maintainability.

Client-ServerModel: A clear separation of concerns was established. The client handles the user interface and drawing input, while the server managesthegamestate,ensuringasinglesourceof truth to prevent cheating and desynchronization.

TechnologyStackSelection: Frontend:React
Backend:Node.jswiththeExpressframework. Real-Time Communication: Socket.IO.
Drawing: HTML5 Canvas API.

Implementation
Development followed agile practices with short sprints.
Real-Time Communication: Socket.IO was implementedtomanageroomcreation,joining,and event broadcasting.

Drawing Engine: A custom drawing engine was built tocapture mouse events, draw on the canvas, and emit stroke data. A key challenge was optimizingthedatasentforstrokes;thiswassolved by capturing points at a reasonable frequency and only sending the vector data (start point, intermediate points, end point, color, size).

GameLogic: Astatemachinewasimplementedon the server to manage the game flow (waiting, drawing round, round ended). The server-side dictionary was built as a simple JSON array.
User Interface: A responsive layout was created with CSS Flexbox. The interface for the artist and guessers was dynamically updated by the server's state.

Evaluation Strategy
A comprehensive evaluation plan was established to assess Sketch Rush's performance and user experience.
UsabilityTesting: Conducted with 40participants. Usability was assessed via System Usability Scale (SUS) scores, task completion times, and open- ended feedback.

PerformanceTesting:Serverloadandlatencywere tested to ensure the application could handle multiple concurrent rooms with 4-6 players each without lag.
A/B Testing: Variations in UI layout and drawing tool placement were tested to determine the most intuitive configuration.

V. RESULT

The development and testing of Sketch Rush yielded positive results, validating its core premise of being an engaging and usable digital adaptation of a social party game.

Quantitative Performance Metrics
A pilot study was conducted with 40 participants over a two-week period. They were asked to play the game in groups of 4 for several sessions.

Average Round Time: 1 minute 45 seconds, aligning with the intended fast-paced nature of the game.

Average Successful Guess Time: The average time for a correct guess was 22 seconds, indicating the game's ability to quickly engage players.

Concurrent User Handling: Server performance tests showed the application could handle up to 10 concurrent rooms (50 users) without noticeable latency, with average drawing stroke delay under 50 milliseconds.

User Experience and Satisfaction
The System Usability Scale (SUS) was administered at the end of the evaluation phase. Sketch Rush scored an average of 85.6/100, placing it in the "excellent" usability category.

Ease of Learning: 95% of users agreed or strongly agreed that the game was easy to learn and start playing.

Interface Clarity: 92% found the layout and features intuitive, with a clear distinction between the artist and guesser views.

Social Enjoyment: 88% of participants rated the game as highly enjoyable and a good way to connect with friends.

Qualitative Feedback
Open-ended responses revealed recurring themes: "Feels Just Like the Real Game": Many users commented that the digital adaptation successfully captured the excitement and fun of physical Pictionary.

"Simple and Works": The simplicity of the interface and the reliability of the real-time drawing were frequently praised.

"Need More Tools": Some users expressed a desire for more advanced drawing tools, such as an undo button and a shape tool, which is a planned future enhancement.

Comparative Analysis
When compared to a similar existing platform, Sketch Rush was noted for its cleaner, less cluttered interface and more straightforward game flow (e.g., integrated scoring and automatic role rotation). Users specifically appreciated the lack of complex account requirements and the ease of joining a private game with a simple room code. Limitations Observed.

During Testing
While the system demonstrated positive results, several limitations were noted:

Mobile Drawing: While functional, the drawing experience on small mobile screens was challenging for precise strokes. This highlights the need for a dedicated mobile app or improved touch-based controls.

Word List Diversity: Some users found the initial word list limited after several rounds, suggesting a need for a larger, more diverse, or user- customizable dictionary

VI. CONCLUSIONS

The development and evaluation of Sketch Rush mark a successful endeavor in the digital adaptation of a classic social game. By leveraging modern web technologies such as WebSockets and the HTML5 Canvas API, the project demonstrates how traditional analog experiences can be not only replicated but also enhanced for the digital age. The system provides a seamless, real-time multiplayer platform that captures the core essence of Pictionary: quick thinking, creativity, and shared social laughter.

Through its modular design, intuitive user interface, and robust real-time architecture, Sketch Rush effectively addresses the limitations of physical play, such as geographical constraints and manual game management. The positive results from usability testing—with high SUS scores and favorable qualitative feedback—validate the system's success in creating an engaging and socially connective experience.

The project highlights the importance of user- centered design in game development. The simplicity and clarity of the interface were as crucial to its success as the underlying technology. By removing friction in joining a game and automating game mechanics, Sketch Rush allows players to focus entirely on what matters most: the fun of playing together. Future work will focus on addressing the limitations identified during testing. This includes developing a dedicated mobile application with touch-optimized drawing controls, expanding the word list and allowing for user-created custom word packs, and integrating voice chat to further enhance the social atmosphere. Additionally, a spectator mode and enhanced drawing tools are planned to enrich the feature set.

In conclusion, Sketch Rush is more than a simple clone; it is a testament to the viability and potential of thoughtfully designed digital social games. It demonstrates that with a focus on core user experience and the intelligent application of real- time technologies, we can create digital spaces that foster genuine connection, creativity, and fun—the fundamental elements of play. As our social interactions continue to migrate online, projects like Sketch Rush provide a blueprint for how to build engaging, collaborative, and emotionally resonant digital experiences.

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