Zudo AI An AI-Based Multiplayer Word Association Game Inspired by the Traditional Maharashtrian Game Zunzumunju

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***Abstract*—Zudo-AI is an intelligent, turn-based multiplayer word association game inspired by the traditional Maharashtrian game "Zunzumunju." This project transforms a culturally rooted activity into a digital platform using a single shared dashboard for sequential gameplay. The system employs Natural Language Processing (NLP) and Machine Learning to automatically evaluate the semantic relevance of player responses against prompts, moving beyond simple keyword matching. By calculating scores based on both semantic correctness and response speed, Zudo-AI provides an objective and competitive environment for vocabulary enhancement and cognitive skill development. The resulting prototype demonstrates a practical integration of traditional gameplay with modern AI-driven evaluation techniques.**

Key Components Included:

Purpose: To digitize a traditional game and automate semantic evaluation for vocabulary building.

Method: A shared-dashboard sequential model utilizing NLP (spaCy/NLTK) for word association analysis.

Findings/Results: Automated, speed-sensitive scoring and real-time leaderboard updates for interactive group learning.

***Index Terms*— Artificial intelligence, machine learning, multiplayer gaming, natural language processing, semantic analysis, word association**

I. INTRODUCTION

Traditional games improve communication, memory, and social interaction among participants. Word association activities strengthen vocabulary and cognitive thinking abilities. Many regional Indian games encourage spontaneous thinking and cultural learning. Zunzumunju is one such traditional Maharashtrian game. Players quickly respond using semantically connected words or phrases.

Modern educational systems increasingly use artificial intelligence for interactive learning applications. Natural language processing enables computers to understand contextual meanings of words. Machine learning algorithms evaluate responses based on semantic relevance. Existing digital word games often depend on exact keyword matching. Such systems cannot accurately identify contextual similarity between responses.

Researchers have explored semantic analysis techniques for intelligent gaming systems. Previous studies demonstrated successful applications of NLP in associative word prediction. AI-assisted gaming platforms improved educational engagement and response evaluation accuracy. However, limited research combines traditional Indian gaming concepts with semantic evaluation models.

This research proposes Zudo AI, an intelligent multiplayer word association platform. The system follows a sequential turn-based gameplay mechanism. All participants interact using a single shared dashboard. Players respond within a fixed time limit during assigned turns. NLP techniques evaluate semantic relationships between prompts and answers. The proposed platform combines cultural gaming traditions with modern AI technologies.

II. LITERATURE REVIEW

A. Semantc Analysis in Intelligent Systems

Semantic analysis techniques are widely used in natural language processing applications. Researchers developed intelligent systems capable of identifying

contextual relationships between words. Jain et al. proposed SentiGames using graph-based semantic classification methods. Their model analyzed semantic similarity instead of exact keyword matching. The study demonstrated improved contextual understanding during automated evaluation.

The proposed research supports intelligent response validation in Zudo AI. Semantic similarity analysis improves answer evaluation accuracy significantly. The methodology also reduces dependency on predefined exact matching rules.

B. Associative Word Prediction Using NLP

Milovanović developed an NLP-based associative word prediction system. The research trained neural networks using associative language datasets. Experimental results showed improved prediction accuracy for semantically related terms. The system effectively identified contextual relationships between prompts and responses.

This research directly supports the gameplay mechanism of Zudo AI. Players respond using semantically associated words during gameplay rounds. NLP-based association prediction improves automatic answer evaluation efficiency.

C. Educational Word-Based Gaming Systems

Several researchers explored educational gaming systems using thematic word interaction. Padiyar and Singh designed a mythology-based word association platform. Their study emphasized cognitive improvement through interactive gameplay activities. Educational games improved vocabulary development and participant engagement significantly.

The findings support the educational objectives of the proposed platform. Zudo AI also promotes vocabulary enhancement and cognitive thinking abilities. The system combines entertainment with intelligent learning experiences.

D. AI-Assisted GameDesign and Evaluation

Recent research explored artificial intelligence applications in board game design. Goodman et al. studied AI-assisted gameplay analysis and evaluation methods. Their work highlighted automated scoring and intelligent interaction mechanisms. AI-based systems improved gaming efficiency and user engagement levels.

The proposed research applies similar AI concepts within educational gaming environments. Automated semantic evaluation reduces manual judgment during gameplay sessions.

III. PROBLEM STATEMENT

Traditional word association games are usually conducted manually and require human judgment to evaluate player responses. Such systems are difficult to scale and lack automated evaluation mechanisms. Existing digital word games often depend on exact keyword matching and fail to evaluate semantic meaning accurately.

The proposed system addresses this problem by developing an AI-based multiplayer word association game that automatically evaluates responses using semantic analysis techniques. The system allows multiple players to participate sequentially using a single shared dashboard. It also calculates scores automatically based on semantic correctness and response time.

IV. OBJECTIVES

The main objectives of the proposed system are:

1. To design and develop a multiplayer AI-based word association game inspired by the traditional Maharashtrian game Zunzumunju.
2. To implement a turn-based gameplay mechanism using a shared dashboard.
3. To generate prompts from predefined categories for interactive gameplay.
4. To develop a machine learning and NLP-based answer evaluation system.
5. To calculate player scores based on semantic relevance and response time.
6. To provide an educational and cognitive skill development platform through interactive gaming.

V. PROPOSED SYSTEM

A. System Overview

Zudo AI is designed as a turn-based multiplayer gaming system where all players interact through a common dashboard. The gameplay consists of multiple rounds. In every round, a prompt is displayed, and players answer sequentially during their assigned turns.

The system architecture consists of the following modules:

1. Player Management Module
2. Prompt Generation Module
3. Timer Management Module
4. NLP-Based Answer Evaluation Module
5. Score Calculation Module
6. Leaderboard and Result Module

B. Working Procedure

The working of the system is divided into the following steps:

Step 1: Player Registration

Players enter their names before the game starts. The system stores player details and assigns turn order.

Step 2: Prompt Generation

The system selects prompts from predefined categories such as:

- Fruits
- Colors
- Festivals
- Animals
- Daily-life objects
- General vocabulary

Step 3: Turn-Based Gameplay

Each player receives a limited time to respond with a semantically related word. After submission, the turn automatically transfers to the next player.

Step 4: Semantic Evaluation

The submitted response is analyzed using NLP techniques. The system checks:

- Semantic similarity
- Contextual relation
- Word association relevance

Step 5: Score Calculation

Scores are assigned based on:

- Correctness of semantic relation
- Response time
- Relevance level

Step 6: Leaderboard Generation

After completion of all rounds, cumulative scores are displayed and the winner is declared.

VI. SYSTEM ARCHITECTURE

The proposed system follows a modular architecture consisting of frontend interaction, backend processing, NLP evaluation, and scoring modules.

Modules Included

A. User Interface Module

Provides a shared dashboard where players interact with the system.

B. Prompt Management Module

Stores and retrieves prompts from categorized datasets.

C. NLP Processing Module

Processes player responses using:

- Tokenization
- Text normalization
- Semantic similarity analysis
- Word association analysis

a. Machine Learning Evaluation Module

Classifies responses into relevance categories.

b. Score Engine

Calculates scores using correctness and response time.

c. Result Display Module

Displays leaderboard rankings and winner information.

VII. METHODOLOGY

a. Requirement Analysis

The project requirements were identified using gameplay characteristics of Zunzumunju. Multiplayer interaction and prompt-response mechanisms were finalized during analysis. Functional requirements included timer control, semantic evaluation, and score generation.

b. Dataset Preparation

A categorized dataset was prepared for semantic association analysis. The dataset contained prompts and semantically related vocabulary terms. Categories included colors, fruits, festivals, animals, and general concepts.

c. NLP Processing

Natural language preprocessing techniques were applied to player responses. Text normalization improved semantic analysis efficiency. Tokenization

and stop-word removal reduced unnecessary textual noise. Lemmatization standardized response words before similarity analysis.

d. Semantic Evaluation

The system calculated semantic similarity between prompts and player responses. Machine learning models classified responses into relevance categories. Responses were labeled as relevant, partially relevant, or unrelated.

e. Score Calculation

The scoring engine combined semantic relevance and response time values. Faster and semantically accurate responses received higher scores. Final scores were stored within the leaderboard database.

f. System Testing

The system was tested using multiple multiplayer gameplay scenarios. Functional testing verified timer handling and turn management processes. Semantic evaluation accuracy was validated using sample prompt-response datasets.

VIII. HARDWARE AND SOFTWARE REQUIREMENTS

a. Hardware Requirements

- Processor: Intel Core i5 or higher
- RAM: 8 GB or more
- Storage: 50 GB free disk space
- Stable internet connection
- Laptop/Desktop system
- Optional projector for classroom demonstration

b. Software Requirements Programming Language

- Python 3.9+

Libraries

- NumPy
- Pandas
- Pygame
- Scikit-learn
- Tkinter

Development Tools

- Jupyter Notebook
- VS Code

IX. ALGORITHM

Semantic Evaluation Algorithm Input:

- Prompt P
- Player Response R

Output:

- Relevance Score S

Steps:

1. Accept prompt and response.
2. Convert text into lowercase format.
3. Remove unnecessary symbols and stop words.
4. Tokenize the response.
5. Generate semantic vectors.
6. Calculate semantic similarity score.
7. Compare similarity score with threshold.
8. Classify response relevance.
9. Calculate final score using response time.
10. Store score in leaderboard.

X. RESULTS

The proposed system successfully implemented multiplayer sequential gameplay using a shared dashboard. Players interacted smoothly during prompt-response sessions. Timer functionality operated correctly during multiple gameplay rounds.

The NLP evaluation module accurately identified semantic relationships between prompts and responses. Relevant responses received higher similarity scores compared to unrelated responses. Experimental testing demonstrated improved contextual evaluation accuracy.

The scoring engine generated scores using semantic correctness and response time. Faster and semantically accurate answers produced higher cumulative scores. Leaderboard generation correctly displayed player rankings after gameplay completion.

The system also improved participant engagement during classroom-style gaming activities. Players demonstrated faster thinking and improved vocabulary interaction throughout gameplay sessions.

XI. APPLICATIONS

The proposed system can be applied in various domains including:

- Educational gaming platforms
- Vocabulary learning systems

- Classroom competitions
- Cognitive skill development activities
- AI and NLP academic demonstrations
- Language learning environments

The project also provides future opportunities for multilingual implementation and adaptive AI-based gameplay.

XII. ADVANTAGES

The proposed system provides several advantages:

- Intelligent semantic evaluation
- Educational and interactive gameplay
- Low hardware requirements
- Shared dashboard support
- Automated scoring system
- Improved vocabulary and thinking skills
- Practical implementation of NLP concepts

XIII. DISCUSSION

The experimental results demonstrate effective integration of AI within educational gaming environments. Semantic analysis improved answer evaluation accuracy significantly. The proposed gameplay model also supported interactive group participation.

The system performed efficiently in classroom and low-resource environments. Shared-dashboard interaction reduced hardware dependency during multiplayer sessions. Players also showed increased engagement during vocabulary-based activities.

However, semantic evaluation accuracy depends heavily on dataset quality. Limited vocabulary datasets may reduce contextual prediction performance. Some partially related responses may also require advanced contextual understanding.

Future integration of deep learning models may improve semantic analysis performance. Multilingual datasets can also enhance regional accessibility and educational applications.

XIV. CONCLUSION

Zudo AI successfully combines traditional gaming culture with artificial intelligence technologies. The system provides intelligent semantic evaluation within a multiplayer educational gaming environment. NLP and machine learning techniques improved automated response analysis significantly.

The proposed platform supports vocabulary enhancement, cognitive development, and interactive learning experiences. Experimental testing confirmed accurate gameplay management and semantic evaluation performance. The research also demonstrated practical applications of AI within educational gaming systems.

Future improvements may include multilingual gameplay, deep learning integration, and online multiplayer support.

XV. FUTURE SCOPE

The project can be enhanced in the future using the following improvements:

1. Marathi language support for regional gameplay.
2. Integration of deep learning-based semantic models.
3. Adaptive difficulty level generation.
4. Online multiplayer support.
5. Voice-based interaction and speech recognition.
6. Cloud database integration.
7. Mobile application deployment.
8. AI-generated dynamic prompts.

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