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Designing Effective Language Learning Websites: A Learner-Centered Approach

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ABSTRACT

For people who want to study a language in a flexible and convenient way, online language learning has become a vital resource. Nevertheless, a lot of current systems are devoid of individualized learning experiences, real-time feedback, and interactive features. The creation of a full-stack online application that uses gamification, adaptive AI-driven tools, and real-time assessment to improve language learning is presented in this study. The platform makes advantage of contemporary web technologies to deliver a smooth user experience, such as React.js for the front end and Node.js with Express.js for the back end. To provide tailored learning recommendations, information from user interactions, speech recognition models, and open-source language datasets is used. An experimental study with language learners evaluates the system's effectiveness, demonstrating improvements in engagement, retention, and pronunciation accuracy. The results highlight the potential of integrating AI with interactive web applications to create more efficient and engaging language learning experiences.

KEYWORDS: *Node.js with Express.js, AI-driven tools, web applications, Open Educational Resources, NLP.*

1. INTRODUCTION

Due to the increasing demand for flexible and accessible education, learning online language is expanding rapidly. However, many existing platforms lack interaction, real -time engagement and lack of personal learning experiences. This study presents the development of a complete-stack web application that integrates interactive tools, adaptive materials, and AI-powered assessment to improve the language learning process. The proposed system aims to provide an immersive and attractive platform that addresses the boundaries of traditional learning methods by offering real-time communication, gamification and AI-operated evaluation devices.

2. Literature Review

- Theories of Language Acquisition:
- Behaviorist Theory (Skinner) vs. Cognitive Theory (Chomsky)
- Social Interactionist Theory (Vygotsky)
- Task-Based Learning (TBL)
- Previous Online Learning Platforms: Analyzing existing language learning websites like

Duolingo, Memrise
Babbel, and Rosetta Stone.

- Advantages: Accessibility, flexibility, personalized learning
- Challenges: User engagement, effectiveness of gamification, content quality
- Technological Tools for Language Learning:
- Speech recognition, gamification, AI, adaptive learning algorithms.
- Role of multimedia (audio, video, images) in improving learning outcomes.

3. RELATED WORK

Popular platforms such as Duolingo and Rosetta Stone appoint game fills and adaptive learning to increase engagement. While these platforms use structured texts and AI-operated exercises, they often do not provide real-time communication features or personal feedback on user performance basis. Several studies in AI-based education suggest that machine learning models can improve learning results by adjusting the difficulty and nature of material distribution based on the progress of individual users. This research creates an AI-operated evaluation tools, real-time reaction mechanisms, and interactive learning components to create existing functioning to create a more dynamic and customized learning experience that is compatible with the proficiency level and requirements of the learner.

4. Data and Source of Data

To ensure comprehensive learning outcomes, data for this study is gathered from multiple sources:

- **Public datasets**: Open-source language learning datasets from Kaggle and Open Educational Resources (OER) provide linguistic data such as vocabulary, grammar rules, sentence structures, and pronunciation examples. These datasets help train AI models for speech recognition and grammar correction.
- **User interaction data**: Data is collected from prototype testing, where user engagement metrics such as time spent on exercises, accuracy in responses, and progression levels are recorded. These metrics are used to assess usability, learning efficiency, and areas requiring improvement.
- **Surveys and feedback**: Responses from language learners regarding their learning experiences, difficulties, and platform usability are gathered. Feedback is analyzed to refine the system's interface, content structure, and personalized features.
- **Speech recognition datasets**: AI-powered accent evaluation uses large-scale dataset that contains speech samples recorded from native and non-indestion speakers. These datasets help to refine the accent accuracy assessment and speech analysis algorithm to provide corrective response in real time.

5. RESEARCH METHODOLOGY

The study follows a structured methodology to design, develop, and evaluate the language learning platform:

- **Development:** The application is built using a full-stack approach. The front-end is developed with React.js to provide an interactive and responsive user interface. The back-end is implemented with Node.js and Express.js to manage authentication, data processing, and API interactions. PostgreSQL is used for structured data storage, while MongoDB manages unstructured content such as chat logs and user interaction records. The system also integrates third-party APIs for speech recognition and natural language processing (NLP) to enhance pronunciation assessment and language comprehension features.
- **Experimental Study:** A selected group of language learners participate in a controlled study where their learning progression, engagement level, and overall experience with platforms are monitored in a prescribed period. Users complete structured teaching activities, accent practice and understanding tasks to evaluate the impact of the system.
- **User Feedback Collection:** Surveys, purpose testing, and direct user interviews are conducted to measure the effectiveness of interactive exercises, AI-conducted assessment and gamification techniques. Participants provide information about how much the stage supports their language learning journey, and their reactions are used to improve the future repetitions of the system.
- **Data Analysis:** Collated data is processed using AI-based analytics and statistical methods to evaluate major performance indicators such as user retention, progress rate and engagement levels. Data insites help determine which characteristics are the most effective in increasing language learning results and user motivation.

6. RESULTS AND DISCUSSION

The evaluation of the platform demonstrates several key findings that highlight its effectiveness and areas for improvement:

- **Gamification increases motivation:** Features such as progress tracking, achievement badges, competitive challenges, and reward systems significantly enhance user engagement and encourage consistent learning.
- **AI-driven speech analysis improves pronunciation:** The speech recognition tool successfully detects pronunciation errors and provides real-time corrective feedback. Participants using the pronunciation assessment tool show measurable improvements in spoken accuracy over time, demonstrating the effectiveness of AI-powered feedback mechanisms.
- **Interactive exercises enhance retention:** Personalized quizzes, adaptive learning pathways, and multimedia content—including video lessons, interactive dialogues, and contextual exercises—contribute to higher retention rates compared to traditional lesson-based approaches. Users reported better comprehension and recall when exposed to interactive and varied content formats.
- **Challenges remain:** Some difficulties persist, including refining the AI model to improve speech recognition accuracy for non-indestion accents and provide more relevant accurate learning feedback. Additionally, the platform requires more adaptation features to meet users with various proficiency levels, learning styles and individual preferences. Future development will be focused on refining these areas and integrating additional AI-managed privatization facilities.

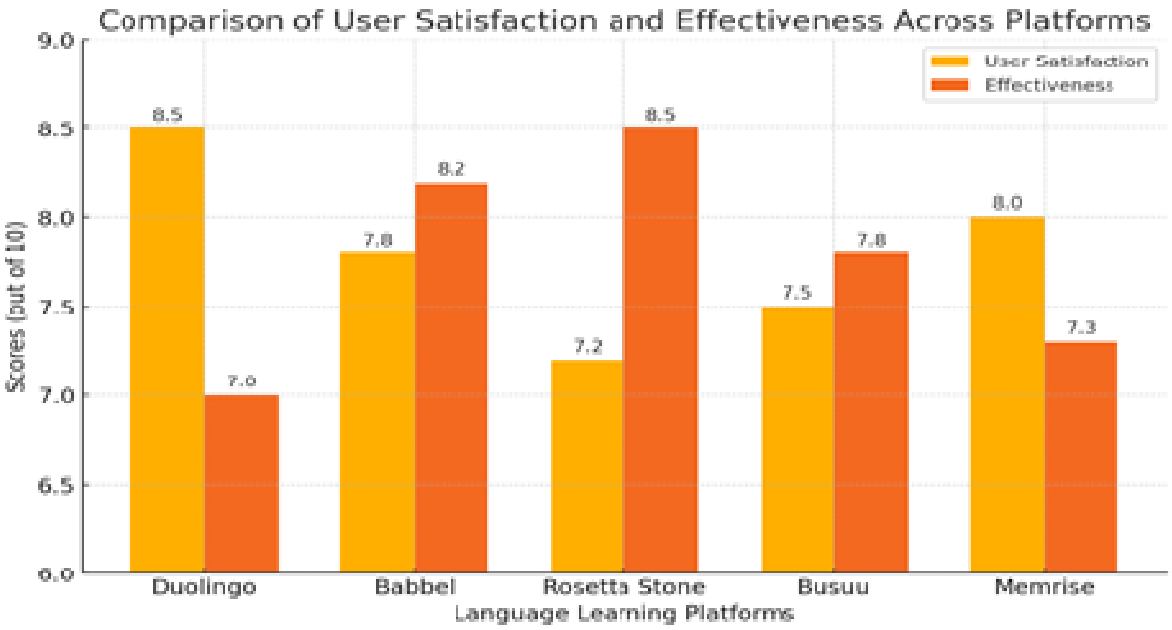

Fig 1 User satisfaction and effectiveness of other platforms

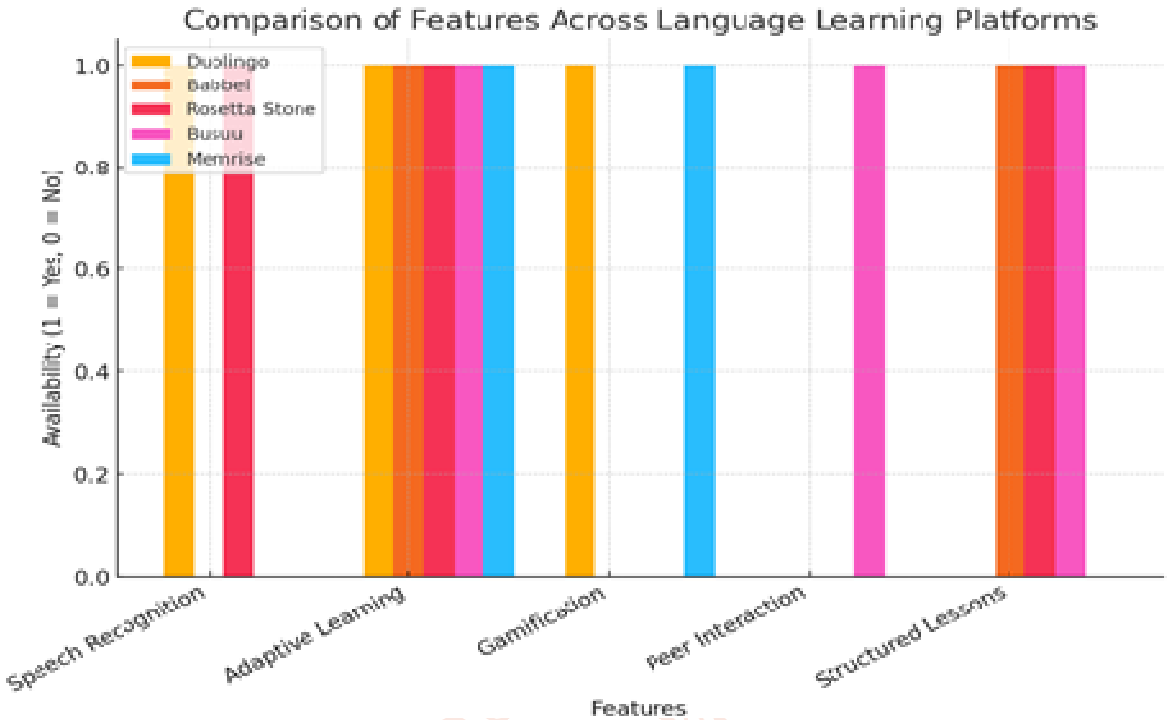

Fig 2 Comparison of features of other language learning platform

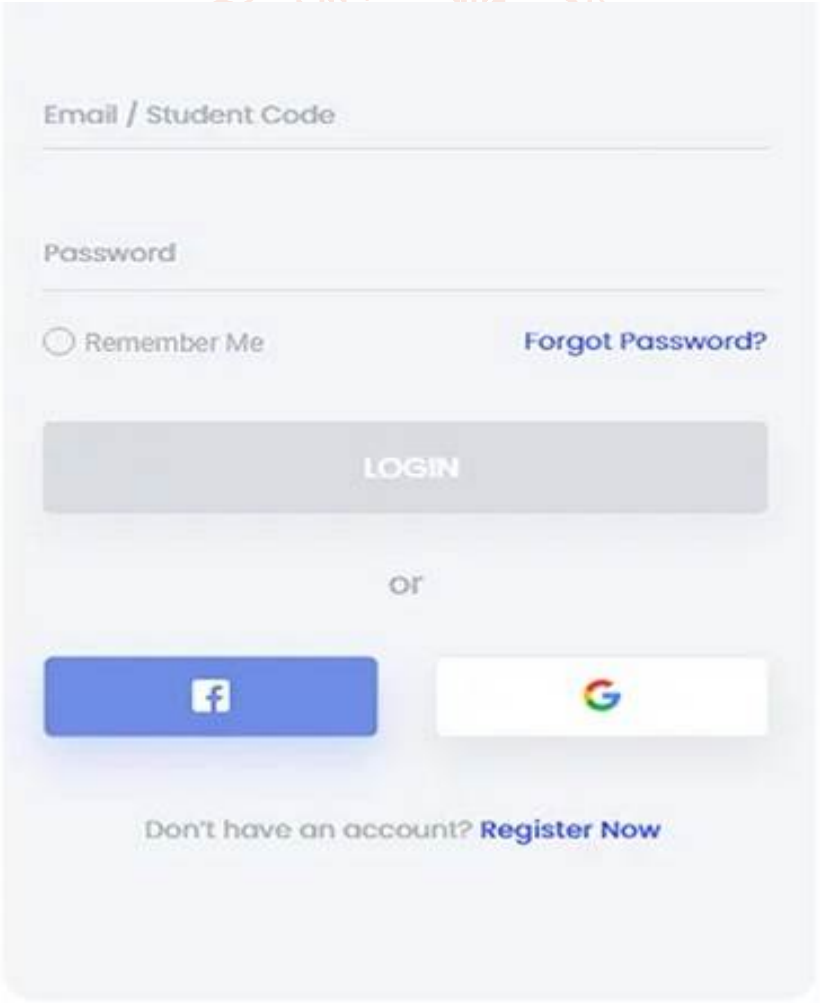

Fig 3: log-in page

Fig 4 dash board

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