



MIRZO ULUG'BEK NOMIDAGI  
O'ZBEKISTON MILLIY UNIVERSITETI  
JIZZAX FILIALI



**KOMPYUTER IMLARI VA  
MUHANDISLIK TEXNOLOGIYALARI  
XALQARO ILMIY-TEXNIK  
ANJUMAN MATERIALLARI  
TO'PLAMI  
2-QISM**



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**MIRZO ULUG'BEK NOMIDAGI O'ZBEKISTON MILLIY  
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**KOMPYUTER IMLARI VA MUHANDISLIK  
TEXNOLOGIYALARI**

*mavzusidagi Xalqaro ilmiy-texnik anjuman materiallari to'plami*  
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Xalqaro miqyosidagi ilmiy-texnik anjuman materiallarida zamonaviy kompyuter ilmlari va muhandislik texnologiyalari sohasidagi innovatsion tadqiqotlar aks etgan.

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Ushbu ilmiy ma’ruza tezislari to‘plamida mamlakatimiz va xorijlik turli yo‘nalishlarda faoliyat olib borayotgan mutaxassislar, olimlar, professor-o‘qituvchilar, ilmiy tadqiqot institutlari va markazlarining ilmiy xodimlari, tadqiqotchilar, magistr va talabalarning ilmiy-tadqiqot ishlari natijalari mujassamlashgan.

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Mazkur to‘plamga kiritilgan ma’ruza tezislarining mazmuni, undagi statistik ma’lumotlar va me’yoriy hujjatlarning to‘g‘riliqi hamda tanqidiy fikr-mulohazalar, keltirilgan takliflarga mualliflarning o‘zlari mas’uldirlar.

# DEVELOPMENT OF AN INTERACTIVE SOFTWARE TOOL FOR AUTOMATIC ASSESSMENT AND IMPROVEMENT OF PRONUNCIATION IN FOREIGN LANGUAGE LEARNING

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**Abstract.** The development of foreign language skills requires not only vocabulary and grammar knowledge but also accurate pronunciation, which is a critical component of effective communication. However, many learners face challenges in evaluating and improving their pronunciation independently without expert guidance. This paper presents the design and development of an interactive software tool aimed at automatic assessment and enhancement of pronunciation in foreign language learning. The system utilizes speech recognition technologies, phonetic analysis, and artificial intelligence algorithms to provide real-time feedback on learners' pronunciation accuracy. By offering interactive exercises, performance tracking, and personalized recommendations, the tool creates an engaging learning environment that supports self-directed practice. Experimental analysis and user testing demonstrate that the proposed solution helps learners to identify phonetic errors, monitor progress, and gradually improve their speaking skills. The study highlights the practical significance of integrating automatic pronunciation assessment systems into digital education platforms and suggests directions for further improvements in adaptive language learning technologies.

**Keywords.** Foreign language learning, pronunciation assessment, interactive software tool, speech recognition, phonetic analysis, automatic feedback, language learning technology.

## Introduction

In today's globalized world, the ability to communicate effectively in a foreign language is becoming increasingly essential for academic, professional, and social success. While vocabulary acquisition and grammatical knowledge are important, pronunciation remains a critical factor in ensuring clear and accurate communication. Improper pronunciation often leads to misunderstandings, reduces learners' confidence, and limits their overall language proficiency. Therefore, providing learners with effective tools to evaluate and improve their pronunciation is a pressing need in modern language education.

Traditional methods of pronunciation practice usually rely on teacher feedback or peer evaluation, which are not always accessible outside the classroom environment. With the rapid advancement of digital technologies, especially in speech recognition, artificial intelligence, and interactive learning systems, it has become possible to design software tools that can automatically assess and guide learners in improving their pronunciation skills. Such systems not only save time and resources but also offer personalized, real-time feedback, making the learning process more engaging and effective.

This study focuses on the development of an interactive software tool that automatically evaluates learners' pronunciation and provides corrective feedback for improvement. By integrating speech recognition and phonetic analysis, the system aims to assist learners in identifying pronunciation errors and practicing with greater accuracy. The paper highlights the methodology of designing such a tool, its potential benefits for language learners, and its practical significance in the context of digital education.

### **Literature Review (Theoretical Background)**

The role of pronunciation in foreign language learning has been widely recognized as a fundamental component of communicative competence. According to Derwing and Munro (2015), intelligible pronunciation is essential for effective interaction, often taking precedence over grammatical accuracy or lexical richness in ensuring mutual understanding. Research has consistently demonstrated that learners with poor pronunciation skills face difficulties in both academic and professional communication, even when their grammatical and lexical knowledge is adequate (Isaacs & Trofimovich, 2017).

In recent decades, technological advancements have facilitated the emergence of Computer-Assisted Language Learning (CALL) systems, many of which integrate pronunciation training modules. Early CALL tools primarily relied on static recordings and manual comparison with native speaker models, offering limited adaptability and feedback (Eskenazi, 2009). However, with the integration of Automatic Speech Recognition (ASR) technologies, systems have become more dynamic, capable of providing real-time feedback on learners' phonetic accuracy (Neri, Cucchiari, & Strik, 2006).

Several commercial applications, such as Duolingo, Rosetta Stone, and SpeechAce, have introduced automatic pronunciation evaluation as part of their language training platforms. While these systems have increased accessibility to pronunciation practice, studies indicate that they often lack detailed phonetic analysis and personalized feedback, thereby limiting their pedagogical effectiveness (Moyer, 2013; Thomson & Derwing, 2016). Academic research further highlights the necessity for systems that not only assess pronunciation but also guide learners toward improvement by offering corrective strategies (Levis, 2018).

The application of artificial intelligence (AI) and machine learning has significantly advanced the field of automated pronunciation assessment. State-of-the-art models, such as deep neural networks and end-to-end ASR systems, enable more accurate detection of phonetic deviations and suprasegmental features like stress, rhythm, and intonation (Zhang et al., 2020). Moreover, interactive software design, which emphasizes learner engagement through gamification, feedback loops, and adaptive learning pathways, has been shown to enhance motivation and long-term retention (Godwin-Jones, 2018).

Taken together, existing literature suggests a growing demand for pronunciation training tools that combine automatic assessment with interactivity and adaptability. While commercial and academic efforts have laid the foundation, there remains a gap in developing systems that provide holistic, real-time, and personalized feedback to support independent learners. Addressing this gap, the present study proposes the

creation of an interactive software tool specifically designed to assess and improve pronunciation in foreign language learning.

## **Methodology**

### **Principles of Developing an Automatic Pronunciation Assessment System.**

The design of the proposed system is based on three core principles: accuracy, adaptability, and learner-centered interactivity. Accuracy ensures that the pronunciation analysis reflects authentic phonetic standards. Adaptability enables the system to adjust to learners' proficiency levels, providing feedback that is neither overly simplistic nor excessively complex. Finally, learner-centered interactivity fosters engagement by creating a dynamic environment where students can actively monitor and improve their progress.

## **Applied Technologies**

The system integrates several cutting-edge technologies to achieve reliable and user-friendly pronunciation assessment:

**Artificial Intelligence (AI):** Deep learning models are employed to detect subtle phonetic deviations, analyze suprasegmental features such as stress and intonation, and classify pronunciation quality.

**Automatic Speech Recognition (ASR):** ASR technology transcribes learners' speech in real time, aligning spoken output with target phonemes and detecting mismatches.

**Machine Learning Algorithms:** Supervised models are trained on large datasets of native and non-native speech to improve accuracy in error detection and scoring.

**Phonetic Analysis:** Segmental (phoneme-level) and suprasegmental (prosody-level) features are analyzed, ensuring comprehensive evaluation beyond simple word recognition.

## **Ensuring Interactivity**

To maximize learner engagement and motivation, the software integrates multiple interactive features:

**Real-time Feedback:** Immediate error detection with suggestions for correction.

**Voice-based Exercises:** Repetition and imitation tasks that allow learners to practice targeted sounds.

**Gamified Scoring System:** A rating and leaderboard system that tracks progress and encourages continuous improvement.

**Personalized Learning Pathways:** Adaptive recommendations based on individual error patterns.

## **Results and Discussion**

### **System Functionality**

The developed software functions by recording the learner's speech, transcribing it through the ASR module, and comparing the output with reference phonetic models. Detected discrepancies are processed by the AI engine, which generates feedback in both textual and visual formats. For instance, mispronounced phonemes are highlighted, and learners are provided with auditory examples of correct pronunciation.

The assessment module operates on a hybrid scoring system:

**Segmental Analysis:** Identifies specific phoneme-level errors (e.g., /θ/ vs. /s/ substitution).

**Suprasegmental Analysis:** Evaluates stress, rhythm, and intonation patterns to ensure natural speech flow.

**Error Categorization:** Groups errors into intelligibility-critical and minor deviations, enabling learners to prioritize improvement.

#### Outcomes for Learners

The implementation of the tool has shown several benefits:

**Pronunciation Improvement:** Learners demonstrate measurable progress in both phoneme accuracy and prosodic fluency.

**Increased Motivation:** The gamification elements and personalized feedback significantly enhance learner engagement.

**Self-directed Learning:** Students can practice independently without constant reliance on instructors, promoting autonomy in language acquisition.

#### Practical Significance

The proposed system contributes to the broader field of digital language learning by bridging the gap between traditional classroom-based pronunciation practice and AI-driven autonomous learning. It provides an effective solution for learners who lack access to native-speaking instructors, making high-quality pronunciation training more accessible and scalable. Furthermore, the integration of interactive features enhances user satisfaction and supports long-term retention of pronunciation skills.

### Conclusion and Recommendations

The findings of this study demonstrate that automatic pronunciation assessment systems play a crucial role in enhancing the effectiveness of foreign language learning. By providing real-time feedback and personalized correction strategies, learners are able to identify phonetic errors more accurately and improve both segmental and suprasegmental aspects of pronunciation. This not only enhances intelligibility but also boosts learners' confidence and motivation, which are essential for long-term language acquisition.

The interactive features of the developed tool, including gamified scoring, voice-based exercises, and adaptive feedback, have proven effective in engaging learners and encouraging self-directed practice. Such an approach bridges the gap between traditional classroom teaching and autonomous digital learning, offering learners greater accessibility and flexibility in improving their speaking skills.

Despite these achievements, there are areas for further development. Future improvements may focus on:

Expanding the system's database to include diverse accents and dialects for broader applicability.

Incorporating advanced AI-driven prosody analysis to refine the evaluation of intonation, rhythm, and stress.

Enhancing user experience with multimodal feedback, including visual articulation models and real-time speech waveform comparison.

Integrating the tool into broader e-learning ecosystems to complement grammar, vocabulary, and listening modules.

By addressing these areas, future systems can become even more adaptive, comprehensive, and impactful in supporting learners to achieve native-like pronunciation in foreign languages.

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## INGLIZ VA O'ZBEK ERTAKLARIDAGI HAYVONLAR OBRAZINING O'RGANILISHI

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**Annotatsiya:** Ushbu maqolada ingliz va o'zbek ertaklarida hayvonlar obrazining shakllanishi, folkloristik ildizlari hamda ularning ramziy, poetik va didaktik funksiyalari ilmiy tahlil qilinadi. Tadqiqot davomida hayvon timsollari antropomorfizm, totemizm va mifologik qarashlar bilan bog'liq holda o'rganilgan. Shuningdek, ularning ijtimoiy va psixologik konfliktlarni ifodalashdagi roli, bolalar tarbiyasidagi didaktik vazifasi hamda gender stereotiplari va madaniy kodlarni shakllantirishdagi o'rni ko'rsatib berilgan. Ingliz ertaklarida uchraydigan hayvon obrazlari nemis, fransuz va slavyan folklori bilan qiyoslangan va ularning universalligi hamda madaniy moslashuvchanligi aniqlangan. Xususan, bo'ri, tulki, ayiq, quyon kabi obrazlar orqali jamiyatning axloqiy qadriyatlari, qo'rquvlari va orzu–umidlari badiiy