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ENTITLED

Design of a Human-Al Interaction Interface for the English Language Assessment

Publicly defended, on 12/06/2024 before the jury consisting of:

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Dedication

I dedicate my thesis to my beloved late father and cherished mother, whose permanent support and encouragement have always guided my way.

To my friends, who provided me with the understanding I needed to pursue my project. Special dedication to Abdessater for his precious assistance and expertise in the development of my web application.

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Table of content

List of figures vii
General Introduction 1
Chapter 1 3
The English Language Placement Test 3
Introduction 4
1. Synopsis of the English Language Placement 4
1.1 Evolution of English Language Placement Testing 4
1.2 Present Approaches and Technologies in Language Evaluation 5
2. The English Language Skills tested 5
3. Understanding the Significance of English Placement Test Levels 7
3.1 The English Placement Test Levels 7
3.2 Deciphering the Importance of English Placement Tests 9
4. Overview of Web Applications 10
4.1 Educational Web Applications 11
4.2 English Placement Test Web Applications 11
4.3 Advantages of Online Testing 11
Conclusion 11
Chapter 2 12
English Placement Test Design 12
Introduction 13
1. User Experience (UX) design principles 13
2. Web Application design and content 14
2.1 Diagrams 15
3. Test Structure and Content 20
3.1. English Placement Test Guide 21
3.2 Test Overview 21
4. Test Automated Scoring System 25
4.1 Test Scoring 26
5. Distinguishing Features of Our Web Application Compared to Traditional Web Applications 27
5.1 Traditional English Placement Test Web Application 28
5.2 Our English Placement Test Web Application 28
Conclusion 29
Chapter 3 30

AI integration in Language Learning and Evaluation 30
Introduction **31**
1. Interplay between Humans and AI in Language Learning and Evaluation **31**
1.1. AI & ML: Outside Natural Language Processing **31**
1.2 AI in English Learning and Evaluation **32**
1.3 Automated Evaluation and Feedback **32**
1.4 Personalization and Immediate Feedback in Language Learning **32**
1.5 Interactive Learning Tools **33**
2. Chatbots **33**
2.1. Chabot with JavaScript **33**
2.2. The English Language Placement Test Chatbot **34**
3. Selection of AI Models **35**
3.1 Logistic Regression **35**
4. Data Collection and Analysis **39**
4.1 Data Collection **39**
4.1 Data Analysis **42**
2 AI Feedback Mechanisms **44**
Conclusion **45**
Chapter 4 46
Implementation and realization 46
Introduction 47
1. Tools **47**
1.1 Development tools **47**
1.2 Programming languages **50**
2. Implementation and Results **53**
3. Additional detailed feedback report **59**
3.1 Language Use: **59**
3.2 Vocabulary: **60**
3.3 Listening Comprehension: **60**
Conclusion **62**
General Conclusion 63
Bibliography 64

List of figures

Fig. 1.1 :English Language Skills ……..11

Fig. 1.2: English Placement Test Levels…….……14

Fig. 2.1: Use case Diagram ……19

Fig. 2.2: Sequence Diagram ……..……..20

Fig. 2.3: Activity Diagram……...……..21

Fig. 2.4: Class Diagram ….……...……..21

Figure 3.1: Schematic diagram for logistic regression classification…..……..37

Fig.4 2: Visual Studio ……...……..48

Fig.4.2: Jupyter……..…….48

Fig.4.3:phpMyAdmin……..……..…….49

Fig.4.4:MySQL……...…….49

Fig.4.5:XAMPP……..……..……..49

Fig.4.6: Google Chrome ……...……..……..50

Fig.4 .7: HTML……..50

Fig.4.8 : CSS……..……..51

Fig.4 9: JavaScript……...……...……..51

Fig. 4.10: php ……..……...……..52

Fig.4 11: SQL……..……..……..52

Fig.4.12: Sign up page……..53

Fig.4.13: Sign In page ……..……..53

Fig.4.14: Home Page……...…...……..54

Fig. 4.15: Chatbot interface……...……..54

Fig. 4.16: Chatbot interface……...……..55

Fig. 4.17: Questions Box……..55

Fig. 4.18: Questions Box……..……..56

Fig. 4.19: Resault Box……...……..56

Fig. 4.20: Chatbot interface……...……..……..57

Fig. 4.20: Chatbot interface……...……..……..58

Fig. 4.24*:* *User Test score*……..……...……..……..59

Fig. 4.24*:* *User Test feedback*……...……..……...…..60

General Introduction

English is considered the global language of business, science, and communication. It is one of the most spoken languages worldwide, with about one in five people able to communicate in English. This widespread usage underscores its importance in various fields, making its proficiency a valuable skill. In the realm of English language education, English language placement tests serve as crucial gateways, determining individuals' proficiency levels and guiding them toward appropriate learning paths. These tests are designed to evaluate various aspects of language competence such as grammar, vocabulary, reading, writing, and speaking. They play a pivotal role in educational settings, language learning programs, and academic institutions worldwide.

However, traditional methods have often fallen short in providing comprehensive feedback, particularly in web applications. Current applications lack detailed reports on users' strengths and areas for improvement. This deficiency limits their effectiveness in facilitating personalized learning experiences.

Nevertheless, with the rapid advancement of artificial intelligence (AI), the landscape of English language placement tests is evolving. State-of-the-art technologies and adaptive learning algorithms are reshaping these tests into dynamic tools for individualized learning. In particular, our research introduces a novel approach by integrating AI to provide detailed reports and personalized feedback to users. By leveraging AI capabilities, we aim to address the limitations of existing web applications, enhancing the user experience and optimizing learning outcomes.

However, our test does not currently include a speaking component. This decision was made due to several reasons, including time constraints and potential logistical challenges associated with assessing speaking proficiency in an automated online setting. While speaking skills are undoubtedly crucial in language proficiency assessment, incorporating them into our AI-driven web application would require significant resources and may introduce additional complexities. Therefore, for the sake of efficiency and practicality, our test focuses primarily on assessing other language competencies such as Language Use, Vocabulary, and Listening Comprehension.

The primary objectives of this research are to design and develop a human-AI interaction interface for the English Language Assessment. The latter will concern the English. Language Placement Test (ELPT). This involves creating a web application that utilizes AI to provide an

accurate and efficient assessment of English language proficiency. The research aims to explore and implement AI models that can enhance the test's accuracy and user experience, investigate the interplay between humans and AI in language learning and evaluation, and ultimately provide a more effective and engaging assessment tool for learners.

This thesis is structured as follows: Chapter 1 provides a detailed overview of the English Language Placement Test, including its history, the skills tested, and the significance of different proficiency levels. Chapter 2 focuses on the design aspects of the English Placement Test, covering user experience (UX) design principles, web application content, and the structure of the test. Chapter 3 discusses the integration of AI into the English Placement Test, detailing the selection of AI models, data collection and analysis, and AI feedback mechanisms. Chapter 4 describes the implementation process, including the tools used, the development process, and the results of the implemented system. The conclusion summarizes the findings of the research, its implications, and potential future work.

In essence, the integration of AI into English Language Placement tests not only enhances the accuracy and efficiency of language assessment but also contributes to more personalized and adaptive learning experiences. This research aims to bridge the gap between traditional language assessment methods and modern technological advancements, paving the way for more innovative educational tools.

Chapter 1

The English Language Placement Test

Introduction

This chapter provides an overview of the English Language Placement Test, a crucial tool for assessing proficiency in English. It begins with a definition and history of the test, highlighting its evolution and significance in various contexts such as education and employment. The chapter then explores the different language skills tested—grammar, vocabulary, reading, writing, listening, and speaking—and explains how test results are used to classify proficiency levels. Additionally, it examines the modern approaches and technologies, like Computer-Based and Internet-Based Testing that have revolutionized these assessments. Finally, it discusses the importance of such a test in guiding learners, enhancing career opportunities, meeting educational or immigration requirements, and the advantages of online testing, including convenience, flexibility, cost-effectiveness, and immediate results.

1. Synopsis of the English Language Placement

The English Placement Test is an assessment designed to determine an individual's proficiency level in the English language. This test is commonly used by educational institutions, language schools, and employers to place individuals in appropriate language courses or job positions that match their skill level. The English Placement Test typically evaluates various aspects of language proficiency, including grammar, listening comprehension, vocabulary and reading comprehension, writing, and speaking. The results of this test help institutions and organizations make informed decisions about placement and instruction.

1.1 Evolution of English Language Placement Testing

The history of English Language Placement Tests dates back to the late 19th century when the need for standardized assessments of language proficiency emerged, particularly in academic and professional settings. Here's a brief overview of the evolution of English Language Placement Tests.[1]

- Late 19th Century: ESL (English as a Second Language) testing began at Cambridge and Oxford in England.
- 1950s: Pioneering studies and tests created by Robert Lado and David Harris marked the beginning of language assessment in the United States. The Michigan Tests were developed by the English Language Institute at the University of Michigan.

- 1964: The Test of English as a Foreign Language (TOEFL) was developed by the Educational Testing Service (ETS), headquartered in Princeton, New Jersey.
- Present: Michigan Tests, now known as Michigan Language Assessment, and TOEFL remain significant assessments in the field of language testing, continually evolving to meet the needs of learners and institutions worldwide[1].

1.2 Present Approaches and Technologies in Language Evaluation

In this section, we explore the current state of language evaluation, examining recent advancements and contemporary technologies used to assess linguistic proficiency. Our investigation begins with developments since the year 2000.

2000s-Present: The advent of Computer-Based Testing (CBT) and Internet-Based Testing (IBT) revolutionizes the administration of English Language Placement Tests.[2]

2005: TOEFL iBT is introduced, offering an internet-based version of the TOEFL test, providing greater accessibility and convenience for test takers worldwide.[2]

2011: The IELTS (International English Language Testing System) test is made available in a computer-delivered format, complementing the traditional paper-based test.[2]

2. The English Language Skills tested

An English Placement Test is designed to assess a student's proficiency in the English language. Depending on the institution, the test can cover various aspects of English language skills. Here's what an English placement test might include:

Grammar

Multiple-choice or fill-in-the-blank questions test knowledge of grammar rules, such as verb tenses, subject-verb agreement, articles, prepositions, and sentence structure.

Vocabulary

Vocabulary exercises assess knowledge of word meanings, synonyms, antonyms, idiomatic expressions, and collocations. Contextual usage questions are also used to test understanding of vocabulary in sentences or paragraphs.

Reading Comprehension

Passages of varying lengths are followed by comprehension questions to evaluate understanding of main ideas, supporting details, inference, and vocabulary in context.

Writing Skills

Essay or short-answer questions requiring written responses to prompts are suggested to test, the ability to organize ideas, express opinions, provide examples, and use correct grammar and vocabulary.

Listening Comprehension

Audio recordings of conversations, lectures, or presentations followed by questions are meant to assess comprehension of spoken English, including main ideas, details, and inference.

Speaking Skills (if applicable)

Oral interview or presentation tasks are introduced in some tests. The students respond to questions, describe pictures, narrate experiences, or engage in discussions to demonstrate speaking fluency, pronunciation, and ability to communicate ideas coherently.

Fig. 1.1 English Language Skills [2]

3. Understanding the Significance of English Placement Test Levels

English placement tests are essential tools for evaluating language proficiency. These tests classify proficiency into levels from beginner to advanced. Understanding these levels helps learners identify their current skills and areas for improvement, guiding them toward appropriate educational and professional opportunities.

3.1 The English Placement Test Levels

According to the CEFRL (Common European Framework of Reference for Languages), the English placement test typically ranges from beginner to advanced levels, categorized as follows:

A: Basic user

- Beginner Level (A1)

At this level, the student can comprehend and utilize common daily expressions and simple phrases, introduce themselves and others, and inquire about and respond to questions regarding personal information.

This level includes basic vocabulary, familiar everyday expressions, and very basic phrases. It is also related to simple grammar and basic sentence structures. Basic Reading Comprehension deals with short texts and simple vocabulary. Listening Comprehension also encompasses simple instructions, greetings, and short conversations.

- Elementary Level (A2)

At this level, the learner is capable of understanding sentences and commonly used expressions related to areas of immediate relevance and daily activities, hobbies, and interests. The student can engage in simple and routine tasks that involve straightforward exchanges of information on familiar topics.

The student can tackle more complex grammar: Present and past tenses, basic question forms, and simple conjunctions. At this level, Reading Comprehension is improved by the introduction of longer texts with more varied vocabulary and basic inference questions. The Listening Comprehension is also enhanced with short dialogues, basic interviews, and simple narratives.

B: Independent User

- Pre-Intermediate Level (B1)

At this level, the student is capable of grasping the primary ideas presented in clear, standard input concerning familiar topics commonly encountered in work, school, leisure, etc, and can effectively handle most situations likely to occur while traveling in regions where the language is spoken. The vocabulary range is increased: common idiomatic expressions, more varied verbs, and adjectives.

The student masters intermediate grammar: Present perfect tense, future tense, comparatives, superlatives, and conditional sentences. Better Reading Comprehension is observed: Texts with more diverse topics, implicit meaning, and multiple-choice questions. There is also an improvement in listening comprehension: longer conversations, narrative passages, and more complex instructions.

- Intermediate Level (B2)

At this proficiency level, students demonstrate the ability to comprehend the main ideas of complex texts spanning both concrete and abstract topics, including technical discussions within their specialized field. They are also capable of engaging in interactions with a degree of fluency and spontaneity that facilitates regular communication with native speakers. Learners have expanded vocabulary: Academic and professional terminology, idiomatic expressions, and phrasal verbs.

They also grasp Intermediate grammar: Past perfect tense, reported speech, modal verbs, and complex sentence structures. In addition, they have advanced Reading Comprehension skills regarding longer articles, literary texts, and analytical questions. Their Listening Comprehension is more advanced as they can understand lectures, debates, news broadcasts, and interviews with multiple speakers.

C: Proficient User

- Upper-Intermediate Level (C1)

Students can comprehend a broad spectrum of challenging and lengthy texts, discerning implicit meanings within them. They can also articulate thoughts with fluency and spontaneity, demonstrating a natural expression of ideas without apparent hesitation or struggle in finding appropriate words.

Furthermore, they can use sophisticated vocabulary: Advanced idioms, synonyms, and nuanced language, as well as advanced grammar: Passive voice, subjunctive mood, relative clauses, and complex conditionals. Advanced Reading Comprehension encompasses the

analysis of complex articles, literary texts, and critical thinking questions. Likewise, advanced Listening Comprehension involves engaging with academic lectures, TED Talks, podcasts, and interviews covering specialized topics.

- Advanced Level (C2)

At this level, students can effortlessly comprehend virtually all information presented orally or in written form, summarize content from various spoken and written sources, and cohesively reconstruct arguments and narratives. They can also express themselves naturally, with great fluency and precision, discerning nuanced meanings even in complex contexts. In addition, they master proficient vocabulary: idiomatic expressions, colloquialisms, and specialized terminology.

At this level, students demonstrate mastery of grammar, showcasing proficiency in all verb tenses, adeptness in constructing advanced sentence structures, and comprehension of complex grammar rules. Furthermore, they exhibit advanced Reading Comprehension skills, allowing them to analyze academic papers, literary works, and texts exploring abstract concepts with depth and precision. Additionally, students possess advanced Listening Comprehension abilities, enabling them to understand specialized lectures, debates, panel discussions, and nuanced interviews effectively.

Fig. 1.2: English Placement Test Levels [3]

3.2 Deciphering the Importance of English Placement Tests

There are several reasons why one might want to take an English Placement Test:

Assessment of Proficiency: the English Placement Tests can provide you with an objective assessment of your proficiency in the language. This can help understand your strengths and areas for improvement, whether you are learning English as a second language or seeking to refine your skills as a native speaker.

Educational Purposes: If you are considering enrolling in an English language course, program, or school, taking a placement test can help determine the most suitable placement for your level. It ensures that you are placed in a class or program that matches your current abilities, maximizing the effectiveness of your learning experience.

Employment Opportunities: Some employers require English language proficiency as a prerequisite for certain positions, especially in multinational companies or roles that involve communication with international clients or colleagues. Taking an English Placement Test and obtaining a recognized certification can enhance your resume and increase your competitiveness in the job market.

Visa and Immigration Requirements: For individuals applying for visas or immigration to English-speaking countries, such as the United States, the United Kingdom, Canada, Australia, or New Zealand, demonstrating English language proficiency may be a requirement. Taking an English Placement Test and achieving a specific score can fulfill these requirements and support your visa or immigration application.

Personal Development: Assessing your English language skills through a Placement Test can be a valuable step in your personal development journey. It allows you to set achievable goals, track your progress over time, and take targeted steps to enhance your proficiency in areas where you may need improvement.

Study Abroad Opportunities: If you are considering studying abroad in an English-speaking country, many educational institutions require proof of English proficiency as part of the application process. Taking an English Placement Test and achieving the required score can qualify you for admission to your desired program and institution.

4. Overview of Web Applications

Web Applications are digital platforms accessible through the internet, designed to provide information, services, or interactive features to users. They come in various forms and serve numerous purposes, such as Informational, E-commerce, Social Media, and Educational Service-based Web Applications [3].

Web Applications are built using a combination of technologies such as HTML, CSS, and JavaScript. They may incorporate multimedia elements like images, videos, and interactive features to enhance user experience. They are accessible via web browsers on various devices, including computers, tablets, and smartphones [4].

4.1 Educational Web Applications

Educational Web Applications are digital platforms designed to provide learning resources, courses, and training materials to users of all ages and educational backgrounds. These Web Applications play a crucial role in facilitating education by offering accessible, flexible, and often interactive learning experiences. They furnish a wide range of subjects and skills, from academic topics to professional development and hobby learning [5].

4.2 English Placement Test Web Applications

In the realm of educational Web Applications, English Placement Test Web Applications hold a special place. These platforms are specifically designed to assess a user's proficiency in the English language to recommend appropriate learning levels and courses [5].

4.3 Advantages of Online Testing

The shift towards online testing brought several benefits for test-takers:

Convenience: Test takers can take the test from anywhere with an internet connection, eliminating the need to travel to a testing center.

Flexibility: Online tests can be taken at any time, allowing test takers to choose a time that best fits their schedule.[6]

Cost-effective: Online tests often cost less to administer compared to traditional paper-based tests, making them more accessible to a wider range of test takers.

Immediate Results: Results are usually available instantly or within a short period, allowing test takers to know their placement quickly.[6]

Adaptive Testing: Many online tests are adaptive, meaning the difficulty of the questions adjusts based on the test taker's responses, providing a more accurate assessment of their English proficiency[6]

Conclusion

The English Language Placement Test is essential for assessing proficiency in English. It helps place individuals in suitable courses or job positions by evaluating grammar, vocabulary, reading, writing, listening, and speaking skills. These tests guide learners in improving their skills and support educational, employment, and personal development goals.

Chapter 2

English Placement Test Design

Introduction

In this chapter, we delve into the methodology behind the creation and implementation of an English placement test Web Application. We explore how User Experience (UX) design principles are integrated to enhance the user journey, the structure and content of the test itself, the use of an advanced automated scoring system, and the distinguishing features that set this Web Application apart from traditional test platforms.

1. User Experience (UX) design principles

User Experience (UX) design principles form the bedrock of creating products and services that offer meaningful, efficient, and enjoyable experiences for users. In the context of an English placement test Web Application, these principles are paramount for ensuring a seamless and effective user experience. User-centered design, the cornerstone of UX, dictates prioritizing the needs and preferences of test-takers. Conducting thorough research to grasp their goals, language proficiency levels, and potential pain points is fundamental.[7]

Usability stands as another crucial principle, necessitating the design of the Web Application with intuitive navigation and clear instructions. Test-takers should easily find and access the test, comprehend questions, and submit answers without confusion. Consistency in design elements such as layout, color scheme, and typography is pivotal. This fosters familiarity and confidence among users as they navigate different sections of the test.[7]

Visual Hierarchy plays a pivotal role in guiding users through the test smoothly. Emphasizing crucial information like test instructions and question prompts through clear differentiation between headings, questions, and answers is essential. Additionally, providing users with control over their testing experience, including the ability to navigate freely between questions, enhances user satisfaction and engagement.[7]

Accessibility is a fundamental principle that ensures the Web Application caters to users with diverse language backgrounds and abilities. This involves providing clear language options and incorporating features like text-to-speech functionality. By adhering to these UX design principles, the English placement test Web Application

can offer an efficient, user-friendly experience for test-takers, ultimately leading to accurate assessments and heightened user satisfaction.[7]

2. Web Application design and content

On our English placement test Web Application, users are greeted with a homepage where they can either sign up for a new account or sign in with their existing credentials. This authentication process ensures that only registered users can access the test content. Once authenticated, users are directed to the homepage where they find comprehensive information about the test structure, including its components and instructions. This homepage serves as a central hub for users to navigate through the test-taking process.

One of the key features of our Web Application is the JavaScript chatbot, which offers personalized assistance and guidance to users. Through the chatbot interface, users can initiate the test-taking process. Upon starting the test, the chatbot seamlessly directs users to the Questions Box, a dedicated interface for answering test questions. Unlike the chatbot interface, the Questions Box is specifically designed for presenting test questions and receiving user responses.

Within the Questions Box, users encounter a series of questions presented one at a time. Users select their answers to each question, and the interface provides immediate feedback on their responses. This interactive process continues until the user completes all the questions in the test. Once all questions are answered, users are automatically redirected to the Result Box, where their test scores and levels are displayed based on their performance.

Additionally, users have the option to request feedback on their test performance. This feedback is tailored to each user based on their test results and stored data in the database. The Web Application ensures data integrity and security by managing user information, test scores, and feedback requests in a structured database. Throughout the entire test-taking process, the Web Application provides a seamless and user-friendly experience, guiding users from authentication to test completion and feedback retrieval.

2.1 Diagrams

Unified Modeling Language (UML) is a standardized visual language used in software engineering to represent system designs and architectures. It offers a variety of diagrams, such as Class Diagrams for illustrating class structures, Use Case Diagrams for showing user interactions, and Sequence Diagrams for visualizing object interactions over time. UML provides a consistent notation with symbols and relationships to depict components like classes, interfaces, and their relationships, aiding in communication and documentation of complex systems. UML diagrams are essential tools for planning, designing, and documenting software systems, facilitating better understanding and collaboration among stakeholders throughout the software development process.

Let's dive into the visual representations that help illustrate the UX design principles applied in my Web Application:

Indent Use Case Diagram: This diagram highlights the functional capabilities and interactions between users and the Web Application's features. It outlines scenarios such as signing up, signing in, starting the test, and receiving feedback, serving as a blueprint for designing user-centric features.

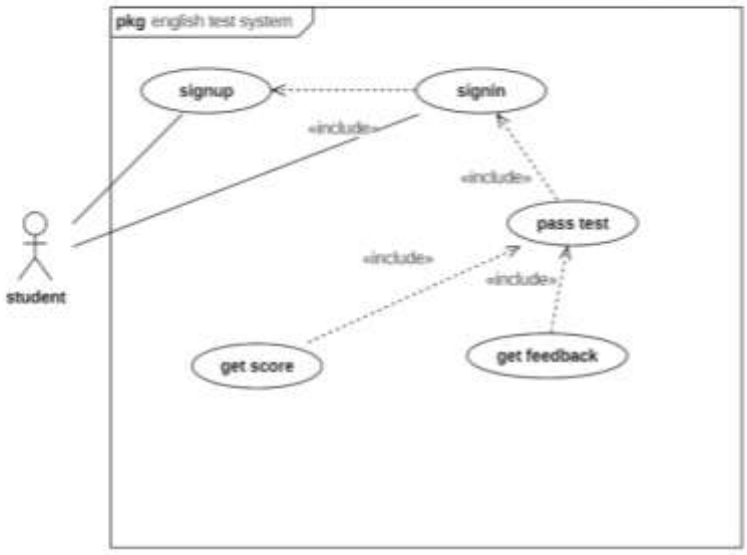

Fig. 2.1: Use case Diagram

This Use Case Diagram outlines interactions within the English Test System. Students can "Sign Up" or "Sign In" to access the system. Once signed in, they navigate to the home page and use a chatbot to "Start Test," answering questions until they

"Finish Test." After completing the test, they can "View Level/Score" and "Receive Feedback" on their performance. The diagram highlights key functionalities and user interactions, emphasizing a smooth and sequential flow from registration to post-test evaluation.

Class Diagram: This diagram provides insight into the structural relationships within the English placement test Web Application's system. It showcases entities such as User, Database highlighting how user information and test scores are stored and associated within the system.

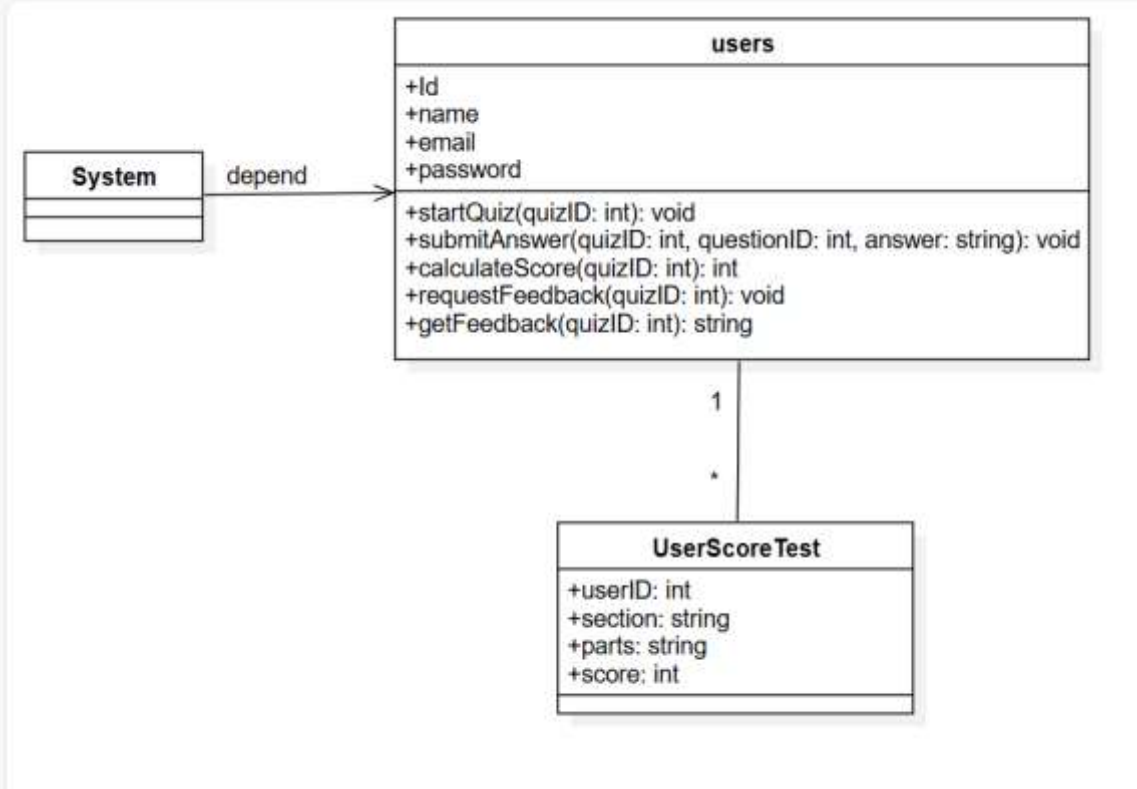

Fig. 2.2: Class Diagram

This UML class diagram depicts a quiz or test system. Users interact through methods like startQuiz, submitAnswer, and getFeedback, managing quizzes and receiving detailed performance feedback. The Feedback class stores feedback details such as section and score, while the System class oversees system-wide operations, ensuring seamless interaction between users and feedback instances.

Sequence Diagram: The Sequence Diagram offers a dynamic depiction of the interactions between users and various components of the Web Application during the test-taking process. It outlines the sequential flow of actions, from signing up or signing in to completing the test and receiving feedback, providing valuable insights into the user journey.

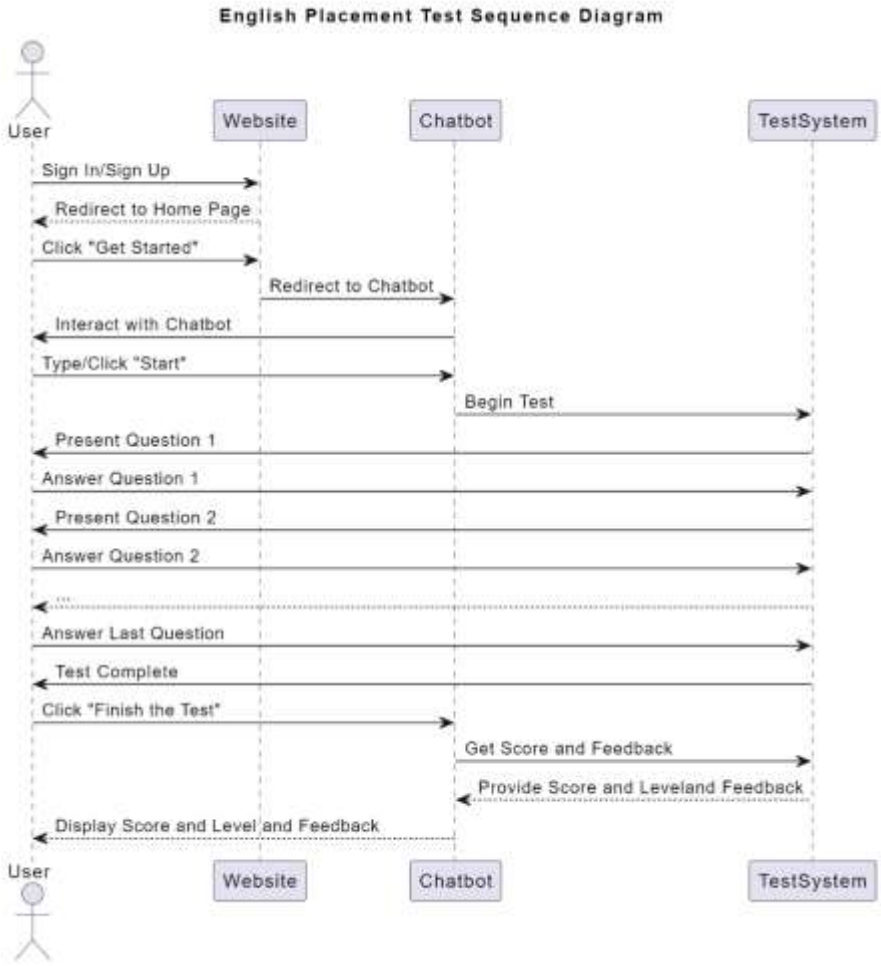

Fig. 2.3: Sequence Diagram

This sequence diagram depicts the user journey for the English placement test. It starts with user sign-in or sign-up on the website, followed by clicking "Get Started" to interact with a chatbot. After starting the test, the chatbot communicates with the test system to present questions sequentially. The user answers each question until completing the test, then requests their score and feedback. The chatbot displays this information, concluding the test process efficiently.

Activity Diagram: The Activity Diagram outlines the procedural flow of activities involved in the test-taking process. It illustrates the sequential steps users take, enabling designers to identify potential bottlenecks or inefficiencies and optimize the user experience accordingly.

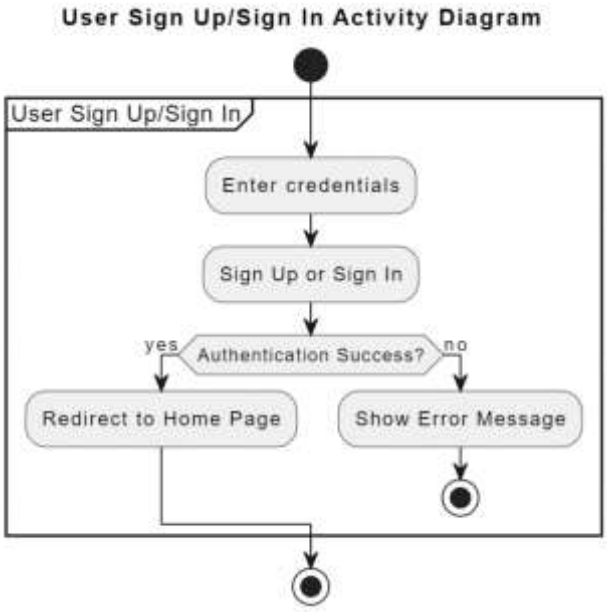

Fig. 2.4: Activity Diagram

User Sign Up/Sign In Activity Diagram

This diagram illustrates the user authentication process. Users enter their credentials to sign up or sign in. If the authentication is successful, they are redirected to the home page. If authentication fails, an error message is shown, and the process stops.

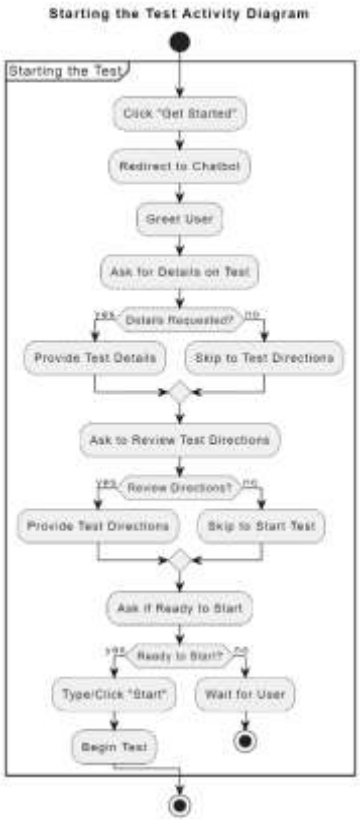

Fig. 2.4: Activity Diagram

Starting the Test Activity Diagram

This diagram shows the activities involved in starting the test. After clicking "Get Started," the user is redirected to the chatbot. The chatbot greets the user, asks if they want test details, and offers to review test directions. Based on the user's responses, the chatbot proceeds to ask if they are ready to start the test.

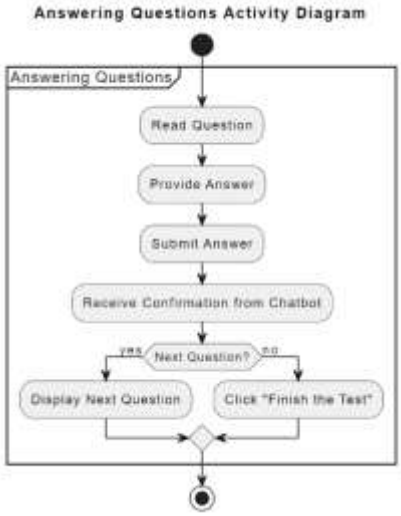

Fig. 2.4: Activity Diagram

Answering Questions Activity Diagram

This diagram details the process of answering test questions. Users read a question, provide their answer, and submit it. The chatbot confirms receipt of the answer. If there are more questions, the next question is displayed. If not, the user clicks the "Finish the Test" button.

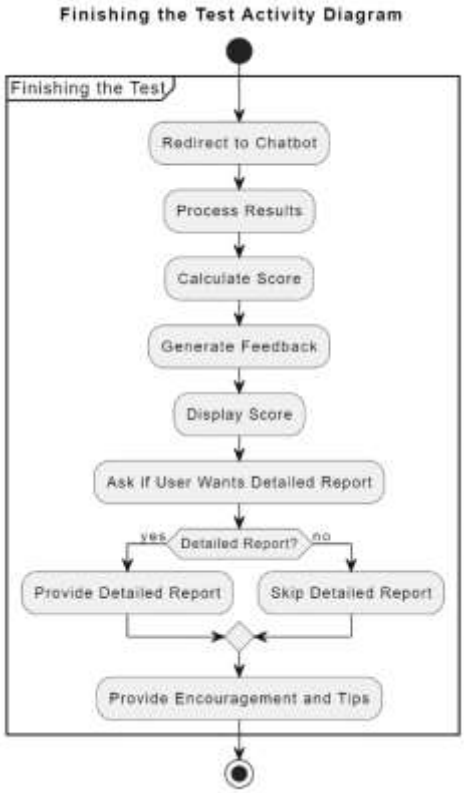

Fig. 2.4: Activity Diagram

Finishing the Test Activity Diagram

This diagram outlines the activities involved in finishing the test. After finishing, users are redirected to the chatbot, which processes the results, calculates the score, and generates feedback. The chatbot then displays the score and asks if the user wants a detailed report. Based on the response, it either provides the report or skips this step, and finally offers encouragement and tips.

3. Test Structure and Content

This test is designed to assess your proficiency in various aspects of the English language. It consists of three sections, each focusing on different skills and areas of evaluation.

3.1. English Placement Test Guide

Section 1: Language Use

In this section, your understanding of English grammar will be evaluated. You will address questions specifically designed to assess your ability to use grammatical elements accurately within sentences. These questions aim to measure your proficiency and reinforce your comprehension of the material.

Section 2: Vocabulary

The Vocabulary section is designed to test your understanding of English vocabulary. You will be given questions that assess your ability to comprehend and use vocabulary in different contexts. This section aims to evaluate your proficiency in accurately applying vocabulary.

Section 3: Listening Comprehension

The Listening Comprehension section evaluates your ability to understand spoken English. You will listen to short audio clips and answer questions based on the information presented. This section assesses your capacity to grasp details, key information, and main points from the audio clips.

3.2 Test Overview

The genuine English placement test comprises 60 questions, yielding a general score out of 100. Aligned with the Common European Framework of Reference for Languages (CEFRL), the proficiency levels range from A1 to C2. To better contextualize our approach, it's essential to grasp the proficiency levels from A1 to C2, each of which corresponds to specific score ranges:

A1: Beginner - Scores below 20

A2: Elementary - Scores between 20 and 40

B1: Intermediate - Scores between 41 and 60

B2: Upper-Intermediate - Scores between 61 and 80

C1: Advanced - Scores between 81 and 90

C2: Proficiency - Scores above 90

However, for the sake of efficiency during the oral interview (viva), we recommend a condensed version, consisting of a sample set of 12 questions to be completed within a twelve-minute timeframe.

The test comprises three sections: Language Use, Vocabulary, and Listening Comprehension. In the Language Use section, there are six questions that specifically target determiners of quantity, transition words, and conjunctions. The Vocabulary section consists of three questions that assess the understanding of words in context and the usage of phrasal verbs. Similarly, the Listening Comprehension section contains three questions aimed at evaluating the ability to discern details, extract key information, and integrate both skills effectively.

Here, we offer an exposition of sections and questions:

I. Language Use Section:

Number of Questions: 6

Parts:

A. Determiners of Quantity

a) Little, few, a few

b) No, none, either, any

c) Most, much, many, most of

B. Transition Words or Conjunctions

a) Of Emphasis

b) Of Alternative

c) Of Addition

C. Tenses: Past, Present, and conditionals

II. Vocabulary Section:

Number of Questions: 3

Parts:

A. Words in Context

B. Phrasal Verbs

III. Listening Comprehension Section:

Number of Questions: 3

Parts:

A. Listening for Details

B. Listening for Key Information

C. Listening for Key Information and Detail

Here are some sample questions Questions from the Test

Language Use

Choose the correct answers to complete the sentences:

Question 1: ……people went to see the film, so it was only on at the cinema for two weeks.

A. A few

B. Few

C. A little

D. Little

Question 2:

…….. of the information is correct.

A. No

B. None

C. Any

D. Either

Question 3:

…….. teenagers use social networking sites.

A. Most

B. Much

C. Many of

D. Most of

Question 4:

I don't remember _____ my computer.

A. How long I've had

B. When did I get

C. For how long have I had

D. When I was getting

Question 5:

Andrew _____ the course on Javascript programming.

A.Had already taken

B.Has already taken

C.Takes

D.Would have already taken

Question 6:

Select the missing transitions from the list:

Therefore But In Fact For Instance Moreover So that Also Since Even though Rather

Though eating disorders produce physical damage to the body, they are not 1 ___ physical illnesses. 2 ___, they are mental issues that develop more frequently among females but do affect the male population as well. Anorexia nervosa, one of the most common eating disorders, is characterized by extremely low body weight and a distorted self-body image accompanied by an intense fear of gaining weight. Extreme exercising is 3 ___ commonly associated with anorexia and is believed to be its direct consequence.

Vocabulary

Select the correct option (A, B, C, or D) to complete each sentence:

Question 7

I am rather ..... about her health. Really, I must see the doctor at once.

A. conceited
B. complicated
C. concerned
D. continuous

Question 8

Punctual people always _____ being a little early for their appointments.

A. hang up on
B. lose track of
C. keep away from
D. make a point of

Question 9

The team decided to _____ the project due to unexpected budget constraints.

A. give up
B. carry on
C. run out
D. look after

Listening Comprehension

Listen to the audio clip, then answer the following questions:

Link of the Audio clip:

https://drive.google.com/file/d/1xZco0KNaYQH1x3AXJS9TdiKaRgBfTJ93/view?usp=sharing

Question 10

Who is conducting the interview on behalf of Smart Travel magazine?

A. Tourist
B. Traveler
C. Photographer
D. Reporter

Question 11

For what reason does the individual from the United States find themselves in the United Kingdom?

A. London Fashion Week
B. Family visit
C. Vacation
D. Business

Question 12

What are the prospective actions of the individual subsequent to their sojourn in London?

A. Fly to Ireland for a vacation
B. Return to the US
C. Attend a photoshoot
D. Visit family in London

This structure provides an overview of our English Placement Test, detailing each section and including examples to illustrate the types of questions and answers.

4. Test Automated Scoring System

Our English Placement Test stands out due to its unique features, which showcase an advanced automated scoring system meticulously designed to deliver prompt and precise results. This is how the process operates :

1. Immediate Feedback

Once you complete the test, the automated system instantly processes your answers. You receive immediate feedback on your performance.

2. Accurate Scoring

The system uses a pre-defined answer key to compare your responses.

Each correct answer is awarded 1 point, with the total possible score being 12 points.

Your final score is calculated based on the number of correct answers out of 12.

3. Detailed Results

The system not only provides your overall score but also breaks down your performance by section.

This detailed feedback helps you understand your strengths and areas for improvement in Language Use, Vocabulary, and Listening Comprehension.

4. Consistency and Fairness

Automated scoring ensures that every test taker is evaluated consistently and fairly.

There is no room for human error or bias, ensuring that all scores are purely based on the responses given.

4.1 Test Scoring

Total Questions: 12

Total Possible Score: 12 points, with a perfect score of 12 points corresponding to 100 marks

Sections and Questions Breakdown:

Language Use Section

Number of Questions: 6

Scoring: 1 point per correct answer (Total: 6 points)

Parts:

Determiners of Quantity, Transition Words or Conjunctions (4 points)

Tenses (2 points)

Vocabulary Section

Number of Questions: 3

Scoring: 1 point per correct answer (Total: 3 points)

Parts:

Words in Context (1 point)

Phrasal Verbs (2 points)

Listening Comprehension Section:

Number of Questions: 3

Scoring: 1 point per correct answer (Total: 3 points)

Parts:

Listening for Details (1 point)

Listening for Key Information (1 point)

Listening for Key Information and Detail (1 point)

General score and feedback

According to the Common European Framework of Reference for Languages (CEFR), the proficiency levels range from A1 to C2. If we are mapping these levels to a total score of 12 points, we could break it down as follows:

- **A1 (Beginner)**: 0-2 points
- **A2 (Elementary)**: 3-4 points
- **B1 (Intermediate)**: 5-6 points
- **B2 (Upper Intermediate)**: 7-8 points
- **C1 (Advanced)**: 9-10 points
- **C2 (Proficient)**: 11-12 points

5. Distinguishing Features of Our Web Application Compared to Traditional Web Applications

Our English Placement Test Web Application stands at the forefront of language assessment technology thanks to its sophisticated methodology, innovative AI integration, and comprehensive user experience. Below, we highlight the key features and distinct aspects of our Web application that set it apart from conventional English Placement Test web applications.

We employ advanced machine learning techniques, including logistic regression models, to analyze test responses and generate personalized feedback. This ensures highly accurate and adaptive assessments that cater to the unique needs of each user. Additionally, our system automates the scoring process and immediately provides detailed feedback. This includes both positive reinforcement for correct answers and specific guidance for incorrect responses, enhancing the learning experience.

Our detailed results provide a breakdown of performance across different sections, helping users identify specific strengths and areas for improvement in Language Use, Vocabulary, and Listening Comprehension. This ensures that users receive a comprehensive understanding of their proficiency levels.

Designed with user experience (UX) principles, our Web Application is easy to navigate, ensuring a seamless and stress-free testing process for users of all ages

and technical abilities. The intuitive interface makes it accessible and straightforward for everyone to use.

Users receive their scores immediately upon completing the test, along with detailed feedback on their performance in each section. This prompt feedback helps users quickly understand their proficiency level and areas needing improvement. Based on test results, our system provides personalized study recommendations and resources, enabling users to effectively target their weaknesses and improve their English skills.

By integrating these advanced features, our English Placement Test Web Application offers a top-tier and comprehensive assessment solution that is accurate, reliable, and user-friendly. This could position our Web application as the preferred choice for individuals seeking to accurately evaluate and improve their English proficiency.

5.1 Traditional English Placement Test Web Application

According to Education First Web Application, there are just two processes.

1. Questions process

These questions present a sentence or a passage with a blank space or a question, and test takers are required to choose the correct answer from a set of options. These questions assess grammar, vocabulary, and comprehension skills.

2. Evaluation process

After completing the test, responses are scored based on predetermined criteria and scoring rubrics and give the user results.

5.2 Our English Placement Test Web Application

In Our English Placement Test Web Application, there are four processes.

1. Questions process Testing Modules (Reading, Writing, Listening)

Our English Placement Test Web Application is designed to provide a comprehensive and engaging assessment experience by incorporating a variety of question types. These include multiple-choice questions (MCQs) to test various levels of understanding, true or false questions for quick knowledge checks, and short answer questions that require more detailed responses. Additionally, the test features innovative formats such as selecting answers from a bar menu and interactive drag-and-drop tasks. This variety ensures a thorough, dynamic assessment capable of accurately assessing different aspects of language proficiency.

2. Assessment process (Programming assessment)

After completing the test, responses are scored based on predetermined criteria and scoring rubrics programmed by us.

3. Result Analysis

Test scores are analyzed to determine the test taker's proficiency level in different aspects of English, such as Grammar, Vocabulary, Reading Comprehension, Listening Comprehension, and Writing. Scores are reported on a standardized of the CEFRL.

4. Feedback process

Test takers receive feedback on their performance in each section of the test, highlighting strengths and areas for improvement.

Conclusion

In conclusion, this chapter has provided a detailed insight into the methodology employed in designing and implementing an English Placement Test Web Application. By prioritizing User Experience (UX) design principles, structuring the test effectively, implementing an advanced automated scoring system, and highlighting distinguishing features, this Web Application ensures a seamless and comprehensive testing experience. Through adherence to these methodologies, the Web Application not only facilitates accurate assessments but also fosters user satisfaction by providing immediate feedback and valuable insights for improvement. As a result, this chapter underscores the importance of meticulous planning and execution in creating a user-friendly and efficient testing Web Application.

Chapter 3

AI integration in Language Learning and Evaluation

Introduction

The chapter on AI Integration in Language Learning and Evaluation examines the dynamic interaction between humans and artificial intelligence (AI) in education. It explores how AI technologies are transforming language learning and assessment. By combining the strengths of AI, including personalization and automated evaluation, with the expertise of human educators, this chapter aims to create a comprehensive and effective learning environment. From interactive learning tools like chatbots to sophisticated feedback mechanisms powered by machine learning models, this chapter explores how AI is reshaping language education, making it more accessible, efficient, and engaging for learners worldwide.

1. Interplay between Humans and AI in Language Learning and Evaluation

The involvement of humans as well as artificial intelligence in processing language in learning and assessment represents a major change in education. Integrated, they produce a more optimal teaching and learning experience. The emergence of AI technologies, especially those based on recent advances in NLP and machine learning, has the potential to provide personalization, near-instant feedback, and interactivity that have never before been possible. In the meantime, human educators provide the vital cultural context, emotional intelligence, and motivational support that are essential for holistic language education. This axial synergy called for a better Language learning product and together made the learning process more accessible, fertile, and fruitful.

1.1. AI & ML: Outside Natural Language Processing

Artificial Intelligence (AI) is the simulation of human intelligence in machines that are programmed to think and learn in ways that resemble human cognitive processes. AI systems are capable of performing tasks that typically require human intelligence, such as reasoning, learning, problem-solving, perception, and language understanding.[8]

Machine Learning (ML) is a subset of AI that involves the use of algorithms and statistical models to enable computers to perform specific tasks without explicit instructions. Instead, ML systems learn from data, identify patterns, and make decisions based on the data they process.[9]

Natural Language Processing (NLP) is a branch of AI that focuses on the interaction between computers and humans through natural language. It involves enabling machines to understand, interpret, and generate human language in a way that is both meaningful and useful.[10]

In our specific case, we do not use NLP. Our focus is on other areas of AI and ML that do not involve processing natural language. This decision may be influenced by the nature of our data, the particular tasks we are aiming to achieve, or specific project requirements.

1.2 AI in English Learning and Evaluation

AI has transformative potential in the field of education, particularly in English learning and evaluation. By leveraging AI technologies, educational platforms can provide personalized learning experiences tailored to individual students' needs (Luckin et al., 2016). For example, AI algorithms analyze students' learning patterns, strengths, and weaknesses to customize lesson plans, ensuring that students receive content that matches their proficiency levels, learning speeds, and interests, making the learning process more efficient and engaging (Wang & Han, 2017) [11].

1.3 Automated Evaluation and Feedback

AI can streamline the evaluation process by automatically grading essays and assignments. Natural Language Processing (NLP) algorithms can analyze students' writing, checking for grammar, syntax, coherence, and style. This not only saves time for educators but also provides immediate feedback to students, helping them understand and correct their errors promptly.[12]

1.4 Personalization and Immediate Feedback in Language Learning

In recent years, the convergence of human expertise and artificial intelligence (AI) has significantly reshaped the landscape of language learning and evaluation. AI-powered tools[13], leveraging advancements in Natural Language Processing (NLP) and machine learning, have emerged as transformative forces in the educational domain. These technologies offer personalized, adaptive, and interactive learning experiences that were previously unattainable [14].

One of the most notable impacts of AI in language learning is the personalization of educational content. AI algorithms can analyze individual learners' strengths, weaknesses, and learning patterns to tailor lessons specifically to their needs. This

individualized approach ensures that students are consistently challenged at an appropriate level, promoting more effective learning. For instance, language learning applications like Duolingo and Rosetta Stone use AI to adapt their exercises based on user performance, providing a customized learning trajectory for each user [15].

Immediate feedback is another critical advantage brought by AI. Traditional language learning often involves a delay between task completion and receiving feedback from an instructor. AI-driven applications, however, can provide instant feedback, allowing learners to correct mistakes and reinforce learning in real time. This immediacy helps solidify knowledge and keeps learners engaged [16].

1.5 Interactive Learning Tools

Chatbots and virtual tutors provide conversational partners (though only digitally) to ESL students. They offer immediate reinforcement, which allows for more interactive learning so that students can practice their language skills. For example, a chatbot can be used to help students practice conversational vocabulary and grammar, responding to real-time dialogues with errors in grammar and choice of words.

2. Chatbots

Chatbots, also known as conversational agents, are AI-powered programs designed to simulate human conversation. They interact with users through text or speech, providing responses to inquiries, assisting with tasks, or offering guidance in various domains[17]. Chatbots utilize Natural Language Processing (NLP) and Machine Learning (ML) algorithms to understand and interpret user input, allowing them to generate appropriate responses[18]. They have applications in customer service, healthcare, education, and more, offering personalized assistance, improving efficiency, and enhancing user experience[19].

2.1. Chabot with JavaScript

Chatbots implemented using JavaScript are popular due to the versatility and accessibility of JavaScript across various platforms[20]. Leveraging frameworks like Node.js, React, or Angular, developers can build interactive and responsive Chabots capable of understanding user input and providing relevant responses. JavaScript-based Chatbots can be deployed on Web Applications, messaging platforms, and voice-enabled devices, offering a flexible solution for creating conversational interfaces[21].

Chabot's functionality can be further customized and expanded based on your specific requirements and use case.

2.2. The English Language Placement Test Chatbot

The English Language Placement Test Chatbot uses JavaScript and is tailored to respond to specific user messages with predefined bot replies. It utilizes arrays to organize user messages and corresponding bot responses, with functions to process user input and generate appropriate bot replies.

JavaScript-based Chatbots showcase a structured approach to conversational interaction, offering a seamless experience for users engaging with it. Here's a deeper look into its functionality and design:

The Chatbot efficiently categorizes user messages into specific groups based on their content. This categorization, organized within the 'userMessage' array, simplifies the task of interpreting user intent and providing suitable responses.

The Chatbot carefully structures its responses within the 'botReply' array, aligning them with the categories of user messages. This meticulous organization allows the Chatbot to retrieve appropriate responses corresponding to user input, ensuring consistency and relevance in the conversation.

Chatbot excels in providing a diverse range of responses for each user inquiry or prompt. This variability within the `'botReply'` array enhances the conversational experience by introducing dynamism and personality to the interactions, making the conversation engaging and enjoyable for users.

In addition to predefined responses, the Chatbot incorporates alternative responses within the `'alternative'` array to handle unexpected or ambiguous user inputs gracefully. These responses offer guidance or clarification, effectively steering the conversation back on track and maintaining coherence in communication.

Through its user-friendly interface, the Chatbot empowers users to input messages and receive bot responses in real-time. This interactive communication style allows users to initiate conversations, ask questions, or engage in dialogue seamlessly, fostering a smooth conversational flow. Even though this was not introduced in the ELPT Chatbot in this work, there is a possibility to extend its use subsequently.

Quick message buttons existent in ELPT Chatbot enable users to perform specific actions without engaging in a full conversation with the Java-Script Chatbot. These quick messages provide users with convenient options to interact with the Chatbot and

access key functionalities. Here's how these quick messages enhance the user experience:

Start Test: The "START" quick message button allows users to initiate a test or assessment provided by the Chatbot without needing to type out a command or question. This streamlined approach saves users time and effort, making it easier to engage with the Chatbot's assessment feature promptly.

Get Report: Similarly, the "Get Report" quick message button enables users to request a report or summary of their performance or results from the test they've completed. By clicking this button, users can quickly access valuable feedback or insights without navigating through complex menus or commands.

3. Selection of AI Models

Artificial Intelligence (AI) models are computational algorithms designed to mimic human intelligence and decision-making processes[23]. These models are trained on vast amounts of data to recognize patterns, make predictions, and classify inputs into different categories. Classification is a fundamental task in AI, where the model assigns a label or category to a given input based on its features[24].

Classification in AI involves assigning predefined categories or labels to input data based on their features. It is a supervised learning technique, meaning the model learns from labeled data during training to make predictions on unseen data. Classification is widely used across various domains, including image recognition, natural language processing, and medical diagnosis[25]. The goal is to build a model that can accurately classify new instances into the correct categories[26].

3.1 Logistic Regression

Logistic regression is a statistical method used for binary classification tasks, where the output variable has only two possible outcomes. Despite its name, logistic regression is a classification algorithm, not a regression algorithm[27]. It predicts the probability of an instance belonging to a particular class based on its features. The model applies a logistic function to the linear combination of input features to produce a probability score between 0 and 1. If the probability is above a certain threshold, the instance is classified into one class; otherwise, it belongs to the other class[28].

Logistic regression, a foundational method in Machine Learning, is designed for binary classification tasks, where the outcome variable can take one of two distinct values, such as yes or no, pass or fail, or 0 or 1. Its versatility spans multiple domains,

from healthcare to finance, as it excels in making probabilistic predictions using input features.

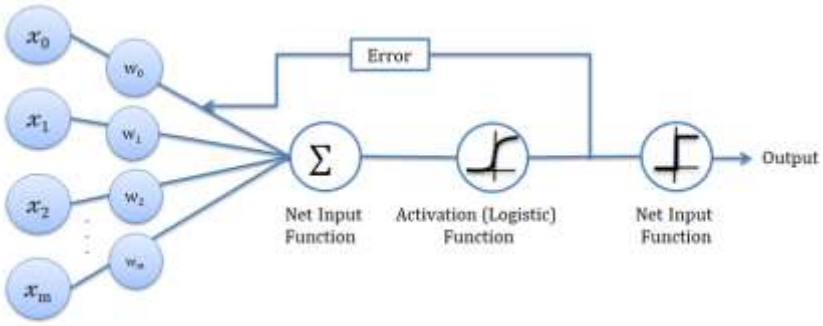

Figure 3.1: Schematic diagram for logistic regression classification [29]

At the heart of logistic regression lies the sigmoid function, which transforms the model's output into probabilities. Expressed as

$$\sigma(z)=1+e-z1$$

When 'z' represents the linear combination of input features and their respective weights, the sigmoid function guarantees that the predicted probabilities lie between 0 and 1. This feature aids in the straightforward interpretation of the predictions as probabilities.

Logistic regression is based on the concept of odds and log odds, where it predicts the log-odds of the probability associated with the default class, often represented as 1. These log-odds are subsequently converted into probabilities through the sigmoid function. This transformation empowers the model to determine class membership based on the derived probabilities.

At the core of the classification process lies the decision boundary, established by a threshold value, commonly set at 0.5. When the predicted probability surpasses this threshold, the model assigns the class label 1; otherwise, it assigns the class label 0. This clear-cut boundary delineates the distinction between the two classes, facilitating straightforward classification.

Mathematically, the logistic regression model is represented as

$$P(Y=1|X)=\sigma(W\cdot X+b)$$

where 'P(Y=1|X)' denotes the probability that the dependent variable Y equals 1 given the input features X. 'W' represents the vector of weights (coefficients), 'X' signifies the vector of input features, 'b' denotes the bias term (intercept), and σ denotes the sigmoid function.

During training, logistic regression enhances its parameters, comprising weights and bias, through techniques like gradient descent, meant to lessen the loss function. The loss function employed is the binary cross-entropy (log loss), computing the inconsistency between predicted probabilities and actual class labels, thus guiding parameter adjustments for enhanced predictive exactness.

Logistic regression is a modest yet prevailing algorithm with numerous benefits. It is computationally effective, interpretable, and offers probabilistic outputs. Furthermore, it can handle both numerical and categorical characteristics and is less inclined to overfit paralleled to more intricate models. Nevertheless, logistic regression assumes a linear relationship between the features and the log-odds of the outcome, which may not always hold true. It is also restricted to binary classification tasks and may be inadequate to highly demanding datasets.

It is also a useful tool for binary classification tasks in AI. Its easiness, interpretability, and efficacy make it appropriate for a varied range of applications. Yet, it is critical to comprehend its assumptions and restrictions when applying it to real-world problems. According to the difficulty and nature of the data, other classification algorithms such as decision trees, support vector machines, or neural networks may be more applicable. The choice of the AI model hangs on factors such as the problem domain, the size and quality of the data, and the desired interpretability of the results.

Let's break down our case in the realm of AI models and logistic regression:

1. Task Description

We are addressing a binary classification problem where the goal is to predict feedback based on input features. The feedback variable likely has two classes (e.g., positive/negative, satisfactory/unsatisfactory), making it suitable for logistic regression.

2. Choice of AI Model

Logistic regression is selected as the AI model for this task. It is a linear classification algorithm that is well-suited for binary classification problems. Given that our target variable has two possible outcomes, logistic regression is an appropriate choice.

3. Data Preprocessing

Before training the model, we preprocess the data. This involves encoding categorical features ('section' and 'parts') using LabelEncoder and scaling numerical

features ('score_x') using StandardScaler. These preprocessing steps are essential to ensure that the data is in a suitable format for the logistic regression model.

```
# Encode categorical features
encoder_section = LabelEncoder()
encoder_parts = LabelEncoder()

combined_data['section'] = encoder_section.fit_transform(combined_data['section'])
combined_data['parts'] = encoder_parts.fit_transform(combined_data['parts'])

# Scale numerical feature
scaler = StandardScaler()
train_data['score_x'] = scaler.fit_transform(train_data[['score_x']])
test_data['score_x'] = scaler.transform(test_data[['score_x']])
```

4. Training the Model

We train the logistic regression model using the training data. The model is trained to learn the relationship between the input features (section, parts, score_x) and the target variable (feedback). During training, the model adjusts its parameters (weights and bias) to minimize the loss function and improve predictive accuracy.

```
# Define features and target variable
X_train = train_data[['section', 'parts', 'score_x']]
y_train = train_data['feedback']

# Train the logistic regression model with increased iterations
model = LogisticRegression(max_iter=1000)  # Increase max_iter to 1000
model.fit(X_train, y_train)
```

5. Making Predictions

After training, we use the trained logistic regression model to make predictions on the test data. The model predicts the feedback for each part in each section based on their respective features. These predictions are then printed in a readable format.

```
# Predict feedback for test data
test_data['predicted_feedback'] = model.predict(X_test)

# Inverse transform the encoded labels to original categorical values
test_data['section_name'] = encoder_section.inverse_transform(test_data['section'])
test_data['part_name'] = encoder_parts.inverse_transform(test_data['parts'])

# Print the output with bold section names and bullet points for parts
printed_sections = set()
for index, row in test_data.iterrows():
    section_name = row['section_name']
    if section_name not in printed_sections:
        printed_sections.add(section_name)
        print(f"Section: \033[1m{section_name}\033[0m")
    print(f" • {row['part_name']}:")
    print(f"   Feedback: {row['predicted_feedback']}")
```

6. Interpretation of Results

The final output provides feedback predictions for each part in each section. By examining these predictions, we can gain insights into which parts and sections are likely to receive positive or negative feedback. This information can be valuable for making data-driven decisions and improving performance in The English Language Placement Test

In summary, our case involves applying logistic regression, an AI model, to perform binary classification and predict feedback based on input features. Through data preprocessing, model training, and prediction, we aim to leverage the power of AI to make informed decisions and improve outcomes in the English Language Placement Test.

4. Data Collection and Analysis

4.1 Data Collection

In the Web Application, data collection begins with initializing an array ‘scoreUser’ which will hold the user's answers and scores for each question. When a user selects an option, the ‘optionSelected’ function is triggered. This function captures the user's selection and compares it to the correct answer for the current question. If the user's choice matches the correct answer, the score is incremented, and the selection is marked as correct. Regardless of correctness, the user's response is recorded in the ‘scoreUser’ array along with details of the section, part, and whether the answer was correct or not.

Each question's options are then disabled to prevent further changes, and the next button is made visible to allow the user to proceed to the next question. This process ensures that each answer is logged accurately as the quiz progresses.

After the English Placement Test is completed, the 'sendData' function is called to transmit the collected data to the server. The 'scoreUser' array is converted into a JSON string for easy transmission. An 'XMLHttpRequest' object is created to send this JSON data to the server asynchronously. This request includes setting the content type to JSON to ensure proper handling by the server.

The server-side script 'dbHelper.php' processes this incoming data and stores it in a MySQL database. This storage allows for persistent tracking of the test results, enabling further analysis and reporting on user performance over time.

By capturing user interactions, processing them in real-time, and sending the data to a server for storage, the Web Application ensures that detailed records of user performance are maintained for future reference and analysis.

-Initialize Data Storage: An array 'scoreUser' is used to store user responses

```
let scoreUser = [];
```

Handle User Interaction: The 'optionSelected' function captures user selections and stores them.

```
function optionSelected(answer) {
    let userAns = answer.textContent;
    let correcAns = questions[que_count].answer;
    let section = questions[que_count].section;
    let part = questions[que_count].part;

    if (userAns == correcAns) {
        userScore += 1;
        scoreUser.push({ section, part, score_x: 1 });
    } else {
        scoreUser.push({ section, part, score_x: 0 });
    }

    // Disable all options after selection
    const allOptions = option_list.children.length;
    for (let i = 0; i < allOptions; i++) {
        option_list.children[i].classList.add("disabled");
    }
    next_btn.classList.add("show"); // Show the next button
}
```

Transmit Data: The sendData function sends collected data to the server as JSON.

```
function sendData() {
    const jsonData = JSON.stringify(scoreUser);
    var xhr = new XMLHttpRequest();
    xhr.open("POST", "dbHelper.php", true);
    xhr.setRequestHeader("Content-Type", "application/json");

    xhr.onreadystatechange = function() {
        if (xhr.readyState === XMLHttpRequest.DONE) {
            if (xhr.status === 200) {
                console.log(xhr.responseText);
            } else {
                console.error("Error:", xhr.status);
            }
        }
    };
    xhr.send(jsonData);
}
```

Server-Side Processing: The server-side script receives the JSON data and inserts it into a MySQL database.

```php
<?php
$servername = "localhost";
$username = "root";
$password = "";
$database = "quize";

// Create connection
$conn = new mysqli($servername, $username, $password, $database);
if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}

// Get the raw POST data
$rawData = file_get_contents("php://input");
$dataArray = json_decode($rawData, true);
if (json_last_error() !== JSON_ERROR_NONE) {
    die("JSON decode error: " . json_last_error_msg());
}

// Prepare the SQL statement
$sql = "INSERT INTO userscoretest (section, parts, score_x) VALUES (?, ?, ?)";
$stmt = $conn->prepare($sql);
if ($stmt === false) {
    die("Prepare failed: " . $conn->error);
}

// Iterate over the data array and bind parameters for each entry
foreach ($dataArray as $item) {
    if (isset($item['section'], $item['part'], $item['score_x'])) {
        $section = $item['section'];
        $parts = $item['part'];
        $score_x = $item['score_x'];

        $stmt->bind_param("sss", $section, $parts, $score_x);

        if (!$stmt->execute()) {
            echo "<p>Error: " . $stmt->error . "</p>";
        }
    }
}

// Close statement and connection
$stmt->close();
$conn->close();
?>
```

4.1 Data Analysis

The process of analyzing data starts with the Flask server receiving CSV data via a POST request, which is then converted into a pandas DataFrame. This DataFrame plays a vital role in the following preprocessing stages. Categorical features, such as 'section' and 'parts', are encoded using specific objects known as 'encoder_section' and 'encoder_parts', respectively. These encoders convert categorical labels into numerical values, ensuring they can be effectively utilized by the machine-learning model

In addition, numerical data, particularly the 'score_x' feature, undergoes standardization to ensure consistency across varying scales. This standardization process is facilitated by the 'scaler' object, which applies the StandardScaler transformation to the numerical feature. By standardizing the data, each feature contributes equally to the analysis, preventing any one feature from exerting undue influence due to differences in scale.

Moving forward, the logistic regression model, referred to as 'model', plays a crucial role in predicting feedback based on the preprocessed data. By utilizing encoded categorical features and standardized numerical features, the model generates predictions for each row of the DataFrame. Subsequently, the model assigns feedback corresponding to the 'section' and 'parts' of the data.

Following prediction, the results undergo formatting for presentation. The encoded labels are reverted to their original categorical values using the 'inverse_transform' method of the LabelEncoder objects. This ensures that the feedback is presented in familiar categories rather than numerical representations.

Ultimately, the formatted results, organized as a list of strings, are returned as a JSON response. This response is then transmitted back to the PHP script that initiated the request.

Data Processing

Categorical features ('section' and 'parts') are encoded using LabelEncoder objects.

The numerical feature ('score_x') is scaled using a StandardScaler.

```
# Data preprocessing
csv_df['section'] = encoder_section.transform(csv_df['section'])
csv_df['parts'] = encoder_parts.transform(csv_df['parts'])
csv_df['score_x'] = scaler.transform(csv_df[['score_x']])
```

Model Prediction

The Trained logistic regression model predicts feedback based on preprocessed data.

```
# Model prediction
csv_df['predicted_feedback'] = model.predict(X_test)
```

Results Formatting

Encoded labels are inverse-transformed back to original categorical values.

Results are formatted into a list containing feedback strings for each section and part.

```
# Results formatting
for index, row in csv_df.iterrows():
    section_name = row['section_name']
    if (section_name not in printed_sections):
        printed_sections.add(section_name)
        results.append(f"<strong>Section: {section_name}</strong>")
    results.append(f" • {row['part_name']}:")
    results.append(f"   Feedback: {row['predicted_feedback']}")
```

Response

Formatted results are returned as a JSON response.

```
# Returning results
return jsonify(results)
```

This process encapsulates data preprocessing, model prediction, and result formatting, providing a streamlined approach to analyzing incoming data and generating feedback predictions based on a trained machine-learning model.

2 AI Feedback Mechanisms

The AI feedback mechanism implemented is a sophisticated system designed to enhance the learning experience by providing personalized guidance and support to users interacting with language tasks or questions. Let's delve deeper into how this mechanism operates:

At the core of the system is a trained logistic regression model, which serves as the intelligence behind the feedback generation process. This model has been trained on historical data, learning patterns, and relationships between various features of language tasks or questions and their corresponding correctness.

When new data is received through the Flask server, it undergoes a series of preprocessing steps to ensure compatibility with the model. Categorical features, such

as the sections and parts of the tasks, are transformed into numerical representations using label encoders. This allows the model to understand and interpret these features during the prediction process. Additionally, numerical features like scores are standardized to maintain consistency and comparability across different inputs.

Once the data is preprocessed, the model swings into action, predicting feedback for each task or question. This feedback can take different forms depending on the prediction outcome. If the model predicts that a response is correct, the feedback provided is one of positive reinforcement, congratulating the user on their accuracy and providing encouragement to continue performing well. Conversely, if the prediction indicates an incorrect response, the feedback becomes instructive, offering specific guidance on areas for improvement. This guidance is tailored to the particular section and part of the task, ensuring that users receive targeted support that directly addresses their weaknesses.

After generating feedback for all tasks or questions, the system formats this feedback into a coherent structure and returns it to the client in the form of a JSON response. This enables seamless integration, allowing the feedback to be displayed to users clearly and intuitively with a detailed report when requested..

Overall, this AI feedback mechanism represents a sophisticated approach to personalized learning support. By leveraging machine learning techniques, it provides users with targeted guidance and encouragement, empowering them to improve their language skills effectively and efficiently.

Conclusion

As a final point, the incorporation of artificial intelligence (AI) in language learning and assessment denotes an imminent revolution in the existing educational paradigms. By using the power of AI to deliver an automated assessment that works with personalized learning experiences and the insights of human educators, we may tailor language education to the needs of each individual better. From interactive tools like Chatbots to complex, Machine learning model-driven feedback mechanisms, the combined efforts of AI and humans are destined to change the language learning landscape, drastically reducing efforts and maximizing efficacy. The inevitable fusion of human and AI interaction will be key moving forward in the learning and assessing of language as technology continues to evolve, fusing language learning and evaluation.

Chapter 4

Implementation and realization

Introduction

This chapter is devoted to the real-world considerations of how the practical implementation of the Human-AI interaction interface, designed for the ELPT, should be conducted. This chapter deals with the tools and technologies used, the conceptual development phases and the possible problems met at all phases. Furthermore, adding the results of the implementation, it is possible to define how the application of AI contributes to the productivity of the test and the satisfaction of users. Analyzing the implementation phase, this chapter aims to provide a clear and detailed understanding of the technological inputs and inventions that shape the establishment of a complex AI-based language assessment system.

1. Tools

1.1 Development tools

Visual Studio :

Visual Studio is an integrated development environment (IDE) used to develop computer programs, as well as websites, web apps, web services, and mobile apps. It includes a code editor supporting IntelliSense (the code completion component) as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a forms designer for building GUI applications, a web designer, a class designer, and a database schema designer[31].

Fig.4.1: *Visual Studio [30]*

Jupyter

Jupyter is an open-source project that allows project managers and developers to use an interactive computing environment in various programming languages. It enables people to produce and share code-based text with live code, formulas, visualizations, and accompanying prose. They are developed as interactive computational environments in the web known as Jupyter Notebooks, that can be used for data

cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more. Jupyter can run languages such as Python, R, Julia, and Scala; and can be run in interactive mode as well as for large-scale data analysis; it has been adopted for medium, and large-scale computing use in academia, industry, and research for reproducible and collaborative computing[32].

Fig.4.2: *jupyter [30]*

phpMyAdmin

phpMyAdmin is a free software tool written in PHP, intended to handle the administration of MySQL over the Web. phpMyAdmin supports a wide range of operations on MySQL and MariaDB. Frequently used operations (managing databases, tables, columns, relations, indexes, users, permissions, etc.) can be performed via the user interface, while you still have the ability to directly execute any SQL statement.[33]

Fig. 4.3: *phpMyAdmin[30]*

MySQL

MySQL is a free relational database that started in 1995 and is widely used on the Web, often in combination with PHP (language) and Apache (webserver). MySQL works equally on all operating systems (Windows, Linux, Mac OS in particular). The principle of a relational database is to store information in tables that represent groupings of data by subject (product table, user table for example). The tables are linked together by relations.[34]

Fig.4.4: *MySQL[30]*

XAMPP

XAMPP is a software package that makes it easy to set up a Web server and an FTP server. It is a free software distribution (X Apache MySQL Perl PHP) offering good flexibility of use, famous for its simple and fast installation. Thus, it is within the reach of a large number of people since it does not require any particular knowledge and, moreover, works on the most widespread operating systems.[35]

Fig.4.5: *XAMPP[30]*

This "distribution" will therefore be responsible for installing all the tools you may need when creating a website. More than a dozen utilities are integrated, such as MySQL, PHP, Perl, or phpMyAdmin. It is distributed with different software libraries that extend the range of services significantly: OpenSSL, Expat (XML parser), PNG, SQLite, ... and various modules Perl and Tomcat, FileZilla Server.[35]

Google Chrome

Google Chrome is a web browser developed by Google, based on the open-source project Chromium. Available for Windows, MacOS, and Linux, Google Chrome is currently the third most used browser with 7.24% of users, according to Net Applications. This browser is appreciated for its free availability, ease of use, and speed, making it an excellent choice for both beginners and experienced users [36]

Fig.4.6: *Google Chrome [30]*

1.2 Programming languages

HTML

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web.

Web browsers receive HTML documents from a web server or local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.[37]

Fig.4 7: *HTML[30]*

HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page. HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes, and other items. HTML elements are delineated by tags, written using angle brackets. Tags such as <img /> and <input /> directly introduce content to the page. Other tags surround and provide information about document text and may include other tags as sub-elements. Browsers do not display the HTML tags but use them to interpret the content of the page.[37]

CSS

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language like HTML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript[38].

Fig.4.8 : *CSS [30]*

CSS is designed to enable the separation of presentation and content, including layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple web pages to share formatting by specifying the relevant CSS in a separate .css file, and reduce complexity and repetition in the structural content.[38]

JavaScript

JavaScript often abbreviated as JS, is a high-level, interpreted programming language that conforms to the ECMAScript specification. JavaScript has curly-bracket syntax, dynamic typing, prototype-based object orientation, and first-class functions. Alongside HTML and CSS, JavaScript is one of the core technologies of the World Wide Web. JavaScript enables interactive web pages and is an essential part of web applications. The vast majority of websites use it, and major web browsers have a dedicated JavaScript engine to execute it.[39]

Fig.4.9: *JavaScript[30]*

PHP

PHP is an HTML-embedded Web scripting language. This means PHP code can be inserted into the HTML of a Web page. When a PHP page is accessed, the PHP code is read or "parsed" by the server the page resides on. The output from the PHP functions on the page is typically returned as HTML code, which can be read by the browser.

Because the PHP code is transformed into HTML before the page is loaded, users cannot view the PHP code on a page. This makes PHP pages secure enough to access databases and other secure information. [40]

Fig. 4.10: *php [30]*

SQL

SQL (Structured Query Language) is a domain-specific language used in programming and designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS). It is particularly useful in handling structured data where there are relations between different entities/variables of the data. SQL offers two main advantages over older read/write APIs like ISAM or VSAM. First, it introduces the concept of accessing many records with one single command; and second, it eliminates the need to specify how to reach a record, e.g. with or without an index. Originally based upon relational algebra and tuple relational calculus, SQL consists of many types of statements, the scope of SQL includes data query, data manipulation (insert, update, and delete), data definition (schema creation and modification), and data access control.[41]

Fig.4.11: *SQL[30]*

2. Implementation and Results

Sign in/Sign up page

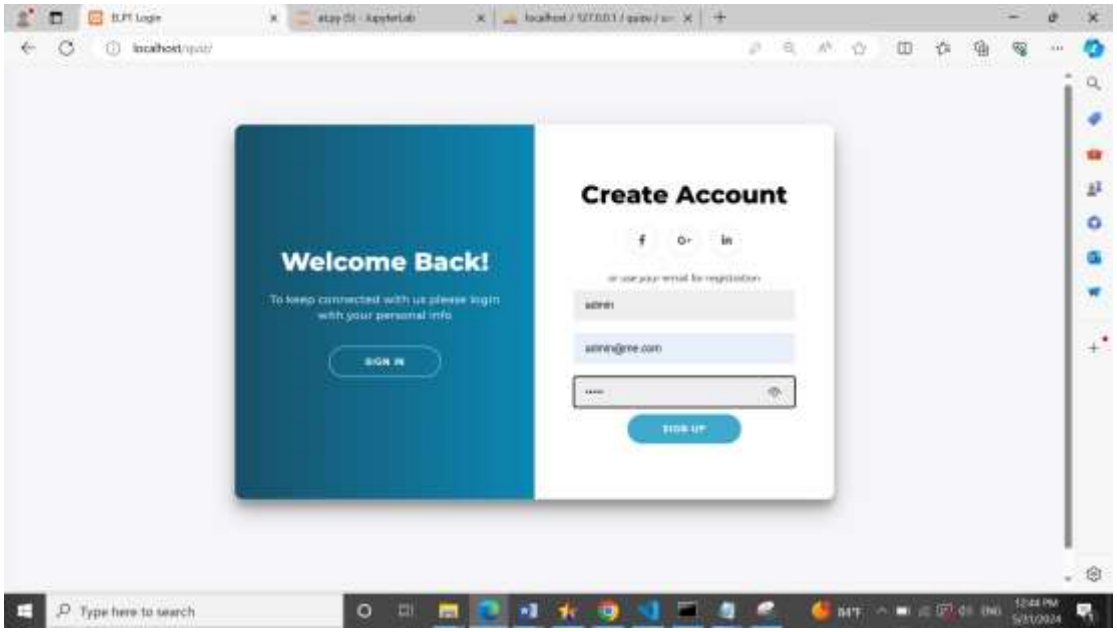

Fig.4.12: *Sign-up page*

The Sign-up page serves as the initial entry point for new users. It collects essential information such as username, email, and password to create a user account.

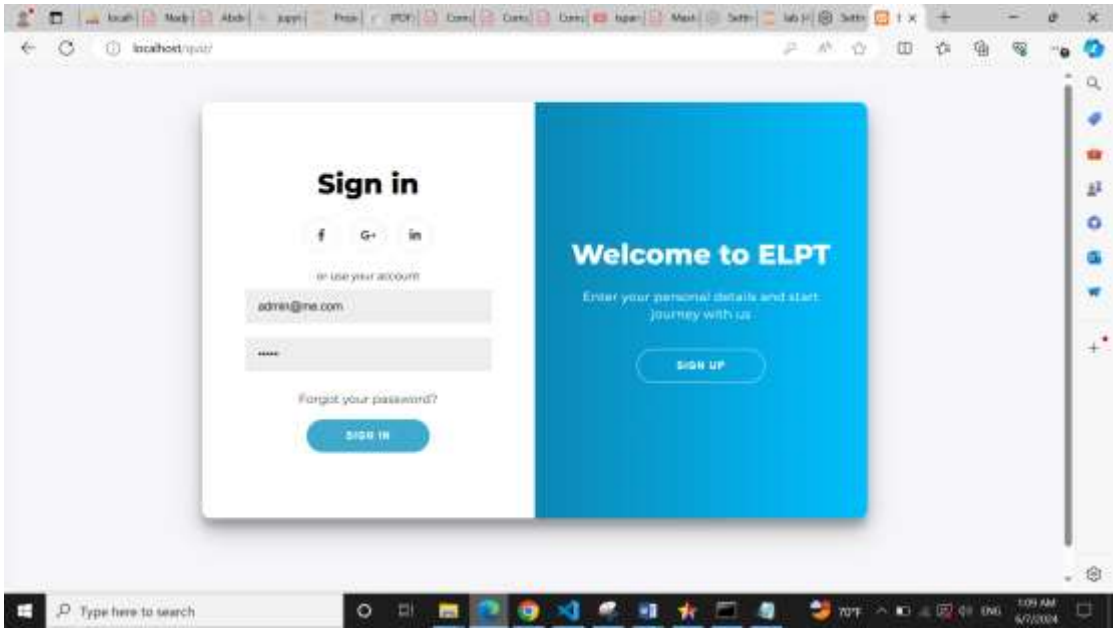

Fig.4.13: *Sign In page*

The Sign In page allows existing users to access their accounts by entering their username and password. This page is crucial for user authentication.

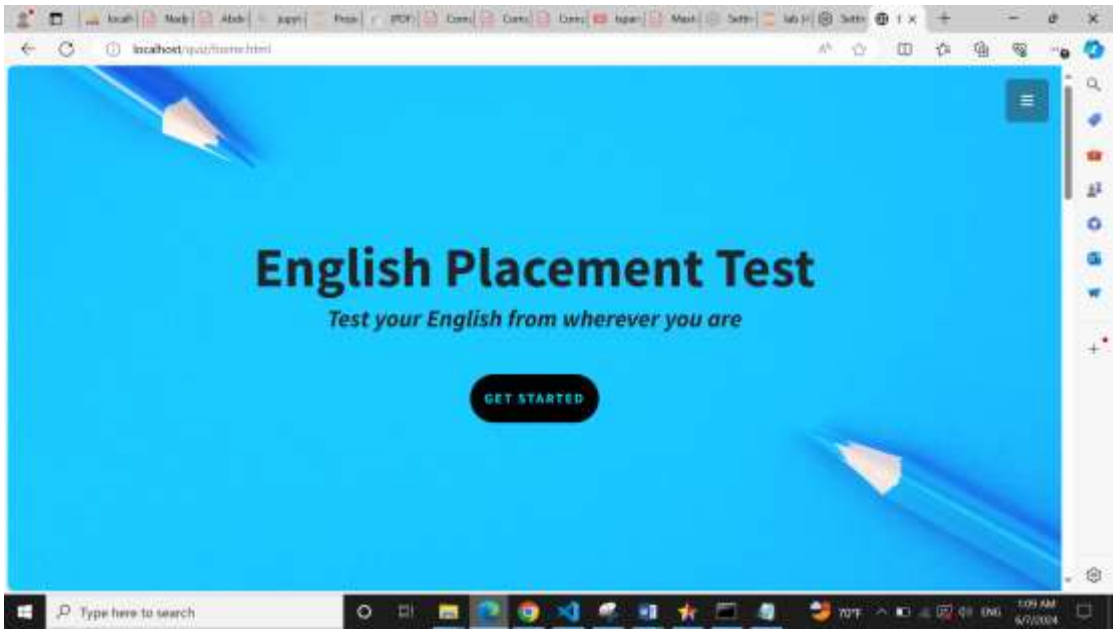

Fig.4.14: *Home Page*

The Home Page acts as the central hub for users once they are logged in. It provides an overview of the available tests and other relevant information. The design focuses on ease of navigation, ensuring that users can effortlessly find and start their placement test.

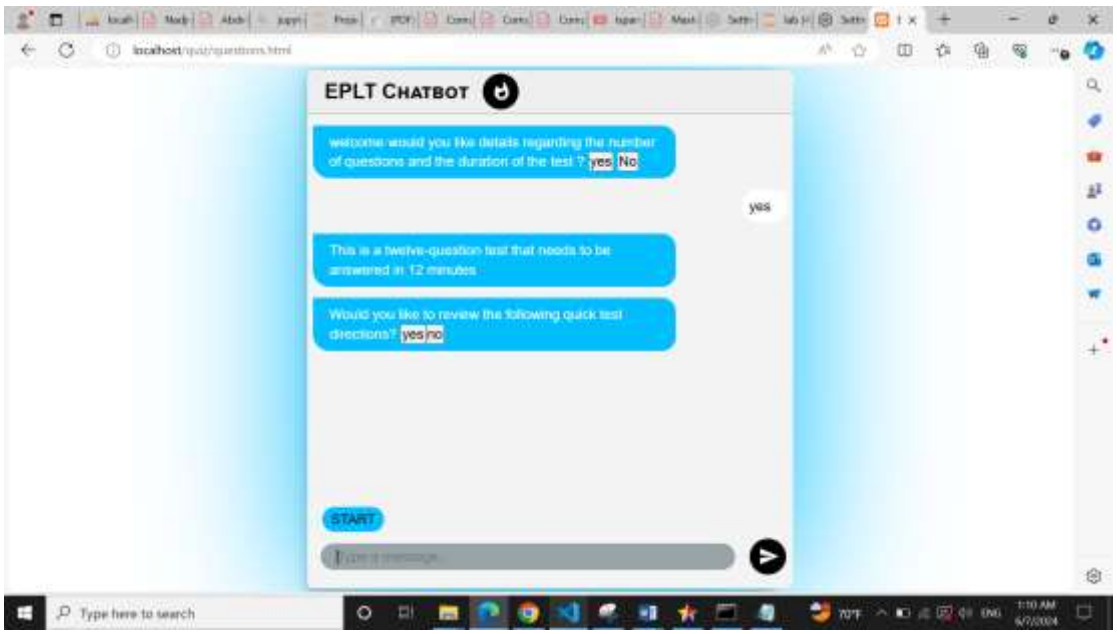

Fig. 4.15: *Chatbot interface*

The Chatbot Interface is a key component of the ELPT system, providing interactive assistance to users throughout the test. This interface uses JavaScript input-output and provides relevant responses. The chatbot guides users to start the test and offers explanations for the rules and directives related to the test, enhancing the overall user experience.

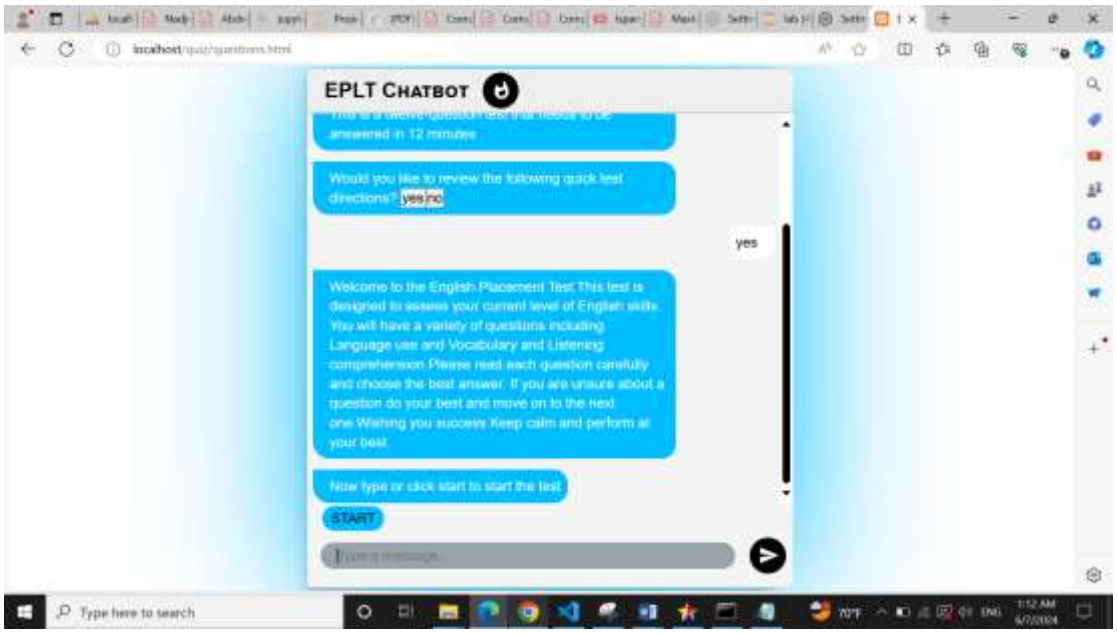

Fig. 4.16: *Chatbot interface*

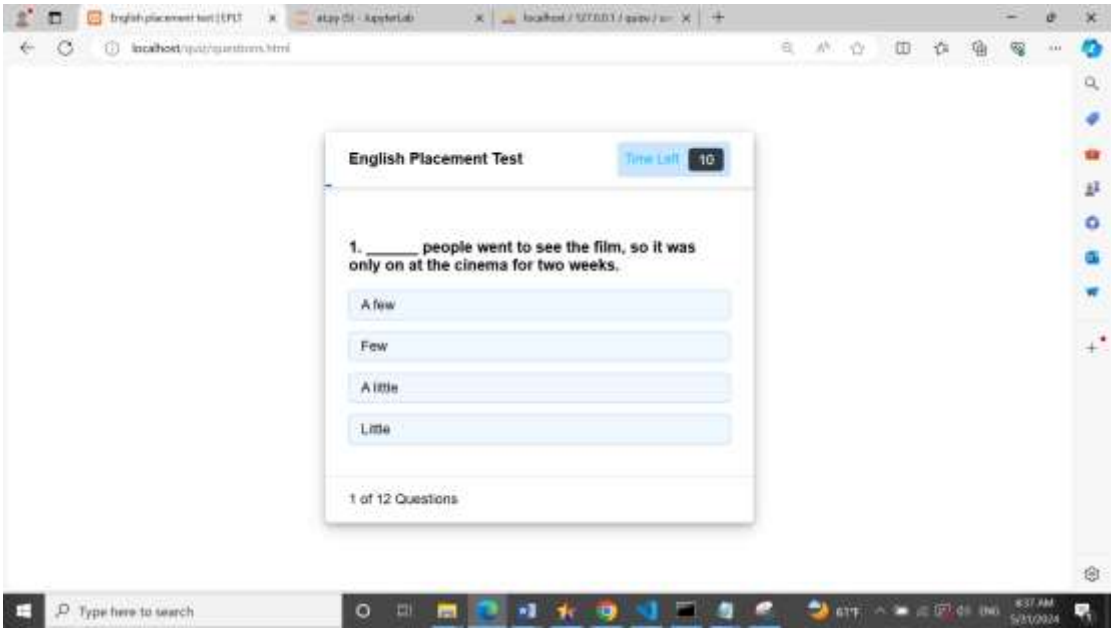

Fig. 4.17: *Questions Box*

The Questions Box displays the questions presented to the users during the test. This component is designed to be intuitive and user-friendly, ensuring that users

can easily read and respond to questions. It supports multiple question formats, including multiple-choice and short-answer questions, to comprehensively assess the user's language skills.

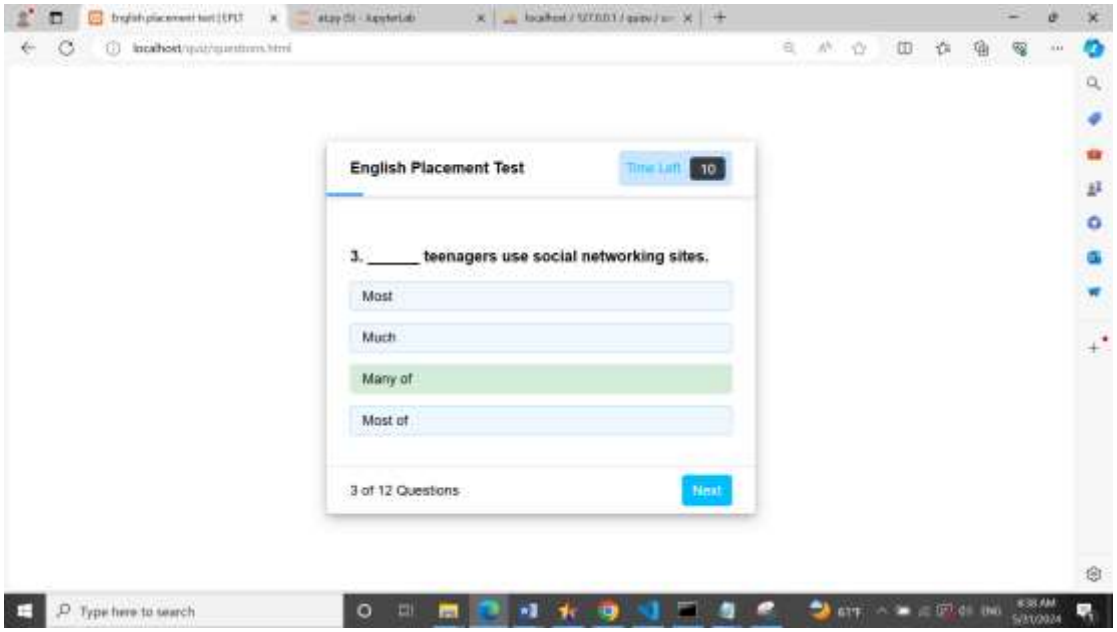

Fig. 4.18: *Questions Box*

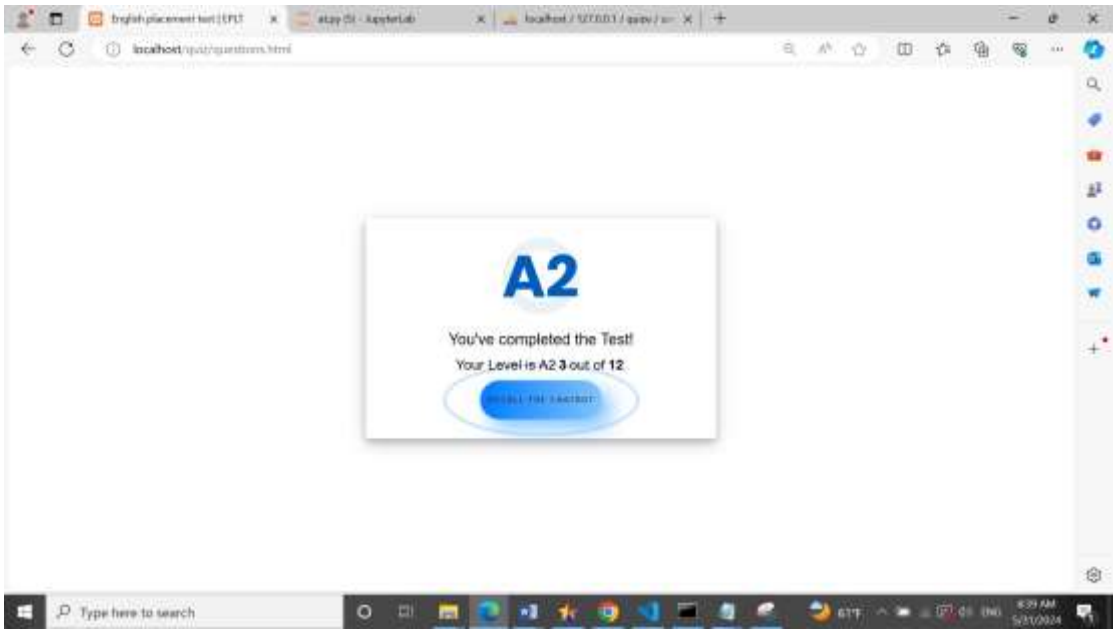

Fig. 4.19: *Resault Box*

The Result Box presents the test results to users upon completion of the ELPT. It displays the scores and levels. This box has a button that redirects the user to the chatbot to get his feedback.

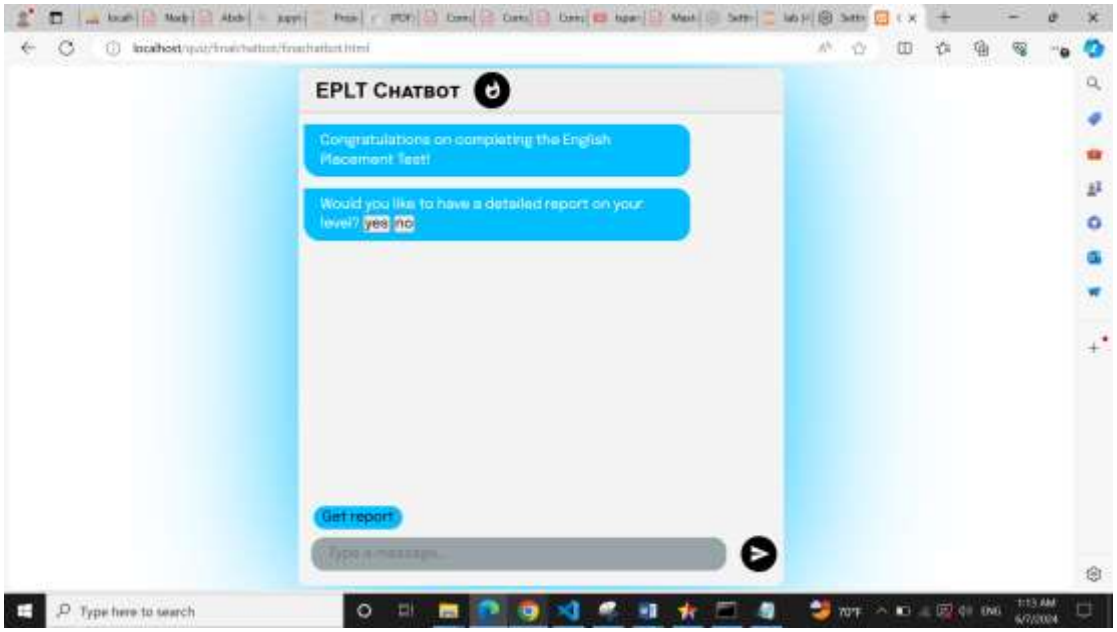

Fig. 4.20: *Chatbot interface*

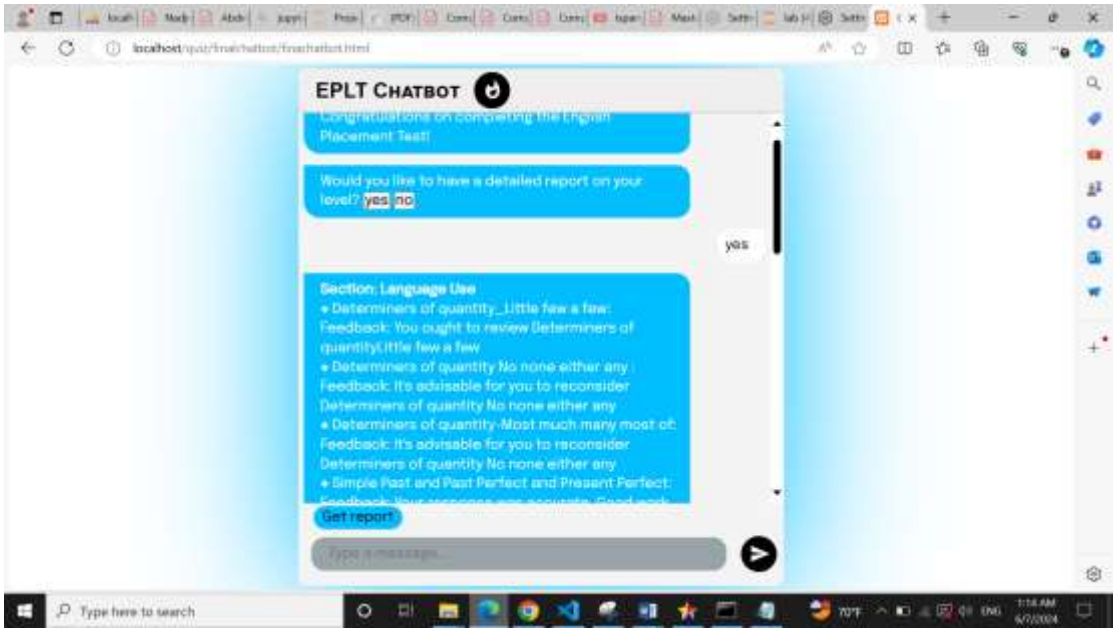

Fig. 4.21: *Chatbot interface*

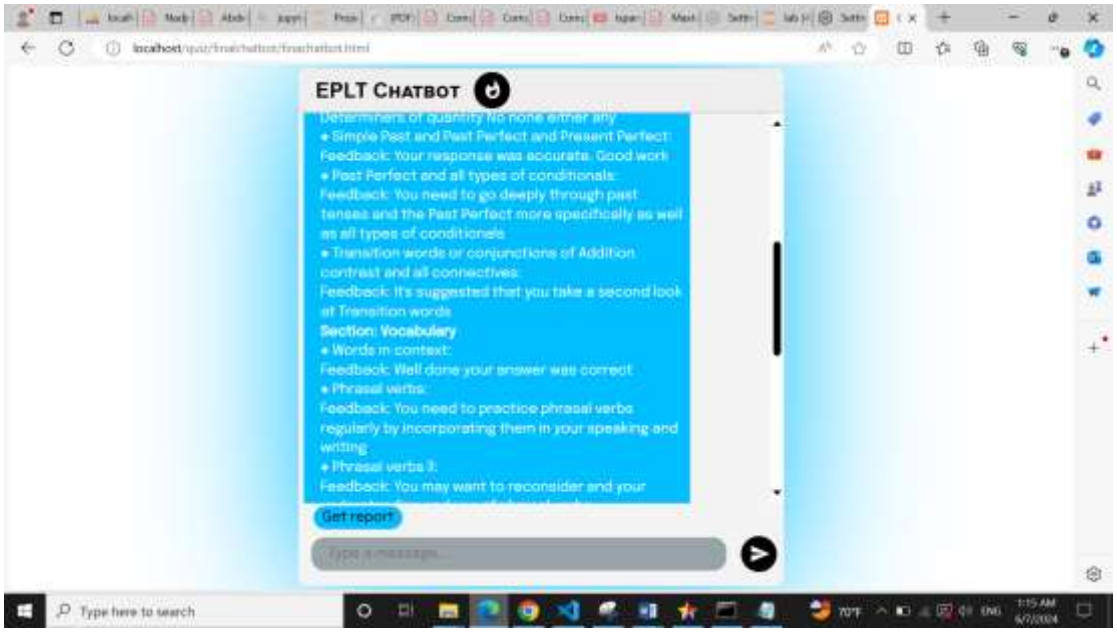

Fig. 4.22: *Chatbot interface*

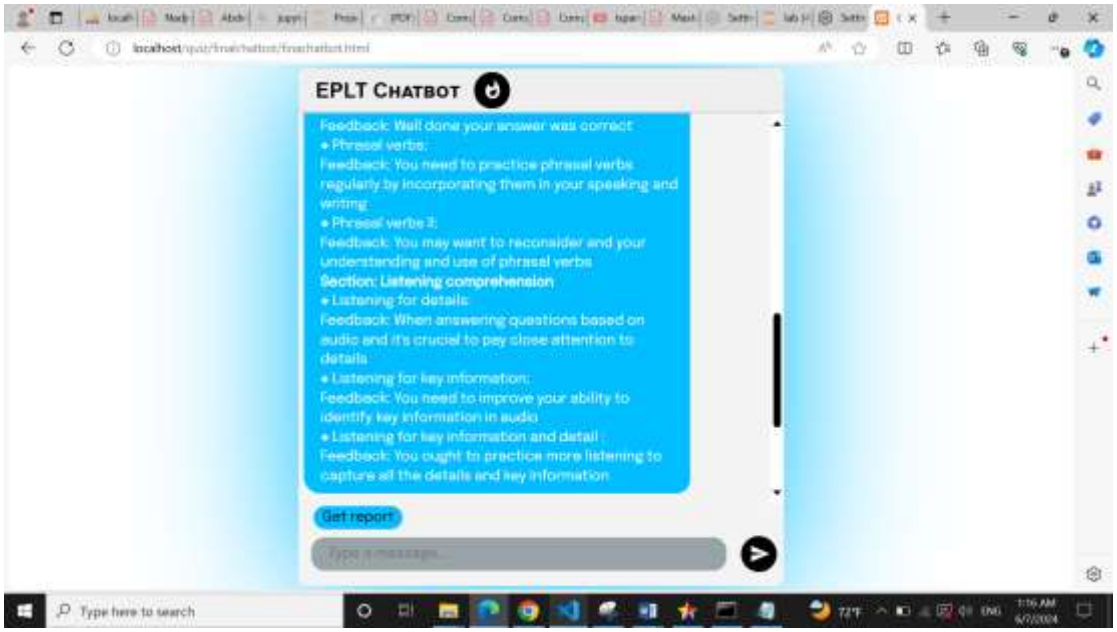

Fig. 4.23: *Chatbot interface*

The Chatbot gives the user feedback on their test. The feedback is based on the score of each question and AI predicts it to help the user know areas of strengths and weaknesses.

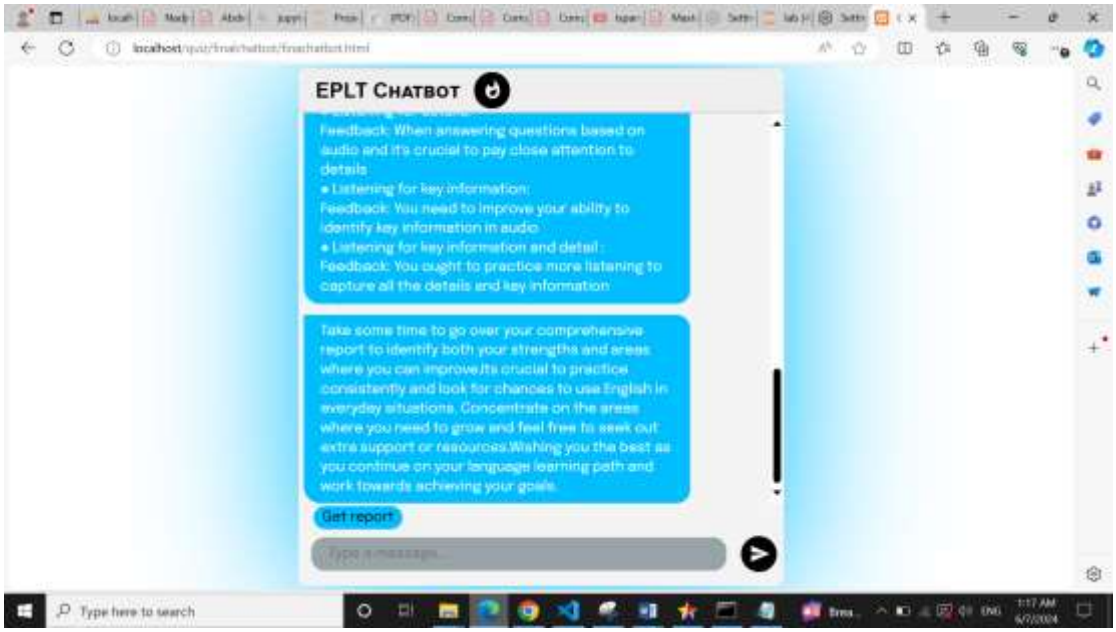

Fig. 4.23: *Chatbot interface*

3. Additional detailed feedback report

3.1 Language Use:

Determiners of Quantity:

- Correct Answer Feedback:
  - "Your response regarding Determiners of quantity Little, few, a few was accurate. Well done."
  - "You provided the correct answer for Determiners of quantity Most, much, many, most of. Good job."
  - "Your answer concerning Determiners of quantity No, none, either, any was correct."
- Incorrect Answer Feedback:
  - "You ought to review Determiners of quantity Little, few, a few."
  - "It would be beneficial for you to go over Determiners of quantity Most, much, many, most of."
  - "It's advisable for you to reconsider Determiners of quantity No, none, either, any."

Tenses:

- Correct Answer Feedback:
  - "Well done! Your answer is correct."
  - "You provided the correct answer. Good job!"
- Incorrect Answer Feedback:
  - "You are encouraged to revise and practice using simple past, past continuous, and present perfect tenses regularly in order to become more familiar with their usages."

    - "You need to go deeply through past tenses and the Past Perfect more specifically, as well as all types of conditionals."

Transition Words or Conjunctions:

- Correct Answer Feedback:
    - "Well done. Your answer is correct."
    - "Your response was accurate. Good work."
- Incorrect Answer Feedback:
    - "You need to go through conjunctions of Clarification and Emphasis again."
    - "It's suggested that you take a second look at all connectives including Transition words or conjunctions of Addition, contrast, and all connectives."

3.2 Vocabulary:
Words in Context:

- Correct Answer Feedback:
    - "Well done, your answer was correct."
- Incorrect Answer Feedback:
    - "You should consider the context and choose the word that best matches the emotional tone or logical flow of the sentence."

Phrasal Verbs:

- Correct Answer Feedback:
    - "Excellent performance."
    - "Your answer on phrasal verbs is correct. Good job!"
- Incorrect Answer Feedback:
    - "You need to practice phrasal verbs regularly by incorporating them in your speaking and writing."
    - "You may want to reconsider your understanding and use of phrasal verbs."

3.3 Listening Comprehension:
Listening for Details:

- Correct Answer Feedback:
    - "Very good answer. You paid attention to the details."
- Incorrect Answer Feedback:
    - "When answering questions based on audio, it's crucial to pay close attention to details."

Listening for Key Information:

- Correct Answer Feedback:
    - "You were able to grasp key information. Good work."
- Incorrect Answer Feedback:

- "You need to improve your ability to identify key information in audio."

Listening for Key Information and Detail:

- Correct Answer Feedback:
  - "Your answer is impressive as you paid attention to details and key information."
- Incorrect Answer Feedback:
  - "You ought to practice more listening to capture all the details and key information."

This detailed feedback provides specific commendations for correct answers and actionable suggestions for areas needing improvement, tailored to each section of language use, vocabulary, and listening comprehension.

Example :

	section	parts	score_x
1	Language Use	Determiners of quantity_Little few a few	0
2	Language Use	Determiners of No none either any	1
3	Language Use	Determiners of quantity-Most much many most of	0
4	Language Use	Simple Past and Past Perfect and Present Perfect	1
5	Language Use	Past Perfect and all types of conditionals	1
6	Language Use	Transition words or conjunctions of Addition contrast and all connectives	1
7	Vocabulary	Words in context	1
8	Vocabulary	Phrasal verbs	1
9	Vocabulary	Phrasal verbs II	1
10	Listening comprehension	Listening for details	1
11	Listening comprehension	Listening for key information	1
12	Listening comprehension	Listening for key information and detail	1

Fig. 4.24: *User Test score*

In this example, ***Fig. 4.24*** shows the results of the test and it appears that the user answered all the questions correctly except two: 'Determiners of quantity Little few a few' and 'Determiners of quantity Most, much, many, most of'

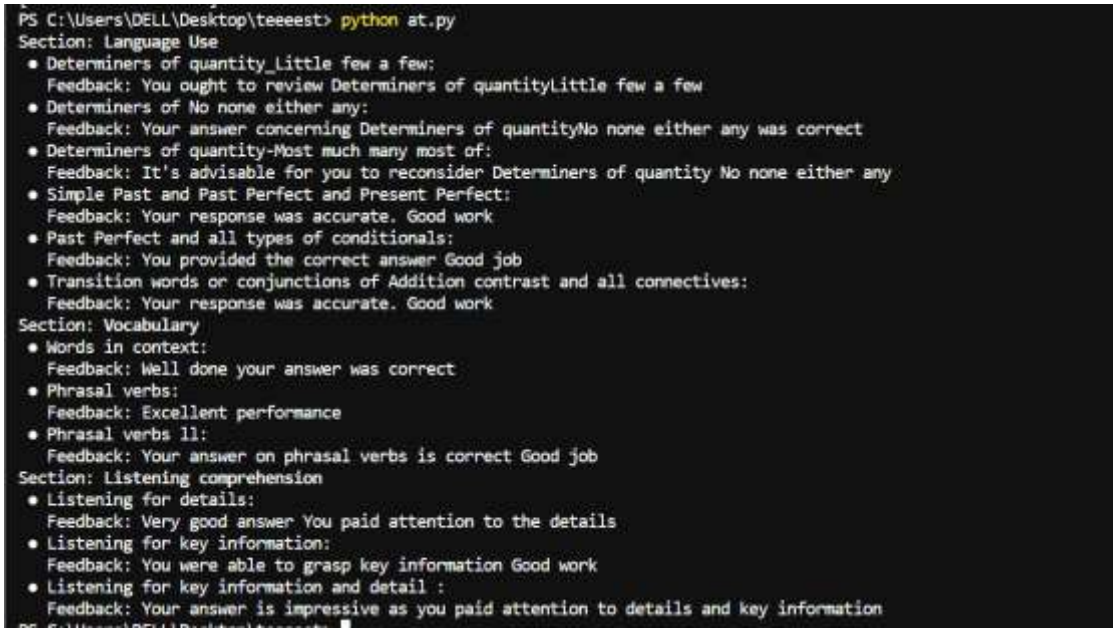

Fig. 4.25: *User Test feedbacks*

Fig. 4.25 shows feedback on all sections and parts of the test. We see every question has positive feedback except two questions related to 'Determiners of quantity: Little, few, a few' and 'Determiners of quantity: Most, much, many, most of;' have negative feedback.

"You ought to review Determiners of quantity: Little, few, a few"

"It would be beneficial for you to go over Determiners of quantity: Most, much, many, and most of"

Conclusion

In conclusion, the implementation of the Human-AI interaction interface for the English Language Placement Test (ELPT) demonstrates the practical feasibility and benefits of integrating advanced AI technologies into language assessment tools. The development process, supported by robust tools and methodologies, resulted in a functional and efficient system capable of accurately evaluating English language proficiency. The challenges faced during implementation were addressed through iterative testing and optimization, ensuring a seamless user experience. This chapter underscores the potential of AI to revolutionize language testing, offering insights into the future of educational technology and its impact on personalized learning.

General Conclusion

The research conducted on our English placement test ~~website~~ Web Application reveals significant findings regarding user experience and system functionality. This summary highlights both the strengths and areas needing improvement.

Throughout the study, several problems and obstacles were identified. These challenges range from technical issues such as authentication glitches and Chatbot performance to user experience concerns like navigation difficulties and inconsistent feedback delivery. Addressing these obstacles is crucial for enhancing the overall effectiveness and reliability of the Web Application.

In the light of the findings, specific recommendations for future studies are proposed. These suggestions aim to refine the research approach, focusing on more in-depth user testing, enhanced data analytics, and the integration of advanced technologies to improve system robustness and user satisfaction.

Concluding thoughts emphasize the importance of continuous evaluation and iterative development. By implementing the proposed recommendations and addressing the identified problems, the English Placement Test ~~website~~ Web Application can evolve to better meet user needs, ensuring a seamless, user-friendly, and effective testing experience.

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Abstract

This thesis presents the design and implementation of a human-AI interaction interface for English language assessment. The primary objective is to develop a web application that integrates AI technologies to enhance the accuracy and user experience of English Placement Tests. The research covers the historical context and significance of the English Language Placement Test, user experience principles, test structure, and the implementation of AI models. The results demonstrate significant improvements in test administration and personalized feedback, highlighting the potential of AI in educational assessments.

Keywords: Human-AI Interaction, English Language Assessment, Web Application, AI Technologies, English Placement Tests, Test Administration.

ملخص

تقدم هذه الأطروحة تصميم وتنفيذ واجهة تفاعل بين الإنسان والذكاء الاصطناعي لتقييم اللغة الإنجليزية. الهدف الأساسي هو تطوير تطبيق على الويب يدمج تقنيات الذكاء الاصطناعي لتعزيز دقة وتجربة المستخدم لاختبارات تحديد المستوى باللغة الإنجليزية. يغطي البحث السياق التاريخي وأهمية اختبار مستوى اللغة الإنجليزية، ومبادئ تجربة المستخدم، وهيكل الاختبار، وتنفيذ نماذج الذكاء الاصطناعي. تُظهر النتائج تحسينات كبيرة في إدارة الاختبارات والتعليقات الشخصية، مما يسلط الضوء على إمكانات الذكاء الاصطناعي في التقييمات التعليمية.

الكلمات المفتاحية: تفاعل الإنسان والذكاء الاصطناعي، تقييم اللغة الإنجليزية، تطبيق ويب، تقنيات الذكاء الاصطناعي، اختبارات تحديد المستوى باللغة الإنجليزية، إدارة الاختبارات.

Résumé

Cette thèse présente la conception et l'implémentation d'une interface d'interaction humain-IA pour l'évaluation de la langue anglaise. L'objectif principal est de développer une application web intégrant des technologies d'IA pour améliorer la précision et l'expérience utilisateur des tests de placement en anglais. La recherche couvre le contexte historique et l'importance du test de placement en anglais, les principes d'expérience utilisateur, la structure du test et la mise en œuvre de modèles d'IA. Les résultats montrent des améliorations significatives dans l'administration des tests et les feedbacks personnalisés, soulignant le potentiel de l'IA dans les évaluations éducatives.

Mots Clés: Interaction humain-IA, Évaluation de la langue anglaise, Application web, Technologies d'IA, Tests de placement en anglais, Administration des tests.