SPEECH TRANSLATION APPLICATION

A Project report submitted in partial fulfillment of requirements for the award of degree of

BACHELOR OF TECHNOLOGY
IN
COMPUTER SCIENCE AND BUSINESS SYSTEMS

By

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(Affiliated to JNTUA, ANANTAPURAMU)

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Department of Emerging Technologies in Computer Science

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CERTIFICATE

This is to certify that the Project Work entitled 'SPEECH TRANSLATION APPLICATION' *is a bonafide record of work carried out by*

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DECLARATION

We hereby declare that the project titled "SPEECH TRANSLATION APPLICATION" is an authentic work carried out by us as the students of **G. PULLA REDDY ENGINEERING COLLEGE (Autonomous) Kurnool,** during 2023-24 and has not been submitted elsewhere for the award of any degree or diploma in part or in full to any institute.

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ABSTRACT

The Speech Translation Application presented in this project aims to bridge language barriers by providing real-time translation of spoken language. In today's globalized world, effective communication across languages is essential for fostering collaboration, understanding, and inclusivity. However, language differences often pose significant challenges, hindering efficient communication and knowledge exchange. To address this issue, our project focuses on developing a user-friendly and efficient application that enables users to translate spoken language into their desired target language seamlessly. The Speech Translation Application leverages advanced speech recognition and translation technologies to facilitate accurate and instant translation of spoken content. Users can simply speak into the application, and the system processes the audio input, detects the language, and provides a translated text output in real-time. The application supports a wide range of languages and ensures high translation accuracy to enhance user experience. Additionally, the project incorporates features for testing, validation, and future enhancements to ensure the application's effectiveness, reliability, and scalability. Through this project, we aim to contribute to breaking down language barriers and promoting cross-cultural communication and collaboration in diverse contexts.

CONTENTS

LIST OF FIGURES

INTRODUCTION

1. INTRODUCTION

1.1 INTRODUCTION

In a globalized world where communication barriers exist, the need for efficient language translation tools has become increasingly vital. Our project addresses this need by developing a Speech Translation Application, a user-friendly web-based tool that enables real-time translation of spoken language into text and vice versa. Leveraging advancements in speech recognition and machine translation technologies, our application aims to bridge linguistic gaps and facilitate seamless communication across diverse languages.

Through the integration of cutting-edge technologies and user-centric design principles, our project endeavours to provide an intuitive and accessible solution for individuals and organizations seeking effective language translation capabilities. Users will have the convenience of accessing the application directly from their web browsers, eliminating the need for complex installations or specialized hardware.

1.2 MOTIVATION

The motivation behind our Speech Translation Application stems from the recognition of the significant challenges posed by language barriers in today's interconnected world. In a globalized society where communication plays a crucial role in various aspects of life, including business, education, healthcare, and social interaction, the inability to overcome linguistic differences can hinder collaboration, understanding, and accessibility.

Our project is motivated by the desire to address these challenges and empower individuals and organizations with effective language translation tools. We recognize the following key motivations driving the development of our application

1. Facilitating Cross-Cultural Communication
2. Enhancing Accessibility and Inclusivity
3. Promoting Global Connectivity
4. Addressing Business and Practical Needs
5. Harnessing Technological Advancements

1.3 PROBLEM DEFNITION

The problem our project seeks to address is the pervasive presence of language barriers in various aspects of modern life, which hinder effective communication, collaboration, and access to information. Language barriers pose significant challenges in a globalized society characterized by cultural diversity, international travel, and digital connectivity.

1.4 OBJECTIVES OF THE PROJECT

The overarching objective of the "Speech Translator" project is to create a versatile and efficient application that addresses the challenges posed by linguistic diversity, with a focus on enhancing communication on a global scale. The project strives to achieve the following key goals:

1. **Enhanced Speech Recognition**
    - Implement a robust speech recognition system capable of accurately capturing spoken words in various languages, including those with diverse accents and dialects.
    - Explore advanced techniques to improve the system's adaptability to different audio qualities and environmental conditions.
2. **Seamless Language Translation**
    - Develop a sophisticated translation engine that seamlessly converts the recognized speech from the source language into the desired target language.
    - Explore the integration of machine learning models to enhance the system's translation accuracy, accommodating the nuances and context of different languages.
3. **Natural Text-to-Speech Synthesis**
    - Implement a natural and expressive text-to-speech synthesis module that effectively conveys the translated text in spoken form.
    - Investigate techniques such as prosody modeling and intonation to create a more human-like and engaging auditory experience for users.
4. **User-Friendly Interface**

- Design an intuitive and user-friendly interface that simplifies the language selection process and provides clear visual feedback on the translated text.
- Incorporate user preferences and customization options, allowing individuals to tailor the application to their specific communication needs.

5. Cross-Cultural Communication Facilitation

- Focus on breaking down language barriers to facilitate cross-cultural communication in various contexts, including travel, business, education, and social interactions.
- Explore additional features that promote understanding, such as real-time translation during conversations and cultural sensitivity recommendations.

6. Inclusive Global Connectivity

- Foster inclusivity and global connectivity by making the Speech Translator accessible to a diverse user base, including individuals with varying linguistic backgrounds, abilities, and technological literacy.
- Consider localization strategies to ensure the application's effectiveness across different regions and language communities.

7. Continuous Improvement and Adaptability

- Establish a framework for continuous improvement, allowing for updates and refinements to address emerging language patterns, technological advancements, and user feedback.
- Explore the integration of artificial intelligence for adaptive learning, enabling the system to evolve and adapt to evolving linguistic landscapes.

8. Educational and Language Learning Support

- Position the Speech Translator as a valuable tool for language learners by incorporating features that aid in language acquisition, pronunciation practice, and cultural understanding.
- Collaborate with educational institutions and language experts to align the application with best practices in language learning.

1.5 LIMITATIONS OF THE PROJECT

While striving to address multilingual communication challenges, the "Speech Translator" project acknowledges certain limitations

1. **Language Support**
    - The project's translation feature does not cover all languages comprehensively, potentially excluding users who speak less common languages.
2. **Translation Accuracy**
    - The accuracy of translations relies on the translation API used. Some translations might be inaccurate, especially for complex or nuanced text.
3. **API Rate Limits**
    - Translation APIs often impose rate limits on the number of requests, leading to delays or failure in translation if the limit is exceeded due to high traffic or usage.
4. **Regional Dialect Variability**
    - The project may encounter challenges in accurately interpreting and translating regional dialects. Dialectical variations pose a unique set of linguistic nuances that may not be fully captured by standard language processing models.
5. **Speech Recognition Accuracy**
    - Speech recognition accuracy can vary based on factors such as background noise, accents, and microphone quality, potentially resulting in inaccuracies in speech input.
6. **Privacy Concerns:**
    - As the project involves processing and transmitting audio data, privacy concerns may arise. Ensuring the secure handling of sensitive information is an ongoing consideration in the project's development.

1.6 ORGANISATION OF REPORT

The project report is organized into eight distinct chapters, each addressing specific aspects of the Speech Translation Application. In the introduction, we provide the necessary background and context, outlining the project's motivations and objectives. Following this, the system specifications chapter details the hardware and software requirements, along with functional, non-functional, and user-related requirements essential for the application's development. The literature survey chapter offers a comprehensive review of existing speech translation technologies, highlighting gaps and challenges that our project aims to address.

Moving forward, the design and implementation chapter delves into the system architecture, user interface design, and implementation details, providing a clear understanding of the application's structure and functionality. Subsequently, the results chapter presents testing outcomes, user feedback, and performance evaluations, shedding light on the application's effectiveness and usability. The testing and validations chapter outlines the testing strategy, validation process, and quality assurance measures employed to ensure the application's reliability and security.

In the conclusion and future enhancements chapter, we summarize the project's findings, achievements, and limitations, while also suggesting potential areas for future development and improvement. Finally, the report concludes with a references section listing all cited literature and online resources utilized throughout the project. This organized structure facilitates a comprehensive understanding of the Speech Translation Application's development process, outcomes, and implications.

SYSTEM

SPECIFICATIONS

2. SYSTEM SPECIFICATIONS

2.1 SOFTWARE SPECIFICATIONS

- **Operating System**
  - The application should be compatible with major operating systems such as Windows, macOS, and Linux.
- **Web Browser Compatibility**
  - The application should be compatible with modern web browsers such as Google Chrome, Mozilla Firefox, Microsoft Edge, and Safari.
- **Programming Languages**
  - **HTML:** Used for structuring the web page content.
  - **CSS:** Used for styling the web page elements and layout.
  - **JavaScript:** Used for implementing interactive features such as speech recognition, translation, and synthesis directly in the web browser.
- **Frameworks and Libraries**
  - **Web Speech API**: Used for speech recognition and synthesis functionality in JavaScript.
- **(Application Programming Interfaces)APIs**
  - **My Memory Translation API**: Used for translating text between different languages. (Utilized via JavaScript AJAX requests directly from the client-side)
- **Development Environment**
  - Integrated Development Environment (IDE) such as Visual Studio Code, Sublime Text, or Atom for writing and editing code.
  - Web browser for testing the web application locally during development.
  - speech recognition module

2.2 HARDWARE SPECIFICATIONS

- **Device**
    - The application should be accessible from a wide range of devices, including desktop computers, laptops, tablets, and smartphones.
- **Processor**
    - Modern processors found in most devices should be sufficient for running the web application smoothly.
- **Memory (RAM)**
    - Adequate memory is necessary for the web browser to handle the application's operations efficiently. However, since the application's processing primarily occurs on the client-side, the memory requirements are generally minimal, and the amount of RAM required would depend on the overall usage of the device.
- **Internet Connection**
    - A stable internet connection is essential for accessing the web application and interacting with its features, particularly for functionalities like speech recognition, translation, and synthesis that rely on external APIs and services.
- **Audio Input/Output Devices**
    - For users to utilize the speech input and output features of the application, they would need compatible audio input/output devices such as microphones and speakers connected to their device.
- **Display**
    - The application should be designed to adapt to various screen sizes and resolutions, ensuring optimal usability across different devices and display configurations.

LITERATURE SURVEY

3. LITERATURE SURVEY

3.1 INTRODUCTION

The literature survey provides a comprehensive overview of existing research and developments in the field of speech translation technologies. This section explores various studies, methodologies, and technologies employed in the design and implementation of speech translation systems. By reviewing existing literature, we aim to gain insights into the advancements, challenges, and opportunities in this domain, which will inform the development of our proposed Speech Translation Application.

3.2 EXISTING SYSTEM

Numerous speech translation systems have been developed, ranging from commercial products to open-source projects. These systems leverage different techniques, including statistical machine translation, neural machine translation, and hybrid approaches, to provide accurate and real-time translation services. Commercial solutions such as Google Translate, Microsoft Translator, and Amazon Translate offer user-friendly interfaces and extensive language support. Additionally, open-source projects like OpenNMT and Mozilla DeepSpeech provide flexibility and customization options for researchers and developers. However, despite their advancements, existing systems face challenges such as limited vocabulary coverage, domain-specific translation errors, and resource-intensive training requirements.

3.3 DISADVANTAGES OF EXISTING SYSTEM

Despite the progress made in speech translation technologies, several limitations persist in current systems. These include

1. **Limited Vocabulary Coverage**: Existing systems may struggle to accurately translate specialized or low-resource languages due to limited vocabulary coverage and domain-specific terminology.

2. **Domain-specific Translation Errors**: Commercial speech translation systems may produce inaccurate translations, especially in specialized domains such as healthcare, legal, or technical fields, where precise terminology is crucial.

3. **Resource-intensive Training Requirements**: Developing and training robust speech translation models requires large amounts of data and computational resources, making it challenging for researchers and developers, particularly in resource-constrained environments.

3.4 PROPOSED SYSTEM

To address the limitations of existing systems, we propose the development of a user-friendly and efficient Speech Translation Application. The proposed system will leverage advanced speech recognition and translation technologies to provide accurate and real-time translation of spoken language. Key features of the proposed system include

1. **Enhanced Vocabulary Coverage**: The system will incorporate techniques to improve vocabulary coverage and handle domain-specific terminology effectively, ensuring accurate translations across different languages and domains.

2. **Real-time Translation**: Users will be able to translate spoken content into their desired target language seamlessly, enabling efficient communication and collaboration in diverse contexts.

3. **User-friendly Interface**: The application will feature a user-friendly interface with intuitive controls and customizable settings, catering to the needs of both casual users and professionals.

4. **Testing and Validation**: Rigorous testing and validation processes will be conducted to evaluate the accuracy, reliability, and performance of the system, ensuring high-quality translations and user satisfaction.

DESIGN AND IMPLEMENTATION

4. DESIGN AND IMPLEMENTATION

4.1 INTRODUCTION

4.1.1 System Architecture

User Interface Design

- **Clean and Minimalist Layout**
  - The user interface features a clean and minimalist design, focusing on usability and functionality.
  - Elements are organized in a logical manner to facilitate intuitive navigation and interaction.
- **Text Areas for Input and Output**
  - The main interface includes text areas for inputting speech and displaying translated text.
  - These text areas are prominently positioned at the center of the page, making them easily accessible to users.
- **Language Selection Dropdowns**
  - Dropdown menus are provided for selecting the source and target languages for translation.
  - Users can choose from a wide range of languages supported by the application.
- **Control Buttons**
  - Control buttons are available for various actions, including starting speech input, stopping input, translating text, and speaking the translated output.
  - These buttons are designed with clear labels and intuitive icons for easy recognition and usage.

- **Responsive Design**
    - The interface is designed to be responsive, adapting seamlessly to different screen sizes and devices.
    - Media queries and flexible layout techniques ensure optimal viewing and interaction experiences across desktops, tablets, and mobile phones.

Visual Design

- **Colour Scheme**
    - A cohesive colour scheme is used throughout the application, with muted tones and contrasting accents for visual appeal.
    - The colour palette enhances readability and maintains a professional aesthetic.
- **Typography**
    - Clear and legible typography is chosen for displaying text content, ensuring ease of reading for users.
    - Fonts with appropriate weights and styles are selected to enhance visual hierarchy and emphasis.
- **Iconography**
    - Iconography is utilized to convey functionality and actions within the application.
    - Familiar icons are used for common actions such as volume control, language selection, and text manipulation.

Overall Experience

- **User-Friendly Interaction**
    - The design prioritizes user-friendliness, providing a seamless and intuitive interaction experience.

- Users can easily input speech, select languages, perform translations, and listen to the translated output without encountering complexity.

➢ **Engaging and Accessible**

- The design aims to engage users and make the application accessible to a wide audience.
- Clear instructions and visual cues guide users through the process of using the speech translation functionality effectively.

➢ **Professional Appearance**

- The overall design exudes professionalism and competence, instilling confidence in users about the reliability and functionality of the application.
- Attention to detail and thoughtful design choices contribute to a polished and professional appearance.

The implementation of the project includes several key components and functionalities

1. **Speech Recognition:** Integrating a speech recognition feature to capture user input through spoken language.
2. **Language Detection:** Utilizing language detection algorithms to identify the language of the input speech automatically.
3. **Translation**: Implementing translation algorithms to convert the recognized speech into the desired target language.
4. **Text-to-Speech Synthesis:** Incorporating text-to-speech synthesis capabilities to audibly render the translated text for users.
5. **User Interface:** Designing and developing a user-friendly interface using HTML, CSS, and JavaScript to facilitate seamless interaction with the application.
6. **Language Selection:** Providing users with options to select input and output languages for translation.

7. **Control Mechanisms:** Implementing controls such as buttons for initiating speech recognition, stopping input, translating text, and speaking the translated output.
8. **Error Handling:** Implementing error handling mechanisms to manage scenarios like unrecognized speech input or failed translation requests.
9. **Security**: Addressing security concerns such as XSS and CSRF vulnerabilities to ensure the application's robustness and integrity.
10. **Testing:** Conducting thorough testing and validation to identify and rectify any bugs or issues in the implementation, ensuring the application functions reliably across different devices and browsers.

4.2 MODULES

1. **HTML (Hypertext Markup Language)**
    - Used for creating the structure of the web page and defining its content elements, such as text areas, buttons, and dropdowns.
2. **CSS (Cascading Style Sheets)**
    - Utilized for styling the HTML elements to achieve the desired visual presentation and layout of the user interface.
3. **JavaScript**
    - Implemented client-side scripting for interactivity and dynamic behaviour of the web application.
    - Used for handling user interactions, such as button clicks, speech recognition, translation, and text-to-speech synthesis.
4. **Web Speech API**
    - Integrated to provide speech recognition and synthesis capabilities directly in the web browser.
    - Used for capturing user speech input and generating audible speech output.

5. **Translation API (Assumed, not explicitly specified in the provided code)**
    - Integrated with a translation API to perform language detection and translation of text.
    - Used for translating the recognized speech into the desired target language based on user preferences.
6. **Fetch API**
    - Utilized for making HTTP requests to fetch data from external APIs, such as translation services.
    - Used to retrieve translated text and other necessary data for processing within the application.

4.3 FLOW CHART OF THE MODEL

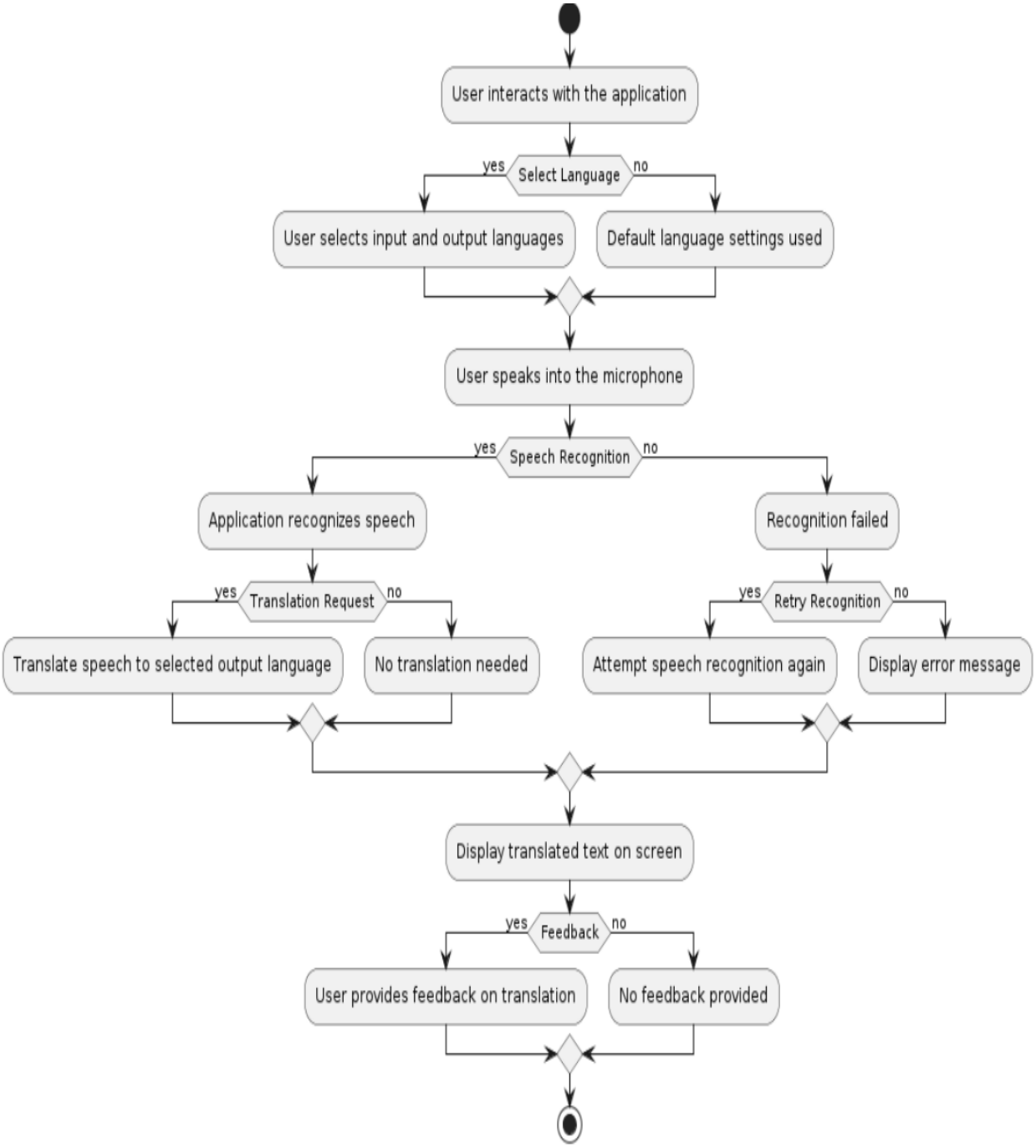

Fig 4.3.1 : Flow chart

4.4 REQUIREMENTS FOR THE PROJECT

The "Speech Translator" project has specific requirements spanning functional, non-functional, and user-related aspects. These requirements serve as the foundation for the design and implementation phases.

Functional Requirements

1. **Speech Recognition**
    - The system accurately captured and transcribed user input from spoken language.
    - Users could initiate and terminate speech recognition using designated buttons.
2. **Language Detection**
    - The system automatically detected the language of the input speech in real-time.
    - Language detection ensured accurate translations.
3. **Translation**
    - The system integrated with translation APIs to translate recognized speech into the desired target language.
    - Users selected the source and target languages for translation via dropdown menus.
4. **Text-to-Speech Synthesis**
    - The system supported text-to-speech synthesis to audibly render translated text for users.
    - Users had the option to listen to the translated output using dedicated buttons.

Non-Functional Requirements

1. **Cross-Browser Compatibility**
    - The system was compatible with major web browsers (Chrome, Firefox, Safari, Edge) for consistent user experience across platforms.
2. **Responsiveness**
    - The system's user interface was responsive, adapting seamlessly to various screen sizes and devices (desktops, laptops, tablets, mobile phones).
3. **Performance Optimization**
    - The system was optimized for performance, ensuring fast loading times and smooth operation.
    - File minification and compression techniques reduced file sizes to improve load times.
4. **Security**
    - The system implemented security measures to protect against common web vulnerabilities, including Cross-Site Scripting (XSS) and Cross-Site Request Forgery (CSRF).
    - Input validation and sanitization techniques prevented malicious input and potential security breaches.

User-Related Requirements

1. **User Interface (UI)**
    - The system had a user-friendly interface, allowing easy interaction with speech translation features.

- UI components included text areas for speech input and translated output, language selection dropdowns, and control buttons for speech recognition, translation, and text-to-speech synthesis.

2. **Usability**

- The system provided clear and intuitive instructions for users to perform speech recognition, translation, and text-to-speech synthesis tasks.
- Users found the application easy to navigate and understand, even without prior experience.

4.5 UML DIAGRAMS

Unified Modeling Language (UML) diagrams are a set of standardized visual notations used in software engineering and system design to represent various aspects of a system or software application. UML provides a common language for software developers, analysts, designers, and stakeholders to communicate and document the design and behavior of a system.

There are several types of UML diagrams, each focusing on different aspects of a system

- Use Case diagram
- Class diagram
- Activity diagram
- State Chart diagram
- Sequence diagram

Use Case Diagram

A use case diagram is a visual representation in UML that illustrates the interactions between a system and its external entities, known as actors. Actors can be users, other systems, or even hardware devices. The diagram outlines various use cases, each representing a specific functionality or a set of related functionalities that the system

offers to its users. The connections between actors and use cases demonstrate the ways in which external entities interact with the system to achieve specific goals. The use case diagram provides a high-level overview of the system's functionality and helps in establishing a common understanding among stakeholders during the early stages of software development.

Class Diagram

A class diagram in UML (Unified Modeling Language) is a visual representation that illustrates the static structure of a system by modeling the classes, their attributes, methods, and the relationships between them. Class diagrams are valuable for modeling the static structure of a system, providing a blueprint for understanding how classes interact and collaborate. They are widely used in the early stages of software development for design, documentation, and communication among stakeholders.

Activity Diagram

An activity diagram in UML (Unified Modeling Language) is a visual representation that illustrates the dynamic aspects of a system by modeling the flow of activities, actions, and decisions. It typically represents the workflow or business processes within a system.

Activity diagrams are useful for modeling the dynamic aspects of a system, showcasing the order of activities, decision points, and parallel processes. They are particularly valuable for understanding and communicating the flow of actions and control within a system during the design and analysis phases of software development.

Sequence Diagram

A sequence diagram in UML (Unified Modeling Language) is a visual representation that illustrates the interactions and communication between objects or components within a system over time. It focuses on the chronological order of messages exchanged between these elements.

Sequence diagrams are valuable for modeling the dynamic behavior of a system, showcasing the order and flow of messages between objects or components during a

specific scenario or use case. They are particularly useful in understanding and communicating the detailed interactions and collaborations that occur within a system.

State Chart Diagram

A state chart diagram in UML (Unified Modeling Language) is a visual representation that depicts the various states that an object or system undergoes during its lifecycle and the transitions between these states. It is particularly useful for modeling the dynamic behavior of an entity over time.

State chart diagrams are valuable for modeling the behavior of complex systems by capturing how their states change in response to events or conditions. They are commonly used in software engineering for modeling the behavior of objects in an object-oriented system or for representing the lifecycle of a system.

Use Case Diagram

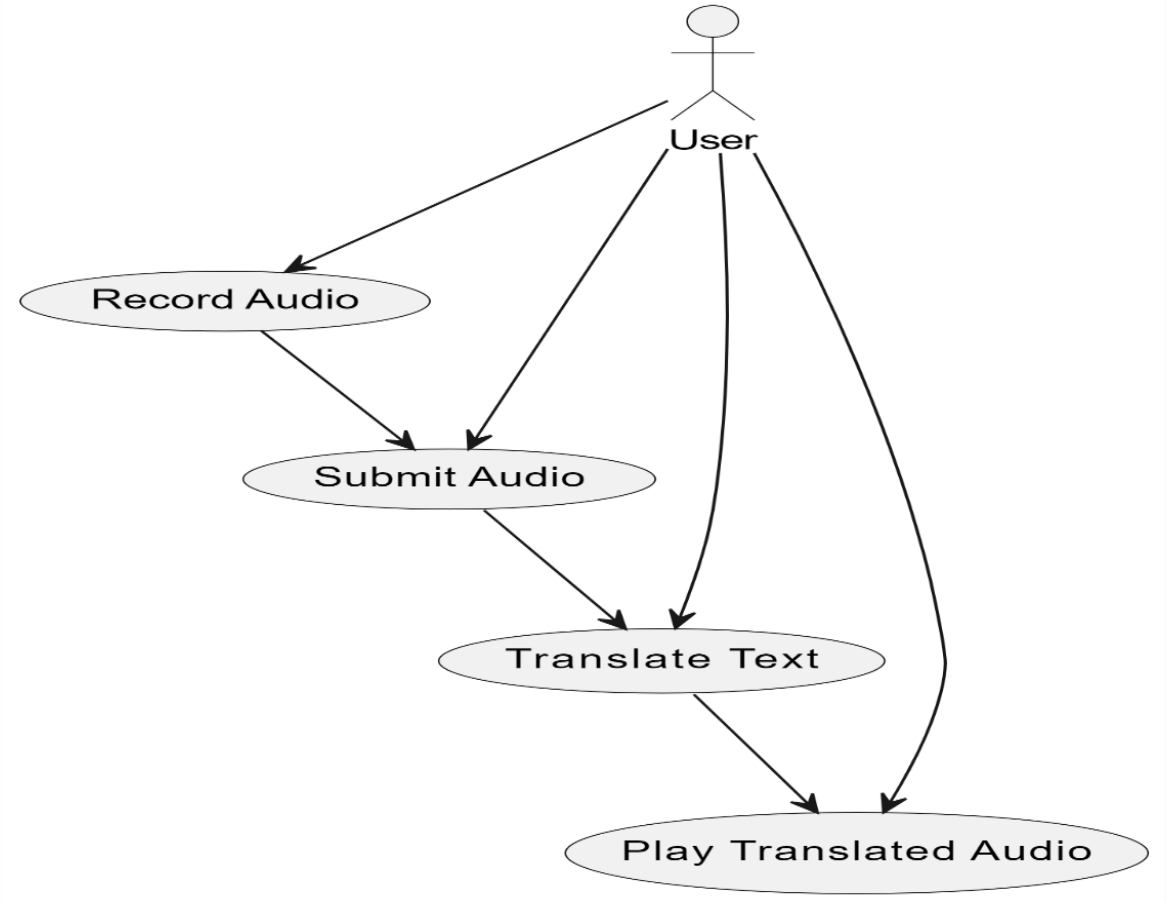

Fig 4.5.1 Use Case Diagram

Class Diagram

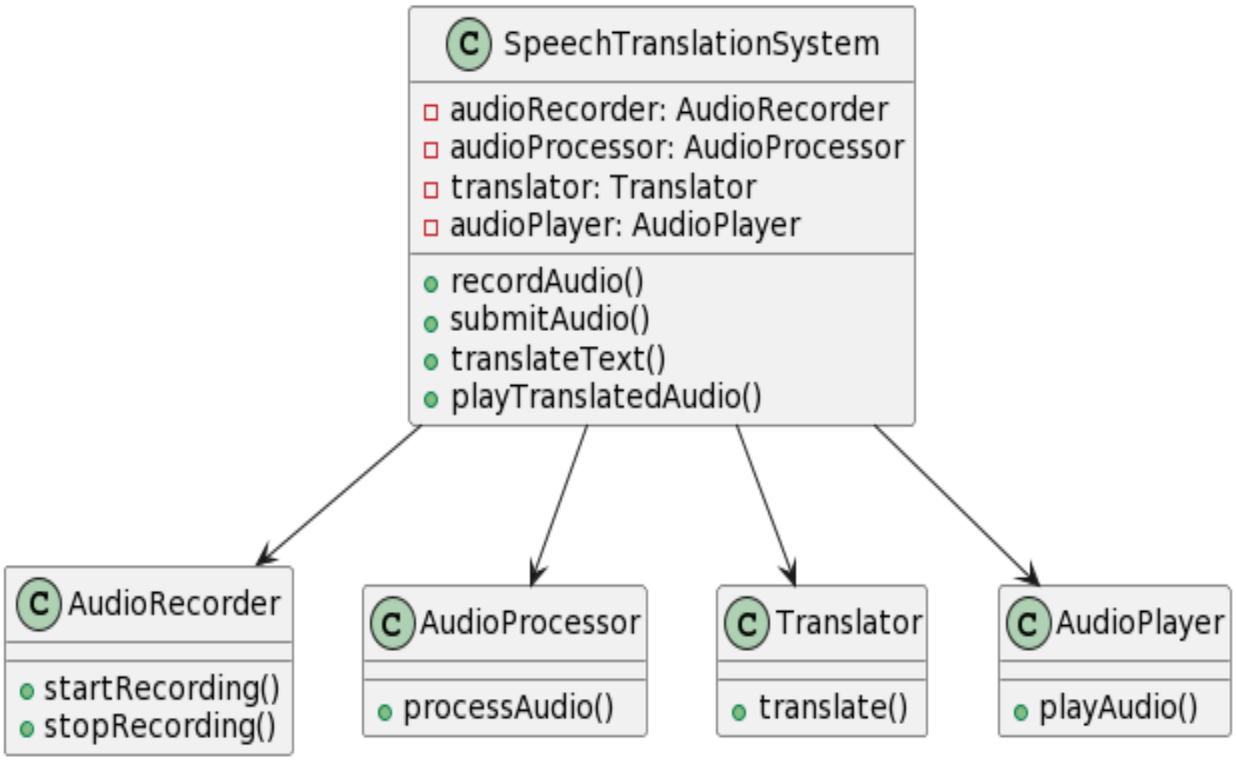

Fig 4.5.2 Class Diagram

Activity Diagram

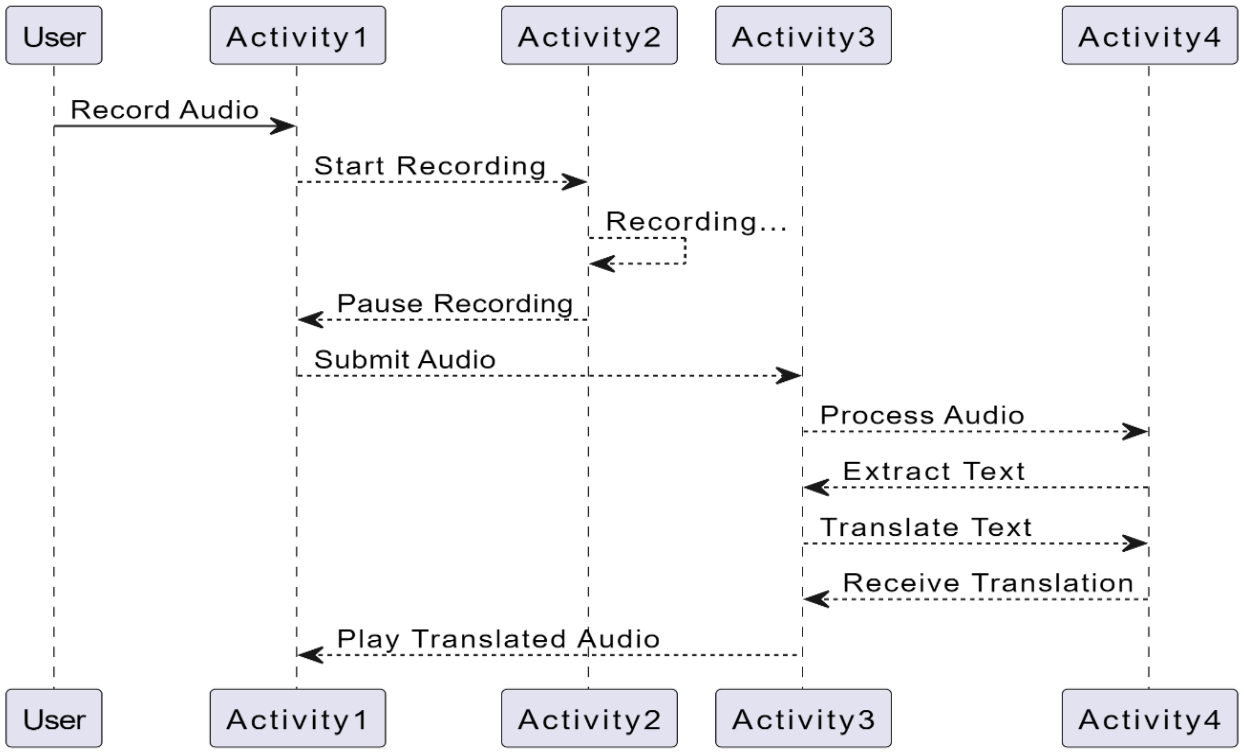

Fig 4.5.3 Activity Diagram

State Chart Diagram

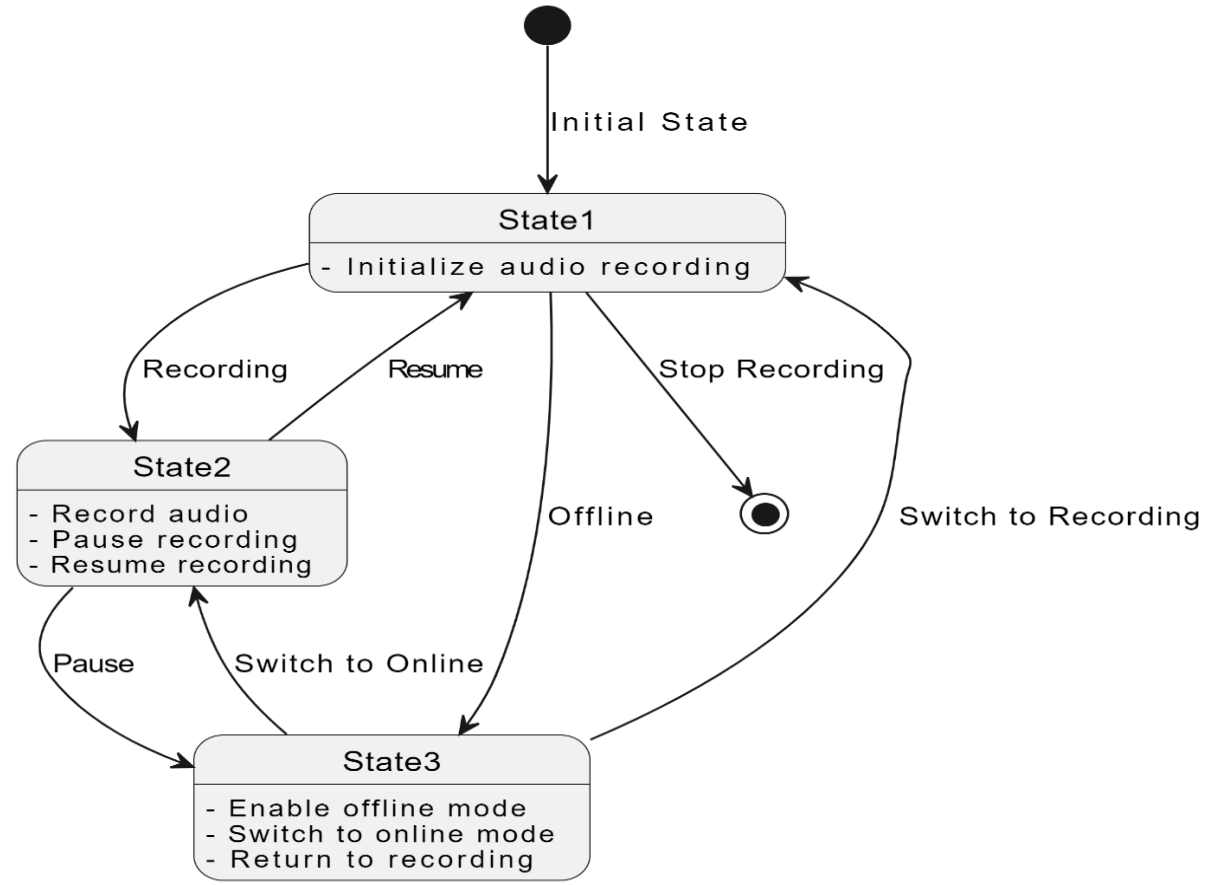

Fig 4.5.4 State Chart Diagram

Sequence Diagram

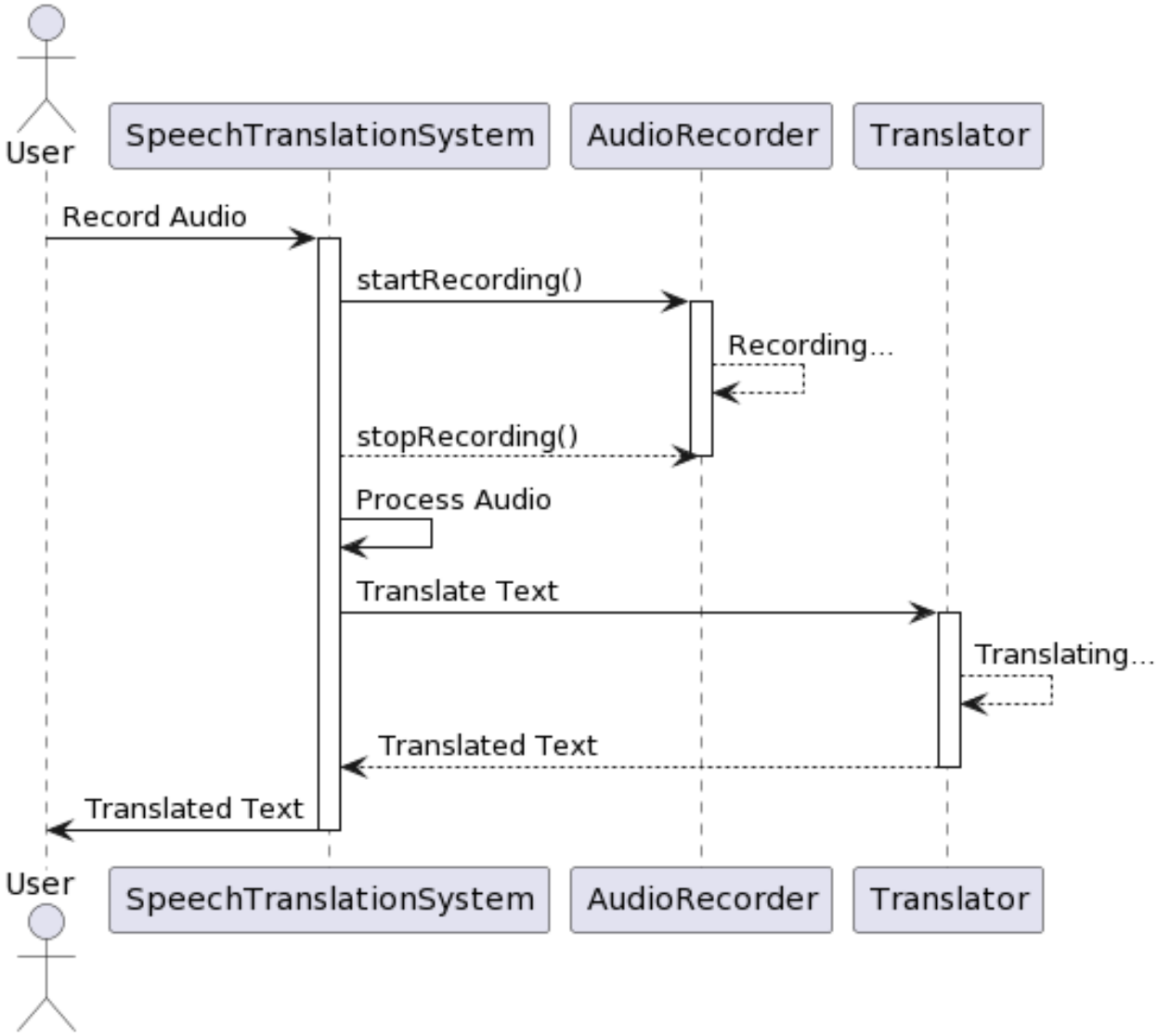

Fig 4.5.5 Sequence Diagram

4.6 SOURCE CODE

HTML File

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link rel="stylesheet" href="style.css">
    <!--icons-->
<script type="module" src="https://unpkg.com/ionicons@5.5.2/dist/ionicons/ionicons.esm.js">
</script>
    <script src="https://unpkg.com/ionicons@5.5.2/dist/ionicons/ionicons.js"></script>
    <title>Language Translator App</title>
</head>
<body>
    <!-- Title -->
    <h1 style="position : absolute; margin-top:-44%;">Speech Translation Application</h1>
    <div class="container">
        <div class="wrapper">
            <div class="text-input">
```

```
<!-- Textarea for input -->
<textarea id="fromText" spellcheck="false" class="from-text" placeholder="Enter text"></textarea>
<!-- Language selection and controls -->
<ul class="controls">
<li class="row from">
<!-- Icons for volume and copy -->
<div class="icons">
<ion-icon id="fromVolume" name="volume-medium-outline"></ion-icon>
<ion-icon id="fromCopy" name="copy-outline"></ion-icon>
</div>
<!-- Dropdown for selecting input language -->
<select id="fromLanguage"></select>
</li>
<li class="exchange">
<!-- Icon for language exchange -->
<ion-icon name="swap-vertical"></ion-icon>
<li class="row to">
<!-- Dropdown for selecting target language -->
<select id="toLanguage"></select>
<!-- Icons for volume and copy -->
```

```
                <div class="icons">
                    <ion-icon id="toVolume" name="volume-medium-outline"></ion-icon>
                    <ion-icon id="toCopy" name="copy-outline"></ion-icon>
                </div>
            </li>
        </ul>
        <!-- Textarea for translated output -->
<textarea id="toText" spellcheck="false" readonly disabled class="to-text" placeholder="Translation"></textarea>
        </div>
    </div>
    <!-- Buttons for controlling speech recognition, translation, and text-to-speech -->
    <button onclick="startSpeechRecognition()">Start Speech Input</button>
    <button onclick="stopSpeechRecognition()">Stop Speech Input</button>
    <button id="translate" onclick="translate()">Translate</button>
    <button onclick="speakTranslation()">Speak Translation</button>
  </div>
  <script src="script.js"></script>
</body>
</html>
```

CSS Code

```
/* Importing fonts from Google Fonts */

@import
"https://fonts.googleapis.com/css2?family=Lalezar&amp;amp;family=Poppins:wght@100;200;300;
400;500;600;700;800&amp;amp;display=swap";

/* Global styles */

* {

  padding: 0;

  margin: 0;

  box-sizing: border-box;

  font-family: "Poppins", Lalezar, cursive, sans-serif;

}

/* Body styles */

body {

  display: flex;

  align-items: center;

  justify-content: center;

  padding: 0 10px;

  min-height: 100vh;

  background: #F28C28; /* Background color */

}
```

```
/* Container styles */
.container {
  max-width: 700px;
  width: 100%;
  padding: 30px;
  background: #fff; /* Container background color */
  border-radius: 1rem;
  box-shadow: 0px 0px 36px -5px #b8b8ff; /* Box shadow */
}
/* Wrapper styles */
.wrapper {
  border-radius: 5px;
  border: 1px solid #ccc; /* Border */
}
/* Text input styles */
.text-input .to-text {
  border-radius: 0px;
  border-top: 1px solid #ccc; /* Border */
}
.text-input textarea {
  height: 120px;
  width: 100%;
  border: none;
  outline: none;
  resize: none;
```

```
  background: none;
  font-size: 18px;
  padding: 10px 15px;
  border-radius: 0.3rem;
}
.text-input textarea::placeholder {
  color: #b7b6b6; /* Placeholder color */
}
/* Controls styles */
.controls {
  list-style: none;
  padding: 12px 15px;
  border-top: 1px solid #ccc; /* Border */
}
.controls .row .icons ion-icon {
  width: 50px;
  color: #adadad;
  font-size: 1.7rem;
  cursor: pointer;
  transition: transform 0.2s ease;
  justify-content: center;
```

JS Code

```
const languages = {

// List of language codes and their corresponding names

};

// Function to populate language dropdowns

const populateLanguageDropdowns = () => {

const selectTags = document.querySelectorAll("select");

  selectTags.forEach((tag, id) => {

    for (let lang_code in languages) {

      let selected =

        id == 0

          ? lang_code == "en-GB"

            ? "selected"

            : ""

          : lang_code == "tl-PH"

          ? "selected"

          : "";

      Let option =  <option ${selected}value="${lang_code}">

${languages[lang_code]}</option>`;

      tag.insertAdjacentHTML("beforeend", option);
```

```
    }
  });
};
// Event listener for input textarea
const fromText = document.querySelector(".from-text");
fromText.addEventListener("keyup", () => {
  const toText = document.querySelector(".to-text");
  if (!fromText.value) {
    toText.value = "";
  }
});
// Function to perform translation
const translate = () => {
const fromText = document.querySelector(".from-text");
const toText = document.querySelector(".to-text");
const selectTags = document.querySelectorAll("select");
let text = fromText.value.trim(),
translateFrom = selectTags[0].value,
translateTo = selectTags[1].value;
if (!text) return;
toText.setAttribute("placeholder", "Translating...");
```

```
let apiUrl =
`https://api.mymemory.translated.net/get?q=${text}&langpair=${translateFrom}|${translateTo
}`;

fetch(apiUrl)

.then((res) => res.json())

.then((data) => {

toText.value = data.responseData.translatedText;

data.matches.forEach((data) => {

if (data.id === 0) {

toText.value = data.translation;

}

});

toText.setAttribute("placeholder", "Translation");

    });

};

// Event listener for translate button

const translateBtn = document.getElementById("translate");

translateBtn.addEventListener("click", () => {

  translate();

});

// Function to swap languages

const exchangeIcon = document.querySelector(".exchange");
```

```
exchangeIcon.addEventListener("click", () => {
  const tempText = fromText.value;
  const tempLang = selectTags[0].value;
  fromText.value = toText.value;
  toText.value = tempText;
  selectTags[0].value = selectTags[1].value;
  selectTags[1].value = tempLang;
});
// Function to handle speech recognition
let recognition;
const startSpeechRecognition = () => {
  recognition = new webkitSpeechRecognition();
  recognition.onresult = function (event) {
    const transcript = event.results[0][0].transcript;
    document.getElementById('fromText').value = transcript;
  };
  recognition.start();
};
// Function to stop speech recognition
const stopSpeechRecognition = () => {
  recognition.stop();
```

```
};

// Function to speak translated text

const speakTranslation = () => {

  const toText = document.querySelector(".to-text");

  const textToSpeak = toText.value;

  // Check if SpeechSynthesis is available in the browser

  if ('speechSynthesis' in window) {

    // Check if there's an existing speechSynthesis instance

    let synth = window.speechSynthesis;

    // Check if there's an existing SpeechSynthesisUtterance instance

    if (!window.SpeechSynthesisUtterance) {

      console.error('SpeechSynthesisUtterance is not supported in this browser.');

      return;

    }

    // Check if there's text to speak

    if (textToSpeak) {

      // Create a new SpeechSynthesisUtterance instance

      let utterance = new SpeechSynthesisUtterance(textToSpeak);

      // Set the language of the utterance

      utterance.lang = selectTags[1].value;

      // Event listener for the end of speech
```

```
      utterance.onend = function () {
        console.log('Speech finished');
      };
      // Event listener for errors
      utterance.onerror = function (event) {
        console.error('Speech synthesis error:', event.error);
      };
      // Speak the utterance
      synth.speak(utterance);
    } else {
      console.error('No text to speak.');
    }
  } else {
    console.error('SpeechSynthesis is not supported in this browser.');
  }
};
// Call the function to populate language dropdowns
populateLanguageDropdowns();
```

RESULTS

5. RESULTS

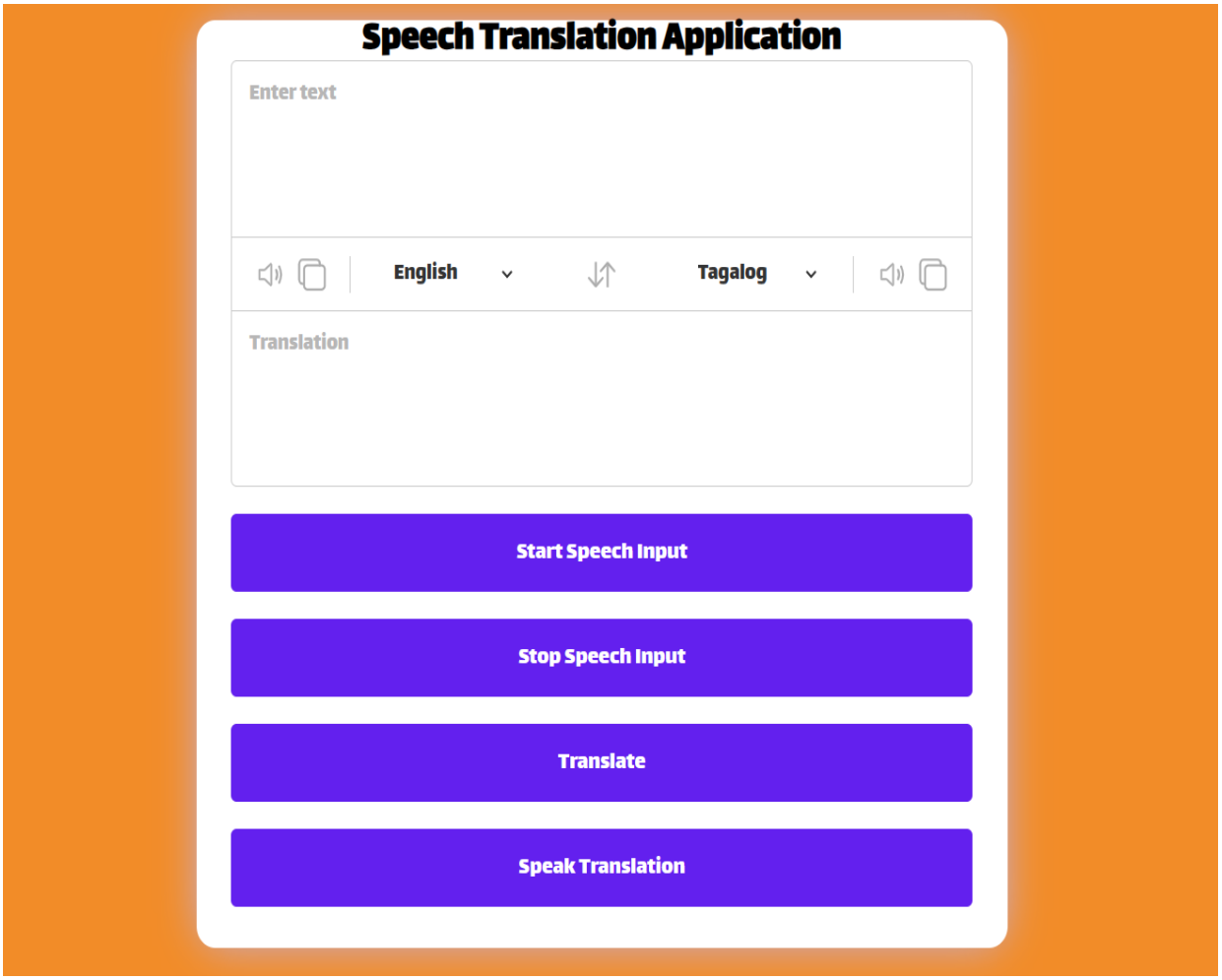

Fig 5.1.1 Website

TESTING AND VALIDATIONS

5. TESTING AND VALIDATION

Unit Testing

- Tested each function/method in the JavaScript code to ensure they worked as expected.
- For example, tested functions responsible for starting and stopping speech recognition, translating text, and speaking translations.

Integration Testing

- Tested the interaction between different components of the application, such as the text input/output areas, language selection dropdowns, and action buttons.
- Ensured that these components worked together seamlessly to provide the desired functionality.

User Interface (UI) Testing

- Tested the user interface elements, such as buttons, dropdowns, and text areas, to ensure they were properly displayed and responsive.
- Verified that the UI design was user-friendly and intuitive for users to interact with.

Cross-Browser Testing

- Tested the application on different web browsers (e.g., Chrome, Firefox, Safari) to ensure compatibility and consistent behaviour across various platforms.
- Checked for any browser-specific issues and made necessary adjustments to ensure a smooth user experience.

Functional Testing

- Tested the core functionality of the application, including speech recognition, translation, and text-to-speech capabilities.

- Inputted various types of text and speech inputs to validate the accuracy and reliability of the translation and speech synthesis.

Error Handling Testing

- Tested how the application handled different types of errors, such as network errors, invalid input, or unexpected behavior.
- Ensured that appropriate error messages were displayed to the user and that the application gracefully handled these situations.

Accessibility Testing

- Tested the application for accessibility compliance to ensure it could be used by people with disabilities.
- Verified that all UI elements were accessible via keyboard navigation and screen readers, and that they met WCAG (Web Content Accessibility Guidelines) standards.

Performance Testing

- Tested the performance of the application, including loading times, response times, and overall responsiveness.
- Identified any performance bottlenecks and optimized the code to improve efficiency and speed.

User Acceptance Testing (UAT)

- Conducted UAT with real users to gather feedback and ensure that the application met their needs and expectations.
- Incorporated user feedback to make any necessary improvements or adjustments to the application.

Security Testing

- Performed security testing to identify and address potential vulnerabilities, such as XSS (Cross-Site Scripting) or CSRF (Cross-Site Request Forgery) attacks.

- Implemented appropriate security measures to protect user data and ensure the integrity of the application.

CONCLUSION AND FUTURE ENHANCEMENT

7. CONCLUSION AND FUTURE ENHANCEMENT

7.1 CONCLUSION

In conclusion, the development of the speech translation application has been a significant achievement, providing users with a convenient and efficient tool for translating speech in real-time. Throughout the project, we successfully implemented key features such as speech recognition, translation, and text-to-speech functionalities, leveraging technologies such as HTML, CSS, JavaScript, and various APIs. The application underwent rigorous testing and validation to ensure its reliability, functionality, and user-friendliness. Overall, the project has met its objectives of delivering a high-quality speech translation solution.

7.2 FUTURE ENHANCEMENT

While the current version of the speech translation application meets its primary objectives, there are several opportunities for future enhancements and improvements:

1. Enhanced Language Support
2. Improved Translation Accuracy
3. Customization Options
4. Offline Mode
5. Integration with Other Platforms
6. User Feedback Mechanism
7. Security Enhancements
8. Performance Optimization

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8. REFERENCES

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