

**Cross-Cultural Nuanced Translation with Emotion  
Preservation Using Emotion-Tagged Parallel Corpora**

*Submitted in partial fulfillment of the requirements for the degree of*

**Bachelor of Technology**  
in  
**Computer Science and Engineering**

*by*

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May, 2024

## **DECLARATION**

I hereby declare that the thesis entitled "Cross-Cultural Nuanced Translation with Emotion Preservation Using Emotion-Tagged Parallel Corpora" submitted by me, for the award of the degree of *Bachelors of Technology in Computer Science and Engineering* to VIT is a record of bonafide work carried out by me under the supervision of Dr Chandra Mohan B.

I further declare that the work reported in this thesis has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

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This is to certify that the thesis entitled “Cross-Cultural Nuanced Translation with Emotion Preservation Using Emotion-Tagged Parallel Corpora” submitted by VINAY VIKKRANTH S 20BCE2059, YERRAMSETTY SAI NAGA SABARISH 20BCE2370, VINEETH KRISHNA S K 20BDS0387, School of Computer Science, VIT, for the award of the degree of *Bachelor of Technology in Computer Science and Engineering*, is a record of bonafide work carried out by him / her under my supervision during the period, 01. 12. 2018 to 30.04.2019, as per the VIT code of academic and research ethics.

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## **Executive Summary**

In an era where effective cross-cultural communication is paramount, traditional language translation systems often fail to capture the emotional subtleties inherent in human expression. Addressing this gap, we proposed an advanced translation system, which can integrate speech recognition, image text extraction, language translation, and text-to-speech conversion functionalities into a unified application framework. We have implemented individual modules for speech recognition, image text extraction, language translation, text-to-speech conversion and text to image conversion utilizing respective libraries and tools such as PyAudio, Google Trans, GTTS, Playsound and AIs tools like Chat gpt and designed an intuitive user interface for the application, ensuring ease of navigation and seamless interaction with the integrated functionalities. We have successfully the integrated and deployed the application with python at the backend we have used Flask to connect the python API with Flutter at front-end. We focused on enhancing user experience by refining features, optimizing response times, and improving the accuracy of functionalities such as speech recognition and language translation.

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## List of Abbreviations

Cv2	Open cv
Gtrans	Google Translator
Google Trans	Google Translator
GTTS	Google Text To Speech Library
NLP	Natural Language Processing
AI	Artificial Intelligence
POS	Parts of Speech
NER	Named Entity Recognition
STT	Speech to Text
TTS	Text to Speech
MFCC	Mel Frequency Cepstral Coefficients
OCR	Optical Character Recognition
API	Application Programming Interface

# 1. INTRODUCTION

## 1.1. OBJECTIVE

The objective of this project is to develop an advanced language translation system that harmonizes the functionalities of speech recognition, image text extraction, language translation, and text-to-speech conversion within a singular application. Our system aims to facilitate effective communication across diverse linguistic barriers by seamlessly integrating these capabilities. Featuring an intuitive user interface crafted for simplicity and effectiveness, our application empowers users to effortlessly accomplish diverse tasks, enhancing efficiency and accessibility across myriad domains and contexts.

To achieve this objective, the following key tasks were undertaken:

1. Development of an efficient mechanism for extracting text from images, utilizing Pytesseract and cv2 libraries.
2. Implementation of a robust system utilizing speech recognition library and pygame to accurately translate audio inputs into text.
3. Leveraging the power of Python package Google Trans to enable seamless language-to-language translation.
4. Employing the GTTS (Google Text-to-Speech) library in conjunction with the Playsound library to facilitate the conversion of textual data into audible speech.
5. the Text-to-Image Generation component, powered by the OpenAI API. This addition marks a significant advancement, allowing our system to not only translate text across languages but also generate visual representations corresponding to the translated text.
6. Amalgamating the functionalities of speech recognition, image text extraction, language translation, image generation and text-to-speech conversion into a unified application framework.

Additionally, rigorous testing was conducted to ensure smooth interoperability and optimal performance of the integrated modules within the unified application environment. Special focus was placed on enhancing user experience by refining features, optimizing response times, and improving the accuracy of functionalities such as speech recognition and language translation.

Overall, this synthesis was meticulously engineered to ensure seamless interoperability and optimal performance within a unified system architecture. By consolidating these capabilities, we deliver a versatile solution that addresses a myriad of user requirements, augmenting efficiency and accessibility across diverse domains and contexts.

## 1.2 MOTIVATION

The motivation behind this project stems from the recognition of the increasing need for advanced language translation systems that can effectively bridge linguistic barriers in various contexts. In response to this need, our project aims to develop a comprehensive integrated application that seamlessly combines speech recognition, image text extraction, language translation, and text-to-speech conversion functionalities. The following steps outline our approach to realizing this objective:

### 1. Requirement Elicitation and Analysis:

We conducted comprehensive interviews, surveys, and discussions with potential users and stakeholders to gather detailed requirements and expectations for the integrated application. Our focus was on understanding specific functionalities needed for each component, ensuring alignment with user needs.

### 2. System Design and Planning:

Based on the gathered requirements, we designed a detailed system architecture outlining the structure and integration of individual modules. Clear interfaces between modules were defined, and a roadmap for development and implementation was established.

### 3. Module Implementation and Integration:

Each module was developed separately, adhering to design specifications and utilizing appropriate libraries and tools. Thorough testing was conducted to ensure correct and efficient functionality before proceeding to integration.

#### 4. Interface Development and User Experience Design:

An intuitive and user-friendly interface was designed for the integrated application, with a focus on ease of navigation and interaction. Feedback from potential users was incorporated to enhance the interface design and overall user experience.

#### 5. Testing and Quality Assurance:

Thorough testing of each module and the integrated application as a whole was conducted to ensure functionality, accuracy, and performance. Unit testing, integration testing, and system testing were performed to identify and resolve any issues or bugs.

#### 6. Deployment and User Training:

The integrated application was deployed on a suitable platform, with comprehensive training and documentation provided to users. This ensured familiarity with the application and its functionalities.

#### 7. Evaluation and Feedback Incorporation:

Feedback from users during deployment and real-world usage was gathered to evaluate the effectiveness, usability, and satisfaction with the application. This feedback was incorporated to make necessary refinements and improvements.

#### 8. Maintenance and Support:

A system for ongoing maintenance and support was established to address any issues, updates, or enhancements needed for the application. Continuous monitoring and optimization ensure reliability and performance over time.

By following this methodology, we aim to systematically develop and deploy a robust and user-friendly integrated application that seamlessly combines speech recognition, image text extraction, language translation, and text-to-speech conversion functionalities to meet the diverse needs of our users effectively

### 1.3 BACKGROUND

The background of this project uses Natural Language Processing. NLP it is a field of artificial intelligence (AI) that focuses on enabling computers to understand, interpret, and generate human language in a way that is both meaningful and contextually appropriate.

Key Components:

- Tokenization: Breaking down text into smaller units, such as words or phrases, for analysis.
- Part-of-Speech (POS) Tagging: Assigning grammatical tags (e.g., noun, verb) to each word in a sentence.
- Named Entity Recognition (NER): Identifying and classifying named entities such as people, organizations, and locations in text.
- Syntactic Analysis: Analyzing the grammatical structure of sentences to understand relationships between words.
- Semantic Analysis: Understanding the meaning of words and sentences based on context.

Language translation with NLP involves converting text from one language (source language) to another language (target language) while preserving the meaning and context of the original text.

NLP-based translation systems typically follow a sequence of steps:

- Tokenization: The input text is segmented into tokens, usually words or subword units, to prepare it for processing.
- Language Identification: The system identifies the source and target languages to determine the translation direction.
- Pre-processing: The text undergoes various pre-processing steps, such as normalization and cleaning, to improve translation accuracy.
- Feature Extraction: Relevant features of the input text are extracted, such as word embeddings or syntactic structures, to capture its meaning and context.
- Statistical or Neural Machine Translation: Translation models are applied to generate the translated output based on the extracted features. This can be done using statistical methods (e.g., phrase-based translation) or neural networks (e.g., sequence-to-sequence models).

- **Post-processing:** The translated text may undergo post-processing steps to improve its fluency and readability.

#### Introduction to Speech-to-Text (STT) and Text-to-Speech (TTS) Conversion:

- **Speech-to-Text (STT) conversion**, also known as automatic speech recognition (ASR), is the process of transcribing spoken language into written text.
- **Text-to-Speech (TTS) conversion** involves synthesizing human-like speech from written text, enabling computers to speak aloud.

#### Components of Speech-to-Text (STT) Conversion:

- **Audio Input Processing:** The audio input, typically in the form of speech, is captured and pre-processed to enhance its quality and remove noise.
- **Feature Extraction:** Relevant features of the audio signal, such as spectrograms or Mel-frequency cepstral coefficients (MFCCs), are extracted to represent the speech content.
- **Language Modeling:** Language models are employed to predict the most likely sequence of words given the acoustic features, incorporating contextual information and grammar rules.

#### Challenges and Future Directions for STT:

- **Accuracy:** Achieving high accuracy in transcribing speech to text remains a significant challenge, especially in noisy environments, with speakers of varying accents, or when dealing with complex linguistic phenomena. Ensuring accurate recognition of spoken words, including proper nouns, abbreviations, and domain-specific terminology, is crucial for the reliability of STT systems.
- **Speaker Variability:** Handling variability in speech patterns, speaking styles, and accents across different speakers presents a challenge for STT systems. Variations in speech rate, pitch, intonation, and pronunciation can impact the performance of automatic speech recognition (ASR) algorithms and require robust adaptation mechanisms.
- **Context and Ambiguity:** Interpreting the contextual meaning and resolving ambiguities in spoken language poses challenges for STT systems. Understanding the semantic context, syntactic structure, and pragmatic cues in speech is essential for accurate transcription,

particularly in conversational or informal settings where language is ambiguous or context-dependent.

- **Neural Network Architectures:** Advancements in deep learning techniques, particularly neural network-based ASR models, hold promise for improving the accuracy and robustness of STT systems. End-to-end trainable models, such as deep neural networks (DNNs), recurrent neural networks (RNNs), and transformer-based architectures, can learn directly from raw audio data, bypassing intermediate feature extraction steps and improving transcription accuracy.
- **Multilingual and Code-Switching ASR:** Developing ASR systems capable of handling multiple languages and code-switching phenomena is an emerging research direction. Multilingual ASR models that can recognize and transcribe speech in multiple languages with high accuracy are essential for supporting linguistic diversity and enabling cross-lingual communication.

#### Components of Text-to-Speech (TTS) Conversion:

- **Text Analysis:** The input text is analyzed to identify linguistic features such as words, punctuation, and prosody cues.
- **Waveform Synthesis:** Acoustic features are synthesized into waveform signals representing human-like speech, which can be outputted through audio playback devices.

#### Challenges and Future Directions for TTS:

- **Naturalness and Intelligibility:** Improving the naturalness and intelligibility of synthesized speech remains a challenge, particularly for complex linguistic structures and emotional expression.
- **Multilingual and Accented Speech:** TTS systems need to handle diverse languages and accents effectively to ensure accurate and natural-sounding speech synthesis.
- **Adaptability to User Preferences:** Personalizing TTS synthesis to accommodate individual user preferences, such as voice gender, speaking rate, or accent, is challenging. Developing adaptive TTS systems that dynamically adjust synthesis parameters based on user feedback or contextual cues is an ongoing research area.
- **Real-Time Processing:** Real-time TTS synthesis with low latency and high throughput is

essential for applications such as voice assistants, navigation systems, and telecommunication services. Optimizing synthesis algorithms and leveraging hardware acceleration techniques are necessary to meet real-time processing requirements.

- **Emotional Speech Synthesis:** Developing TTS systems capable of synthesizing emotional speech with varying degrees of expressiveness is an emerging research direction. Integrating emotional models and prosody control mechanisms into TTS synthesis pipelines can enable more nuanced and expressive speech synthesis across a range of emotions.
- **Low-Resource and Cross-Lingual TTS:** Addressing the challenge of synthesizing speech in low-resource languages or dialects is essential for promoting linguistic diversity and inclusivity. Developing cross-lingual and multilingual TTS models that can transfer knowledge across languages and leverage shared linguistic features is a promising direction for future research.

#### Introduction to Image-to-Text (OCR) Conversion:

- Image-to-Text conversion, also known as Optical Character Recognition (OCR), is the process of extracting text from images or scanned documents.
- OCR technology enables computers to recognize and interpret text within images, making it accessible and searchable.

#### Components of Image-to-Text (OCR) Conversion:

- **Image Pre-processing:** The input image undergoes pre-processing techniques such as noise reduction, contrast enhancement, and binarization to improve text extraction accuracy.
- **Text Detection:** Text regions within the image are detected using techniques such as edge detection, connected component analysis, and deep learning-based object detection.
- **Character Segmentation:** Individual characters within detected text regions are segmented to isolate them for recognition.
- **Character Recognition:** Recognized characters are identified and mapped to corresponding textual representations using pattern recognition algorithms or neural networks.



## Challenges and future directions of OCR Conversion:

- **Accuracy:** One of the primary challenges in OCR conversion is achieving high accuracy, especially when dealing with complex fonts, degraded images, or handwritten text. Ensuring accurate character recognition is essential for the reliability of the OCR system.
- **Handling Variability:** OCR systems must be able to handle variability in text layout, font styles, sizes, and orientations. Variations in text alignment, skew, and perspective can pose challenges to accurate character recognition and require robust preprocessing techniques.
- **Document Structure Recognition:** Recognizing and preserving the structure of documents, including headings, paragraphs, tables, and columns, presents a significant challenge in OCR conversion. Maintaining the original document layout is crucial for retaining the semantic meaning and context of the text.
- **Adaptive OCR Systems:** Building adaptive OCR systems that can dynamically adjust their behavior based on input data characteristics, user preferences, or environmental conditions is an emerging research direction. Adaptive preprocessing, feature extraction, and recognition algorithms can improve OCR performance across diverse input scenarios.
- **Real-Time and Edge Computing:** With the proliferation of mobile devices and IoT (Internet of Things) applications, there is a growing need for real-time OCR capabilities that can operate efficiently on edge devices with limited computational resources. Optimizing OCR algorithms for low-power devices and edge computing environments is an important area for future development.

## Introduction to Language Translation Using (google\_translate Package and Chat-gpt)

- **Multilingual Communication:** Your system enables seamless communication across language barriers by providing instant translation between multiple languages. This functionality is particularly valuable for individuals, businesses, and organizations operating in diverse linguistic environments, facilitating effective communication and collaboration.
- **Accessibility:** Your system enhances accessibility by breaking down language barriers and enabling users to access information and interact with content in their preferred language. This inclusivity promotes equal participation and engagement for individuals who may have limited proficiency in certain languages.

- **Efficiency and Convenience:** Your system offers a convenient and efficient solution for translating text, eliminating the need for manual translation or reliance on external translation services. Users can quickly translate text on-the-fly, saving time and effort in cross-lingual communication and content localization tasks.
- **Integration with ChatGPT API:** By integrating the ChatGPT API with the translation functionality, your system goes beyond simple text translation by offering contextually relevant responses and conversational interactions in multiple languages. This integration enhances the user experience and allows for more natural and engaging communication across language barriers.
- **Scalability and Customization:** Your system provides scalability and customization options, allowing for the addition of new languages, customization of translation models, and integration with other APIs or services. This flexibility ensures that the system can adapt to evolving user needs and support a wide range of use cases and applications.

#### Components of the Language Translator System:

- **Text Input Interface:** A user-friendly interface where users can input text to be translated. This interface may support various input methods, including manual typing, copy-pasting, or uploading text files.
- **Language Selection:** A feature allowing users to select the source and target languages for translation. This component provides a dropdown menu or similar interface for users to choose from a list of supported languages.
- **Translation Engine (Google Translate API):** The core component responsible for translating text between different languages. This component utilizes the Google Translate API to perform machine translation and generate translated output.
- **Contextual Understanding (ChatGPT):** Integration of the ChatGPT model to provide contextually relevant translations. This component analyzes the input text and generates contextually appropriate responses to enhance the quality and coherence of translations.
- **Real-Time Translation:** Support for real-time translation of text input, enabling users to see translated output as they type or speak. This component provides instant feedback and facilitates seamless communication in live conversations or interactive scenarios.

- **Customization and Settings:** Options for users to customize translation preferences and settings, such as choosing preferred translation models, adjusting translation accuracy levels, or enabling/disabling specific features. This component allows users to tailor the translator system to their individual needs and preferences.

#### Challenges and Future Directions for The Language Translator System:

- **Translation Quality:** Despite advancements in machine translation, achieving high-quality translations that accurately capture nuances, idiomatic expressions, and cultural context remains a challenge. Improving translation quality requires addressing issues such as ambiguity, word sense disambiguation, and context-aware translation.
- **Language Specificity:** Some languages pose unique challenges for machine translation due to their complex grammar, morphology, or lack of parallel corpora for training. Addressing the translation needs of low-resource languages or languages with limited linguistic resources requires innovative approaches and specialized techniques.
- **Domain Adaptation:** Adapting translation models to specific domains, such as technical, legal, or medical domains, presents challenges due to domain-specific vocabulary, terminology, and discourse patterns. Developing domain-adaptive translation models that can tailor translations to specific contexts and domains is essential for improving translation accuracy and relevance.
- **Neural Machine Translation (NMT):** Advancements in neural machine translation techniques, such as transformer-based models, offer promising directions for improving translation quality, scalability, and efficiency. Future research will focus on refining NMT architectures, training methods, and optimization techniques to further enhance translation performance.
- **Multilingual and Zero-Shot Translation:** Developing multilingual and zero-shot translation models that can translate between multiple language pairs and handle translation tasks for languages not seen during training is an emerging research direction. Improving multilingual and zero-shot translation capabilities will enhance the versatility and applicability of machine translation systems.

## Introduction to Text to Image:

- Recently, a new component has been added to our existing language translation system: the Text-to-Image Generation component, powered by the OpenAI API.
- This addition marks a significant advancement, allowing our system to not only translate text across languages but also generate visual representations corresponding to the translated text.

## Components of Text to Image:

1. **Text Input Interface:** A user-friendly interface for inputting text to be converted into images. This interface may support various input methods, including manual typing, copy-pasting, or uploading text files.
2. **Image Output Preview:** A preview feature that displays the generated images based on the input text before finalizing the conversion. This component allows users to review and verify the accuracy and suitability of the generated images.
3. **Image Generation Engine (OpenAI API):** The core component responsible for generating images based on the input text. This component utilizes the OpenAI API to perform text-to-image conversion using advanced machine learning models.
4. **Real-Time Image Generation:** Support for real-time generation of images as users type or speak input text. This component provides instant feedback and allows users to see the visual output dynamically updated as they input text.

## Challenges and Future Direction:

- **Interpretation Challenges:** Generating accurate visual representations from translated text may pose challenges, particularly when dealing with abstract or subjective concepts. The interpretation of text and conversion into visual form may vary depending on individual perspectives and cultural contexts, leading to potential misinterpretations or inaccuracies.
- **Computational Complexity:** Text-to-Image Generation involves complex computational processes, requiring significant computational resources and processing time. The integration of this component may introduce additional overhead and performance considerations, particularly in real-time or resource-constrained environments.

- **Potential Bias in Generated Images:** Like any AI-generated content, images produced by Text-to-Image Generation may reflect biases present in the training data or underlying algorithms. Careful attention must be paid to mitigate biases and ensure the fairness and inclusivity of generated visual content.
- **Personalized Visualizations:** Future advancements in Text-to-Image Generation may enable the creation of personalized visualizations tailored to individual preferences, contexts, and communication styles. Customizable visual representations can enhance user engagement and satisfaction by aligning with user preferences and needs
- **Multimodal Integration:** Integrating Text-to-Image Generation with other modalities, such as speech and audio, can enrich communication experiences and enable more immersive interactions. Multimodal integration allows for the creation of dynamic presentations, interactive storytelling, and augmented reality experiences that combine text, images, and audio seamlessly.
- **Ethical and Cultural Considerations:** Future developments in Text-to-Image Generation will need to address ethical and cultural considerations, including privacy, consent, and representation. Ensuring transparency, accountability, and cultural sensitivity in the generation of visual content is essential for fostering trust and acceptance of AI-generated images.

## 2. PROJECT DESCRIPTION AND GOALS

### 2.1 Survey on Existing System:

S.no	Title	Focus of the Paper	Year	Author(s)
1.	Novel Technique for Script Translation using NLP: Performance Evaluation	Researchers developed machine translation techniques, including rule-based, statistical-based, and hybrid, to aid comprehension of data in various languages like Hindi, Marathi, and English on social media and knowledge resources. The MVET (Marathi video to English Text translation) technique translates Marathi video content into English text, addressing the regional language barrier	2021	Darshana Patil, S.B.Chaudhari, Sharmila Shinde
2.	NLP Challenges For Machine Translation From English to Indian Languages.	Statistical machine translation (SMT) generates translations using statistical models derived from	2020	MALLAMMA V REDDY, DR. M. HANUMANTHAPPA

		bilingual text corpora analysis, contrasting with rule-based and		
		example-based approaches to machine translation for the Dravidian Language Kannada.		
3.	English to Spanish translation of signboard images from mobile phone camera	The authors propose an architecture for translating English text on JPEG natural scene images taken with a mobile phone camera to Spanish. We detect text using DCT coefficient frequency information, binarize it with a clustering-based algorithm, recognize it using OCR, and translate and phonetically transcribe it.	2021	Adrian Canedo-Rodriguez, Soohyung Kim, Jung H. Kim, Yolanda Blanco-Fernandez
4.	Statistical Machine Translation for Indic Languages	This paper discusses the development of bilingual Statistical Machine Translation (SMT) models for translating English to fifteen low-resource	2023	Sudhansu Bala Das, Divyajoti Panda, Tapas Kumar Mishra, Bidyut Kr. Patra

		Indian Languages (ILs) and vice versa. It covers the analysis of		
		datasets, including Samanantar and OPUS, along with preprocessing techniques to handle dataset noise. The MOSES open-source SMT toolkit is utilized, with distance reordering employed to understand grammar rules and context adjustments. Translation quality is evaluated using standard metrics like BLEU, METEOR, and RIBES.		



5.	Automatic Recognition of Mexican Sign Language Using a Depth Camera and Recurrent Neural Networks	This study introduces an automatic sign language recognition system utilizing multiple gestures, including hands, body, and face, captured through a depth camera (OAK-D) for 3D motion coordinates. A dataset of 3000 samples from 30 Mexican Sign	2022	Kenneth Mejía-Peréz, Diana- Margarita Córdova-Esparza, Juan Terven, Ana- Marcela Herrera- Navarro
		Language (MSL) signs was collected, and the best model achieved 97% accuracy on clean test data and 90% on highly noisy data after extensive evaluation and ablation studies.		

6.	Investigating Low-resource Machine Translation for English-to-Tamil	This study compares the performance of phrase-based statistical machine translation (PB-SMT) and neural machine translation (NMT) on the low-resource language pair of English-to-Tamil, focusing on software localization. Despite the recent dominance of end-to-end deep learning approaches in machine translation, PB-SMT and NMT are evaluated in this specialized domain.	2020	Akshai Ramesh, Venkatesh Balavadhani parthasa, Rejwanul Haque, Andy Way
7.	A Corpus-based Evaluation of English-	This paper addresses the challenges posed	2024	Yadan Zhang, Omer Hassan Ali

	Mandarin Cultural References between Fansubbing and Official Subtitling	by ambiguity in machine translation, particularly between genetically unrelated languages like Arabic, English, and French. It explores instances of ambiguity in translation, focusing on lexical and semantic differences, segmentation, determination, coordination, and word function.		Mahfoodh, Debbita Ai Lin Tan
8.	Malayalam Natural Language Processing: Challenges in Building a Phrase-Based Statistical Machine Translation System	This article explores the adaptation of Statistical Machine Translation (SMT) to the Malayalam language, a Dravidian language with unique characteristics. It discusses the challenges in applying SMT methods designed for foreign languages to Malayalam and proposes	2023	Mary Priya Sebastian, Santhosh Kumar

		improvements by refining alignments between English-Malayalam sentence pairs.		
9.	PyThaiNLP: Thai Natural Language Processing in Python	<p>This paper introduces PyThaiNLP, an open-source NLP library for the Thai language, implemented in Python. It provides various tools, models, and datasets for Thai language processing. The paper includes a historical overview of previous tools for Thai language processing, outlines PyThaiNLP's functionalities, datasets, and pre-trained models, highlights development milestones, and shares the authors' experiences during its development.</p>	2023	Wannaphong Phatthiyaphaibun, Korakot Chaovavanich, Charin Polpanumas, Arthit Suriyawongkul

10	End-to-End Transformer-Based Models in Textual-Based NLP.	This paper presents a literature review on Transformer-based (TB) models, focusing on their applications in Natural Language Processing (NLP) for textual-based tasks. It outlines the core concepts of Transformer architectures and provides a detailed overview of various TB models, comparing them to the standard Transformer architecture.	2023	Abir Rahali and Moulay, A Akhloufi
11.	Document-Level Machine Translation with Large Language Models	This paper evaluates large language models (LLMs) like ChatGPT in the context of document-level machine translation (MT), focusing on discourse modeling. It examines the effects of context-aware prompts, compares LLMs with	2023	Longyue Wang, Chenyang Lyu, Tianbo Ji, Zhirui Zhang, Dian Yu, Shuming Shi, Zhaopeng Tu

		commercial MT systems and advanced document-level MT methods, and analyzes discourse modeling abilities.		
12.	Parallel Corpus for Indigenous Language Translation: Spanish-Mazatec and Spanish-Mixtec	This paper introduces a parallel Spanish-Mazatec and Spanish-Mixtec corpus for machine translation tasks, focusing on indigenous Mexican languages. The usability of the corpus is evaluated using three approaches: transformer, transfer learning, and fine-tuning pre-trained multilingual MT models. Fine-tuning the Facebook M2M100-48 model yielded the best results, emphasizing the importance of creating parallel corpora for indigenous languages and fine-tuning models for	2023	Atnafu Lambebo Tonja, Christian Maldonado-Sifuentes, David Alejandro Mendoza Castillo

		low-resource translation tasks.		
13.	ParroT: Translating during Chat using Large Language Models tuned with Human Translation and Feedback	This paper introduces ParroT, a framework designed to enhance and regulate translation abilities during chat using open-source large language models (LLMs) like LLaMA. ParroT reformulates translation data into instruction-following style and introduces a "Hint" field for additional requirements. Three instruction types—translation, contrastive, and error-guided—are proposed for fine-tuning ParroT models. Experiments on Flores subsets and	2023	Wenxiang Jiao, Jentse Huang, Wenxuan Wang, Zhiwei He, Tian Liang, Xing Wang, Shuming Shi

		WMT22 test sets demonstrate significant performance improvements with translation instruction, further enhanced by error-guided instruction.		
14.	Translating Natural Language to Planning Goals with Large-Language Models	This work investigates whether large language models (LLMs) can translate goals specified in natural language to a structured planning language, potentially serving as a natural interface between human users and planners. Empirical results on GPT 3.5 variants indicate that while LLMs excel at translation tasks and can leverage commonsense knowledge for under-specified goals, they struggle with tasks	2023	Yaqi Xie, Chen Yu, Tongyao Zhu, Jinbin Bai, Ze Gong, Harold Soh



		requiring numerical or physical reasoning.		
15.	Named entity recognition in Odia language: a rule-based approach	<p>This research focuses on named entity recognition (NER), an essential task in natural language processing (NLP). NER involves extracting named entities from unstructured data and categorizing them into predefined classes. The study uses a rule-based approach to automatically identify named entities from tourism domain data, achieving accuracy rates of 83% and 71% with and without word repetition, respectively.</p>	2023	Amrita Anandika, Sujata Chakravarty and Bijay Kumar Paikaray

16	Improving text-to-image generation with object layout guidance	<p>The focus of the research paper is on the automatic generation of realistic images directly from a story text. The paper proposes a novel approach that decomposes the task of story visualization into three phases: semantic text understanding, object layout prediction, and image generation and refinement. The approach utilizes a scene graph triple notation to encode semantic relationships between story objects and introduces an object layout module to capture the features of these objects. The paper evaluates the performance of the approach using the COCO dataset and compares it with three baseline approaches, demonstrating significant improvements in terms of accuracy of semantic matching and realism of the generated images representing the story text sentences.</p>	2021	<p>Jezia Zakaroui, Moutaz Saleh, Jihad Mohammed, Somaya Al-Maadeed</p>
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17	DiverGAN: An Efficient and Effective Single-Stage Framework for Diverse Text-to-Image Generation	<p>The focus of this paper is on presenting an efficient and effective single-stage framework called DiverGAN for generating diverse, plausible, and semantically consistent images based on natural-language descriptions. The framework introduces two novel word-level attention modules, namely the channel-attention module (CAM) and the pixel-attention module (PAM), to model the importance of each word in the given sentence. These modules allow the network to assign larger weights to significant channels and pixels that semantically align with salient words, improving the visual-semantic representation. Additionally, Conditional Adaptive Instance-Layer Normalization (CAaILN) is introduced to enable linguistic cues from the</p>	2021	Zhenxing Zhang, Lambert Schomaker
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		<p>sentence embedding to flexibly manipulate shape and texture changes, further enhancing visual-semantic representation and stabilizing training.</p>		
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Darshana Patil, S.B.Chaudhari, Sharmila Shinde et al. introduces machine translation techniques for aiding comprehension of data across languages like Hindi, Marathi, and English on social media and knowledge resources. While the MVET technique effectively addresses the regional language barrier by translating Marathi video content into English text, it relies heavily on rule-based, statistical-based, and hybrid approaches.

Mallama V Reddy, DR. M. Hanumanthappa et al. explores statistical machine translation (SMT) for translating English to Dravidian Language Kannada, offering a practical solution for bridging language gaps. Although SMT provides efficient translations based on statistical models derived from bilingual corpora.

Adrian Canedo-Rodriguez, Soohyung Kim, Jung H. Kim, Yolanda Blanco-Fernandez et al, The proposed architecture for translating English text on JPEG images to Spanish addresses the practical need for real-time translation. By leveraging DCT coefficient frequency information and OCR techniques, the system offers a convenient solution for translating signboard text captured via mobile phone cameras.

Sudhansu Bala Das, Divyajoti Panda, Tapas Kumar Mishra, Bidyut Kr. Patra et al, presents bilingual Statistical Machine Translation (SMT) models for translating English to fifteen low-resource Indian Languages (ILs) and vice versa. Despite the utilization of robust SMT models and preprocessing techniques, the system may face challenges in handling linguistic variations and idiosyncrasies across different Indic languages.

Kenneth Mejía-Peréz, Diana-Margarita Córdova-Esparza, Juan Terven, Ana-Marcela Herrera-Navarro et al. proposed automatic sign language recognition system offers a promising solution for enhancing accessibility for the hearing impaired. By leveraging depth camera technology and recurrent neural networks, the system achieves high accuracy in recognizing Mexican Sign Language gestures.

Akshai Ramesh, Venkatesh Balavadhani parthasa, Rejwanul Haque, Andy Way et al, study compares the performance of phrase-based statistical machine translation (PB-SMT) and neural machine translation (NMT) for the low-resource language pair of English-to-Tamil. Despite advancements in NMT, PB-SMT continues to demonstrate competitive performance, particularly in specialized domains like software localization.

Yadan Zhang, Omer Hassan Ali Mahfoodh, Debbita Ai Lin Tan et al, study compares the performance of phrase-based statistical machine translation (PB-SMT) and neural machine translation (NMT) for the low-resource language pair of English-to-Tamil. Despite advancements in NMT, PB-SMT continues to demonstrate competitive performance, particularly in specialized domains like software localization.

Mary Priya Sebastian, Santhosh Kumar et al, The exploration of Statistical Machine Translation (SMT) for the Malayalam language sheds light on unique linguistic characteristics and challenges. Despite efforts to adapt SMT methods to Malayalam, the system may face difficulties in accurately capturing language-specific nuances and idiosyncrasies.

Wannaphong Phatthiyaphaibun, Korakot Chaovavanich, Charin Polpanumas, Arthit Suriyawongkul et al., use PyThaiNLP which introduces an open-source NLP library for the Thai language, offering a comprehensive suite of tools, models, and datasets for Thai language processing. While addressing the need for Thai language processing resources, the system may encounter limitations in coverage and accuracy, particularly in specialized domains or dialectical variations.

Abir Rahali, A Akhloufi et al, literature review provides insights into Transformer-based (TB) models' applications in Natural Language Processing (NLP), offering a comprehensive overview of their functionalities and capabilities.

Longyue Wang, Chenyang Lyu, Tianbo Ji, Zhirui Zhang, Dian Yu, Shuming Shi, Zhaopeng Tu et al. used the evaluation of large language models (LLMs) like ChatGPT in document-

level machine translation (MT) underscores their potential for discourse modeling. However, challenges in context-aware prompts and discourse modeling abilities may impact translation accuracy and coherence.

Yaqi Xie, Chen Yu, Tongyao Zhu, Jinbin Bai, Ze Gong, Harold Soh et al, explores the translation of goals specified in natural language to a structured planning language using large language models (LLMs). While LLMs excel at translation tasks and leverage commonsense knowledge, challenges in handling numerical or physical reasoning may limit their applicability in certain domains.

## 2.2 Gaps Identified:

- While the MVET technique effectively addresses the regional language barrier by translating Marathi video content into English text, it relies heavily on rule-based, statistical-based, and hybrid approaches. However, such approaches may encounter limitations in handling complex linguistic nuances and may require extensive training data for optimal performance.
- Although SMT provides efficient translations based on statistical models derived from bilingual corpora, it may struggle with low-resource languages and fail to capture contextual nuances accurately. Additionally, the reliance on bilingual corpora may limit the system's adaptability to new linguistic patterns and expressions.
- The reliance on image preprocessing techniques and OCR accuracy may pose challenges in accurately extracting and translating text from complex or low-quality images.
- Despite the utilization of robust SMT models and preprocessing techniques, the system may face challenges in handling linguistic variations and idiosyncrasies across different Indic languages. Additionally, reliance on standard evaluation metrics like BLEU, METEOR, and RIBES may not fully capture the system's performance nuances.
- limitations in dataset diversity and noise robustness may impact the system's generalizability to real-world scenarios.
- Despite advancements in NMT, PB-SMT continues to demonstrate competitive performance, particularly in specialized domains like software localization. However, both approaches may encounter challenges in handling linguistic nuances and domain-specific terminology accurately.

- limitations in segmentation, determination, coordination, and word function may further complicate the translation process.
- The reliance on alignments between English-Malayalam sentence pairs may pose challenges in handling linguistic variations and context dependencies.
- While Transformer architectures demonstrate significant advancements in NLP tasks, including textual-based applications, they may require extensive computational resources and data for training, limiting their scalability and practical deployment.
- While LLMs excel at translation tasks and leverage commonsense knowledge, challenges in handling numerical or physical reasoning may limit their applicability in certain domains. Additionally, the study may underscore the importance of domain-specific adaptations and enhancements for accurate goal translation.

### 2.3 Problem Statement:

- In the domain of natural language processing (NLP) and machine translation, significant advancements have been made to address the challenges of language barriers and cross-lingual communication. However, existing systems often exhibit limitations and drawbacks that hinder their effectiveness and applicability in real-world scenarios.
- The problem statement revolves around the need to overcome these limitations and enhance the performance, accuracy, and usability of NLP and machine translation systems. Specifically, the following issues need to be addressed:
- Translation Accuracy and Linguistic Nuances: Existing machine translation systems, such as Statistical Machine Translation (SMT) and Neural Machine Translation (NMT), struggle to accurately capture linguistic nuances and context-specific expressions, particularly in low-resource languages and specialized domains.
- Robustness to Noise and Image Quality: Systems for image text extraction and sign language recognition may encounter challenges in handling noisy or low-quality images, impacting the accuracy and reliability of text extraction and gesture recognition.
- Resource Constraints and Domain Adaptability: Many NLP systems face resource constraints, limiting their adaptability to diverse linguistic patterns and expressions. Additionally, the adaptation of machine translation systems to specialized domains, such as software localization or sign language translation, may require extensive training data and domain-specific enhancements.

- **Usability and Accessibility:** User interfaces for NLP and machine translation systems may lack intuitiveness and accessibility features, hindering their adoption and usability, particularly for users with disabilities or limited technological proficiency.
- **Security and Privacy Concerns:** With the increasing reliance on machine learning algorithms and cloud-based services, concerns regarding data privacy, security vulnerabilities, and ethical implications arise, necessitating robust measures for data protection and user confidentiality.
- By developing solutions that mitigate these limitations and enhance the performance and usability of NLP and machine translation systems, we can foster cross-cultural communication, knowledge dissemination, and societal inclusivity on a global scale.

### **3. TECHNICAL SPECIFICATION**

#### **3.1 REQUIREMENT ANALYSIS**

##### **3.1.1 FUNCTIONAL REQUIREMENTS**

###### **Speech Recognition:**

- The system should be able to accurately transcribe speech input in various languages.
- It should support real-time speech recognition with minimal latency.
- The system should be capable of handling different accents and speech variations.

###### **Image Text Extraction:**

- The system should be able to extract text from images captured by a camera or uploaded from a device.
- It should support text extraction from various image formats, including JPEG, PNG, and GIF.
- The system should handle text extraction from images with varying levels of noise and distortion.



#### Language Translation:

- The system should support translation between multiple language pairs, including commonly spoken languages and low-resource languages.
- It should provide accurate translation of text input with consideration for linguistic nuances and context.
- The system should offer options for both automatic and manual language selection for translation.

#### Text-to-Speech Conversion:

- The system should be capable of converting text input into natural-sounding speech output.
- It should support multiple languages and accents for text-to-speech conversion.
- The system should allow users to adjust the speech rate, pitch, and volume according to their preferences.

#### User Interface:

- The system should have an intuitive and user-friendly interface accessible via both desktop and mobile devices.
- It should provide clear instructions and feedback to users during speech recognition, text extraction, translation, and text-to-speech conversion processes.
- The user interface should support accessibility features such as screen readers and keyboard navigation for users with disabilities.

#### Integration and Compatibility:

- The system should integrate seamlessly with existing applications and platforms, including web browsers, mobile apps, and desktop software.
- It should support APIs for easy integration with third-party services and applications.
- The system should be compatible with popular operating systems, including Windows, macOS, iOS, and Android.

### Performance and Scalability:

- The system should be able to handle a large volume of concurrent requests without experiencing performance degradation.
- It should scale horizontally to accommodate increased user traffic and processing demands.
- The system should have mechanisms in place for load balancing and resource optimization to ensure efficient performance.

### Security and Privacy:

- The system should implement robust security measures to protect user data and prevent unauthorized access.
- It should support encryption for data transmission and storage to safeguard sensitive information.
- The system should comply with relevant data privacy regulations, such as GDPR and HIPAA, and provide users with control over their data.

### Error Handling and Logging:

- The system should have comprehensive error handling mechanisms to gracefully manage exceptions and failures.
- It should log errors, warnings, and system events for troubleshooting and audit purposes.
- The system should provide informative error messages to users and prompt them with possible solutions or next steps.

### Documentation and Support:

- The system should come with thorough documentation, including installation instructions, usage guides, and API references.
- It should offer responsive customer support channels, such as email, chat, or forums, to assist users with inquiries and issues.
- The documentation should include troubleshooting tips, FAQs, and best practices for optimal usage of the system.

### 3.1.2 NON- FUNCTIONAL REQUIREMENTS:

#### Performance:

- The system should demonstrate high performance with minimal latency in processing user requests.
- It should be able to handle a large number of concurrent users without experiencing performance degradation.
- Response times for speech recognition, text extraction, translation, and text-to-speech conversion should be within acceptable limits.

#### Reliability:

- The system should be highly reliable, with a low probability of failure or downtime.
- It should have built-in mechanisms for fault tolerance and recovery to ensure continuous operation in the event of failures.
- Data integrity and consistency should be maintained across all system components.

#### Scalability:

- The system should be scalable to accommodate increasing user demands and data volumes.
- It should support horizontal scalability by adding more resources or instances to handle growing workloads.
- Scalability should be achieved without significant changes to the system architecture or performance degradation.

#### Security:

- The system should prioritize data security and implement robust measures to protect sensitive information.
- It should enforce authentication and authorization mechanisms to control access to system resources.

- Data encryption should be used for data transmission and storage to prevent unauthorized access or interception.

#### Usability:

- The system should have a user-friendly interface that is intuitive and easy to navigate.
- It should provide clear feedback and instructions to users at each stage of interaction.
- Accessibility features should be implemented to ensure usability for users with disabilities.

#### Compatibility:

- The system should be compatible with a wide range of devices, browsers, and operating systems.
- It should adhere to industry standards and protocols to ensure interoperability with other systems and applications.
- Compatibility testing should be conducted to verify the system's functionality across different environments.

#### Maintainability:

- The system should be designed with modularity and extensibility in mind to facilitate easy maintenance and updates.
- Codebase should be well-documented and adhere to coding standards to enhance readability and maintainability.
- Automated testing and continuous integration practices should be employed to detect and address issues early in the development lifecycle.

#### Performance:

- The system should be optimized for efficient resource utilization to minimize hardware and software costs.
- It should have mechanisms in place for monitoring and optimizing performance metrics such as CPU utilization, memory usage, and network throughput.

#### Legal and Regulatory Compliance:

- The system should comply with relevant laws, regulations, and industry standards governing data privacy and security, such as GDPR, HIPAA, and PCI DSS.
- It should provide mechanisms for obtaining user consent and managing user data in accordance with privacy regulations.

#### Documentation and Support:

- Comprehensive documentation should be provided to guide users on system installation, configuration, and usage.
- Responsive customer support channels should be available to assist users with inquiries, issues, and feedback.
- Documentation and support materials should be regularly updated to reflect changes and improvements to the system.

### 3.2 FEASIBILITY STUDY

#### 3.2.1 TECHNICAL FEASIBILITY:

The system's technical feasibility relies on the availability of suitable deep learning frameworks and hardware resources capable of handling large-scale image processing tasks. Integration with existing healthcare IT infrastructure and compatibility with standard image formats are essential considerations. When reviewing the proposed system, it's crucial to evaluate the accessibility of the requisite technologies, encompassing OCR programs, Python libraries, and AI frameworks. This assessment ensures optimal utilization of existing resources and tools. Additionally, it's imperative to gauge the requisite expertise for system development and maintenance, spanning software developers, data scientists, and domain specialists. Adequate proficiency ensures proficient execution and ongoing support for the AI-integrated approach. Lastly, any integration challenges, such as compatibility issues between different system components, must be identified and resolved promptly.

#### 3.2.2 ECONOMIC FEASIBILITY:

The system's economic feasibility depends on factors such as the cost of hardware infrastructure, software licenses, and ongoing maintenance. Cost-benefit analysis should be

conducted to evaluate the system's return on investment compared to traditional diagnostic methods. Next, researchers should evaluate the potential advantages of adopting the AI-integrated methodology, such as heightened efficiency in literature reviews and enriched research insights. Additionally, it's essential to identify and mitigate potential financial risks and uncertainties, such as budgetary overruns and fluctuations in technology expenses. Through economic feasibility analysis, researchers can ascertain whether the benefits of the proposed AI-assisted methodology outweigh the accompanying costs and risks.

### 3.2.3 SOCIAL FEASIBILITY:

Social feasibility involves assessing the system's acceptance and adoption by healthcare professionals and patients. Considerations for cultural sensitivities, language barriers, and user education programs may influence the system's social feasibility. Secondly, it's imperative to assess user acceptance of the AI-assisted methodology, taking into account factors like usability, perceived benefits, and concerns regarding data privacy and security. Addressing user apprehensions and ensuring a user-friendly interface are pivotal for widespread adoption. Lastly, researchers should contemplate the ethical implications associated with AI utilization in literature reviews, encompassing data privacy, algorithmic bias, and responsible AI practices. By tackling these ethical considerations head-on, researchers can uphold ethical standards and prioritize stakeholder interests in the implementation of the proposed AI-integrated methodology.

## 3.3 SYSTEM SPECIFICATION:

### 3.3.1 HARDWARE REQUIREMENTS:

Server:

- Multi-core processor (e.g., Intel Core i5 or equivalent) for handling concurrent requests efficiently.
- Sufficient RAM (e.g., 8GB or more) to accommodate memory-intensive tasks such as machine learning inference and image processing.
- Solid State Drive (SSD) for faster data access and storage.
- Reliable power supply and backup systems to ensure continuous operation.

### 3.3.2 SOFTWARE REQUIREMENTS:

#### Operating System:

- Server: Linux-based operating systems such as Ubuntu Server or CentOS for stability and compatibility with server-side technologies.
- Client Devices: Support for major operating systems including Windows, macOS, iOS, and Android.

#### Web Server:

- Apache or Nginx web server for hosting the system's backend application.
- Configuration for HTTPS encryption to ensure secure communication between clients and the server.

#### Backend Technologies:

- Programming Language: Python for backend development due to its versatility and extensive libraries for NLP, image processing, and machine learning.
- Frameworks and Libraries: Flask or Django for building RESTful APIs, and libraries such as TensorFlow, PyTorch, OpenCV, and NLTK for implementing speech recognition, image text extraction, language translation, and text-to-speech conversion functionalities.

#### Database:

- Relational database management system (RDBMS) such as PostgreSQL or MySQL for storing user data, system configurations, and logs.
- NoSQL database like MongoDB for handling unstructured data if needed.

#### Frontend Technologies:

- HTML5, CSS3, and JavaScript for building the user interface.
- Frontend frameworks like React, Angular, or Vue.js for developing dynamic and responsive web applications.
- Libraries for integrating multimedia elements such as audio playback and image rendering.

#### Client Devices:

- Desktop computers, laptops, tablets, or smartphones with modern web browsers for accessing the system.
- Adequate processing power and memory to support browser-based applications.
- Built-in or external microphones for capturing speech input.
- Cameras for capturing images for text extraction (optional).

#### 3.3.3 STANDARDS AND POLICIES:

##### **Data Privacy and Protection:**

- Compliance with General Data Protection Regulation (GDPR) or other relevant data protection laws to safeguard user data privacy.
- Implementation of data encryption mechanisms (e.g., TLS/SSL) for secure transmission and storage of sensitive information.

##### **Accessibility Standards:**

- Adherence to Web Content Accessibility Guidelines (WCAG) to ensure that the system is accessible to users with disabilities, including those using assistive technologies such as screen readers.

##### **Security Policies:**

- Development and enforcement of security policies covering aspects such as authentication, authorization, data encryption, secure coding practices, and vulnerability management.
- Regular security audits and penetration testing to identify and address potential security vulnerabilities.

##### **Software Development Lifecycle (SDLC) Standards:**

- Adoption of industry-standard software development methodologies such as Agile or DevOps to ensure efficient and iterative development processes.
- Documentation of requirements, design specifications, test plans, and user manuals to facilitate collaboration and maintainability.



**Documentation and Change Management:**

- Documentation of system architecture, design decisions, configuration settings, and operational procedures to facilitate maintenance and troubleshooting.
- Implementation of change management processes to manage and track changes to the system configuration, codebase, and infrastructure.

**Ethical Guidelines:**

- Establishment of ethical guidelines and principles governing the collection, use, and dissemination of data, particularly in sensitive or regulated domains.
- Consideration of ethical implications related to bias, fairness, and transparency in algorithmic decision-making processes.

**Vendor and Third-Party Management:**

- Evaluation and selection of vendors and third-party services based on their compliance with relevant standards and policies.
- Implementation of contractual agreements and service level agreements (SLAs) to ensure accountability and performance standards.

**Training and Awareness:**

- Provision of training and awareness programs for project team members to ensure understanding and compliance with standards, policies, and best practices.
- Regular updates and communication on changes to standards, policies, and regulatory requirements to keep stakeholders informed

## 4. DESIGN APPROACH AND DETAILS

### 4.1 SYSTEM ARCHITECTURE

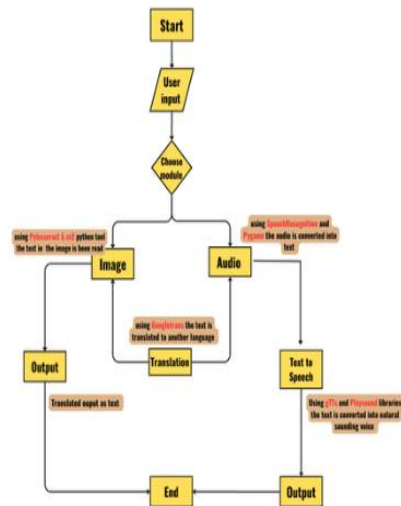


Fig1. System Architecture

### 4.2 DESIGN

#### 4.2.1 DATA FLOW DIAGRAM:

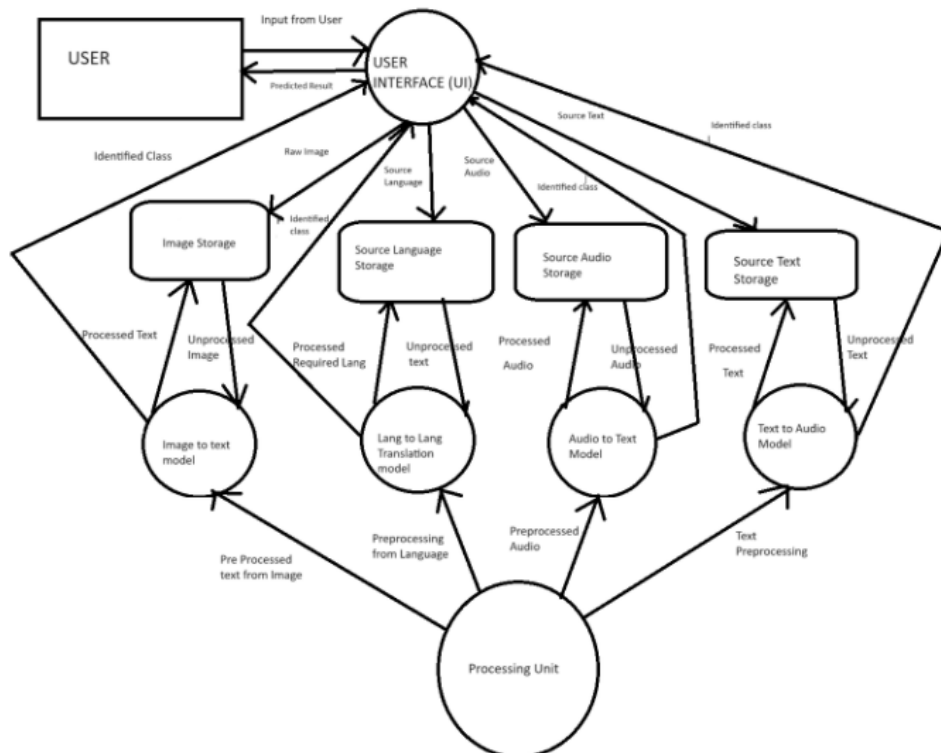


Figure 2. Dataflow Diagram

#### 4.2.2 USE CASE DIAGRAM:

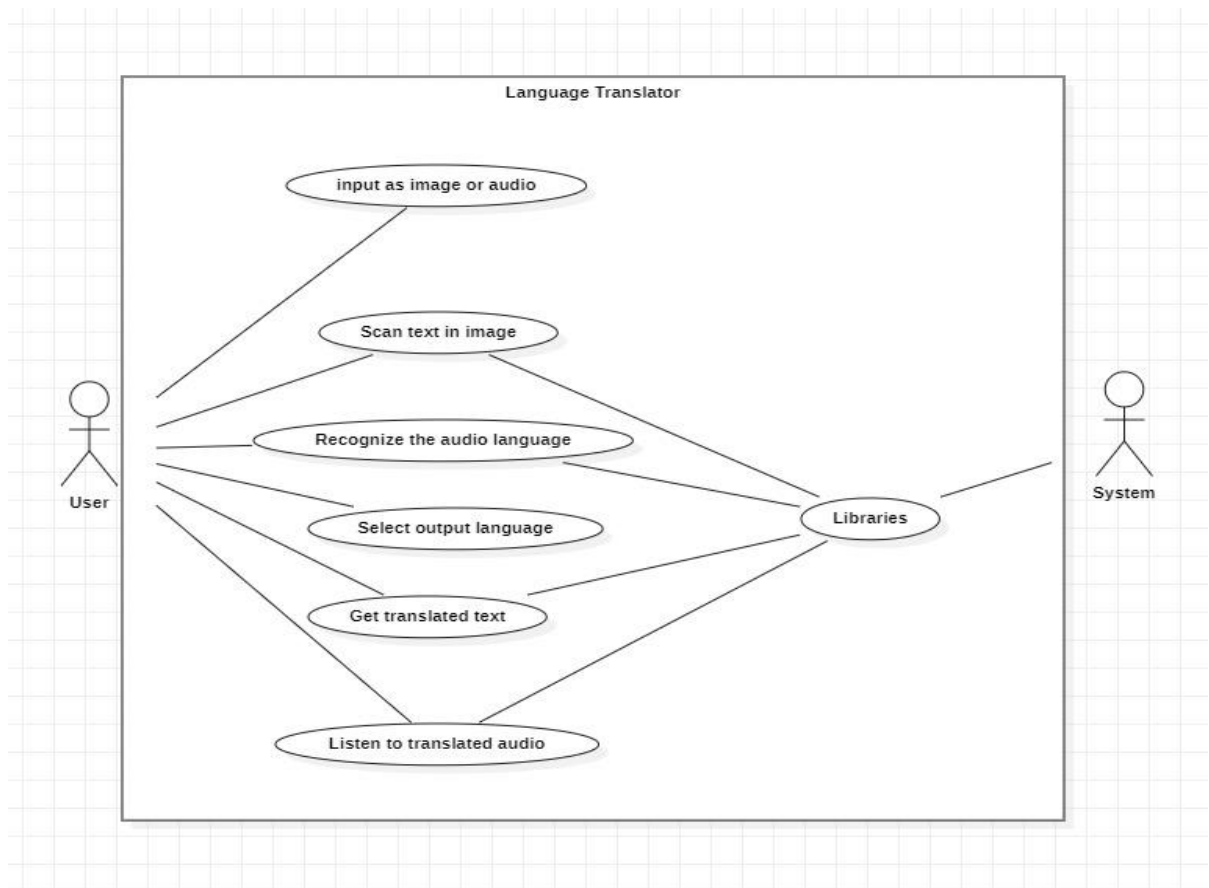


Figure 3. Use Case Diagram

#### 4.2.3 CLASS DIAGRAM:

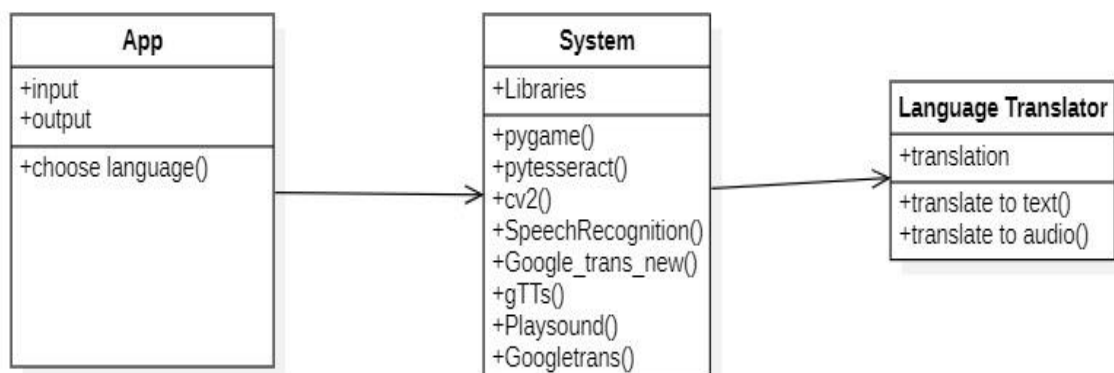


Figure 4. Class Diagram

#### 4.2.4 SEQUENCE DIAGRAM:

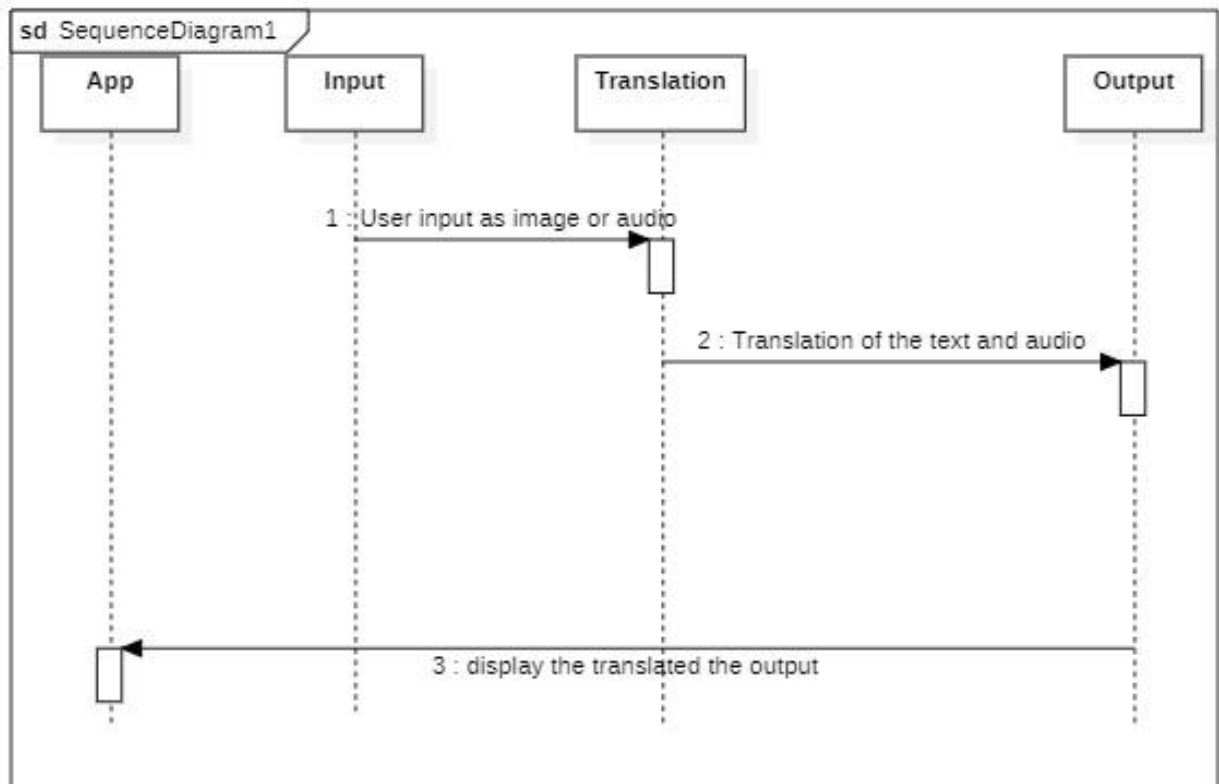


Figure 5. Sequence Diagram

#### 4.3 CONSTRAINTS, ALTERNATIVES AND TRADEOFFS:

##### 1. **Speech to Text Conversion:**

Constraints:

- Dependence on internet connectivity for speech recognition APIs.
- Accuracy may vary depending on environmental noise and speaker accent.
- Limited language support for speech recognition.

Alternatives:

- Implement offline speech recognition models for improved privacy and reliability.
- Use alternative speech recognition APIs for comparison and flexibility.

- Explore domain-specific speech recognition models for enhanced accuracy.

Trade-offs:

- Offline models may require significant computational resources for training and inference.
- Alternative APIs may have different pricing structures and feature sets.
- Domain-specific models may require additional data and customization efforts.

## 2. Text to Speech Conversion:

Constraints:

- Voice synthesis quality may vary across different text-to-speech (TTS) engines.
- Limited control over voice characteristics such as pitch, speed, and accent.
- Dependency on external libraries and APIs for TTS functionality.

Alternatives:

- Explore multiple TTS engines to find the best balance between quality and flexibility.
- Implement custom voice modulation algorithms for more control over voice characteristics.
- Consider open-source TTS solutions for greater customization and self-hosting options.

Trade-offs:

- Higher-quality TTS engines may come with higher costs or usage limitations.
- Custom voice modulation algorithms may require significant development effort and expertise.
- Open-source solutions may require more maintenance and support compared to commercial APIs.

### 3. **Text Detection from Image:**

Constraints:

- Accuracy and performance of text detection algorithms may vary depending on image quality and complexity.
- Dependency on external APIs for text detection functionality.
- Privacy concerns related to sending images to external servers for processing.

Alternatives:

- Implement on-device text detection models for improved privacy and latency.
- Explore alternative text detection algorithms and libraries for comparison.
- Develop custom preprocessing techniques to enhance text detection accuracy.

Trade-offs:

- On-device models may require more computational resources and memory.
- Alternative algorithms may offer different trade-offs between speed and accuracy.
- Custom preprocessing techniques may introduce additional complexity and maintenance overhead.

### 4. **Text to Image Generation:**

Constraints:

- Complexity and computational cost of training generative models for text-to-image synthesis.
- Limited control over image attributes and visual style in generated images.
- Dependency on external APIs or pre-trained models for text-to-image generation.

Alternatives:

- Explore pre-trained models and transfer learning techniques to accelerate model development.
- Implement conditional image generation models for finer control over generated images.
- Consider using style transfer techniques to incorporate user preferences into generated images.

Trade-offs:

- Pre-trained models may have limitations in terms of customization and adaptation to specific use cases.
- Conditional image generation models may require more training data and fine-tuning efforts.
- Style transfer techniques may sacrifice realism for artistic expression, depending on user preferences.

## **5. Language Translation**

**Constraints:**

- Accuracy: The accuracy of translations may vary, especially for complex or nuanced language expressions.
- Language Support: Google Translate may not support all languages, leading to limitations in translation coverage.
- Latency: Translating large amounts of text or complex sentences may result in latency issues.

**Alternatives:**

- Multiple Translation APIs: Explore alternative translation APIs to compare accuracy and performance.
- Custom Translation Models: Train custom translation models tailored to specific language pairs or domains.
- Human Translators: Utilize human translators for critical or sensitive translations to ensure accuracy.

**Trade-offs:**

- Accuracy vs. Speed: Faster translations may sacrifice accuracy, while more accurate translations may take longer to generate.
- Cost vs. Quality: Custom translation models and human translators may offer higher quality but at a higher cost compared to automated solutions.
- Language Coverage vs. Depth: Google Translate may offer broad language coverage but may lack depth in specialized or less commonly spoken languages.

**Integration with ChatGPT:**

- Constraints:
  - Contextual Understanding: ChatGPT may struggle with understanding context-specific nuances in translations.
  - Limitations in Multilingual Capabilities: ChatGPT may perform better in certain languages or language pairs than others.
- Alternatives:
  - Language-specific preprocessing: Implement preprocessing techniques to improve ChatGPT's performance for specific languages or language families.
  - Multilingual Training: Train ChatGPT on multilingual datasets to enhance its performance across various languages.
- Trade-offs:
  - Language-specific preprocessing may require additional development effort and resources.
  - Multilingual training may result in trade-offs in performance for individual languages compared to language-specific models.



5. SCHEDULE, TASKS AND MILESTONES

5.1 GHATT CHART

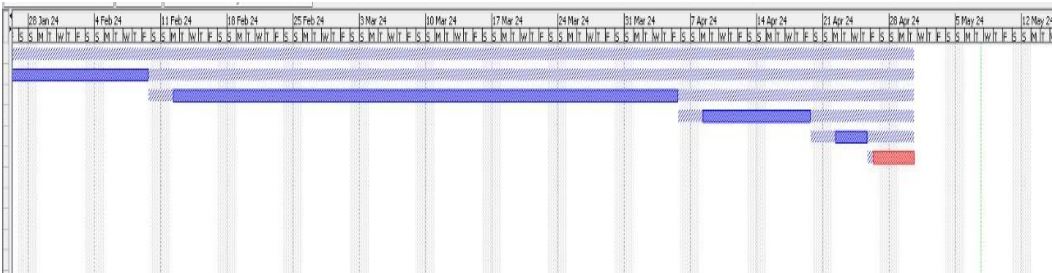


Figure 6. The Main Gantt Chart

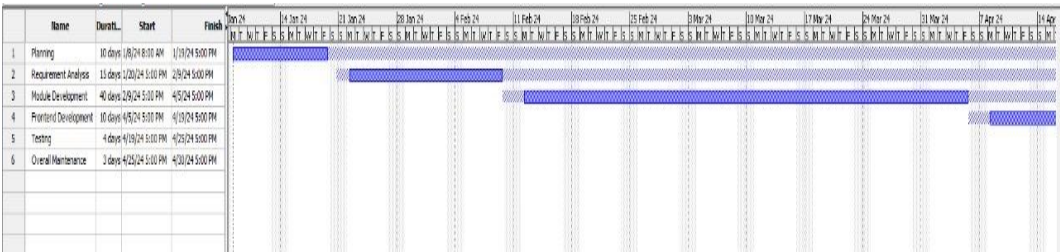


Figure 7. Gantt Chart Continuation - 1

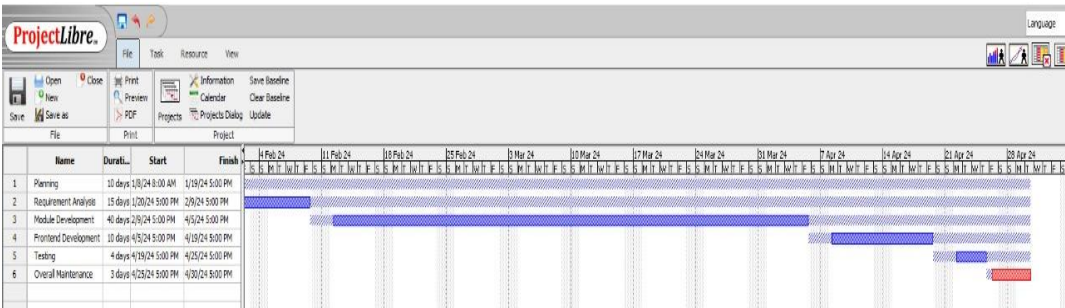


Figure 8. Gantt Chart Continuation – 2

	⑩	Name	Duration
1		Planning	10 days
2	📁	Requirement Analysis	15 days
5	📁	Module Development	40 days?
6	📁	Module 1(Image to text)	19 days?
7		English image to text	1 day?
8		Hindi image to text	2 days
9		Tamil image to text	2 days
10		Telugu image to text	2 days
11		Smybol image to text	2 days
12	📁	Module 2( Audio to text)	19 days?
13		English audio to text	4 days
14		Tamil audio to text	4 days
15		Hindi audio to text	4 days?
16	📁	Module 3 (Translation)	19 days
17		English Text to Tamil text	4 days
18		Tamil text to English text	5 days
19		English audio to Tamil audio	5 days
20		Tamil audio to English audio	5 days
21	📁	Frontend Development	10 days
22	📁	Testing	4 days
23		Unit Testing	2 days
24		Integration Testing	2 days
25	📁	Overall Maintenance	3 days

Figure 9. Requirement Analysis of Gantt Chart

## 5.2 MODULE DESCRIPTION

### 5.2.1 Language Recognition from the Image:

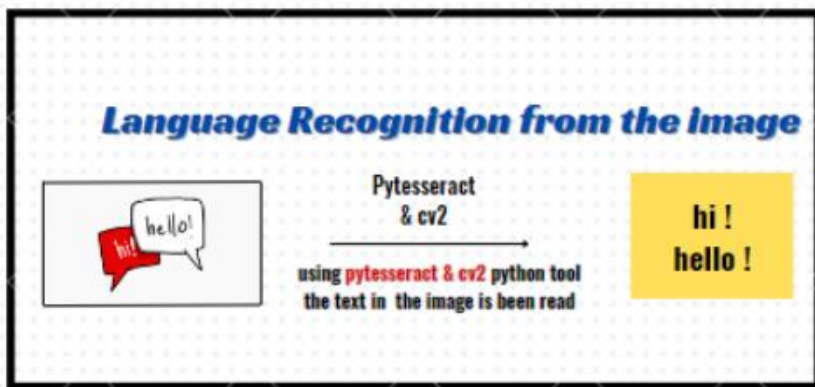


Figure 10. Language Recognition from the Image

Pytesseract:

- pytesseract is a Python wrapper for Google's Tesseract-OCR Engine.
- It allows you to extract text from images or perform **Optical Character Recognition (OCR)** tasks in Python.
- With pytesseract, you can process images containing text and extract the text content programmatically.
- It's widely used in various applications such as document analysis, text recognition in images, and automating data entry tasks.

CV2:

- cv2 stands for OpenCV, which is an open-source computer vision and machine learning software library.
- It provides various functionalities for image processing, video analysis, and computer vision tasks.
- With cv2, you can perform tasks like image manipulation, object detection, feature extraction, and more.
- It's widely used in applications ranging from facial recognition to self-driving cars and augmented reality.

### 5.2.2 Language Translation:

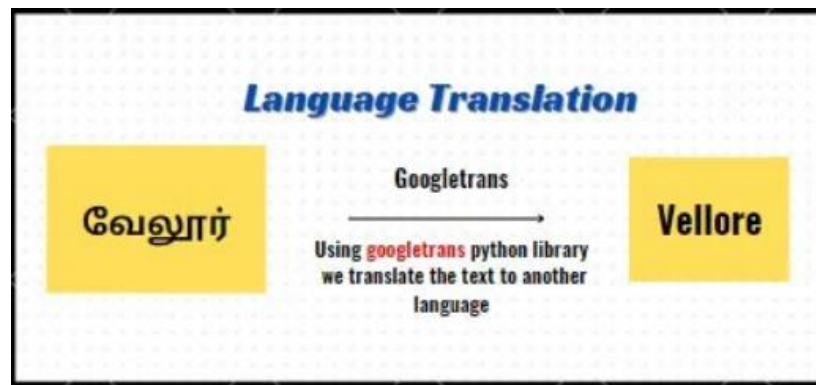


Figure 11. Language Translation

Google ML Tool Kit V2:

Google provides a Machine Learning (ML) tool known as the Google ML Kit. This tool offers developers access to powerful machine learning capabilities for various tasks, including text recognition in images,

- Text Recognition: Google ML Kit offers text recognition functionality, allowing developers to extract text from images accurately.
- OCR Integration: Developers can seamlessly integrate Optical Character Recognition (OCR) features into their mobile applications using ML Kit.
- Real-Time Processing: ML Kit supports real-time text detection, enabling applications to process text from live camera feeds or images in near real-time.

- **Cross-Platform Compatibility:** ML Kit is designed to work across multiple platforms, including Android and iOS, providing developers with a unified solution for text detection across different devices.
- **Custom Models:** While ML Kit offers pre-trained models for text recognition, developers also have the option to train and deploy custom models for specific use cases.

### 5.2.3 Speech translation:

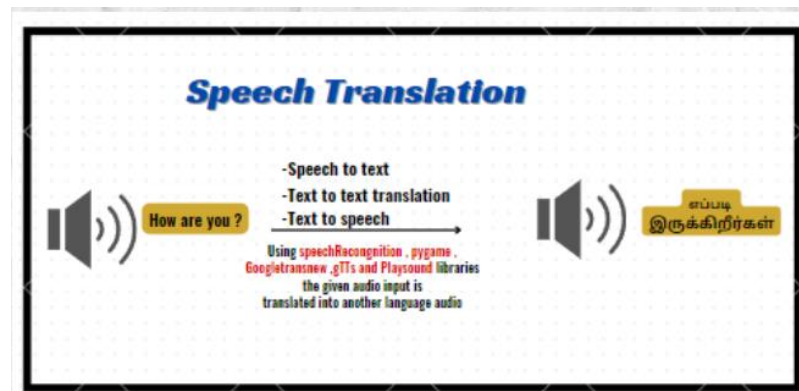


Figure 12. Speech Tanslation

### SpeechRecognition:

A Python library for converting speech to text using various speech recognition APIs.

- It provides a convenient wrapper for accessing services like Google Speech Recognition and IBM Speech to Text.
- Allows conversion of spoken language into written text, facilitating tasks such as voice commands, transcriptions, and more.

### Pygame:

A Python library for audio input and output.

- **pygame** provides bindings for PortAudio, allowing cross-platform audio I/O operations in Python.
- It's commonly used for recording and playing audio, essential for speech recognition tasks.
- Pygame captures audio from the microphone.

Google\_trans\_new:

An unofficial Python wrapper for the Google Translate API.

- Enables translation of text from one language to another seamlessly using Google Translate.
- Simplifies the process of language translation by providing an easy-to-use interface.
- Offers support for translating text between a wide range of languages.

gTTS (Google Text-to-Speech):

A Python library and CLI tool for Google Translate's text-to-speech API.

- Allows conversion of text into natural-sounding speech in various languages.
- Provides access to Google's high-quality text-to-speech service, enabling the synthesis of speech from text inputs.

Playsound:

A cross-platform Python library for playing simple sound files.

- **P**laysound facilitates playing audio files generated by gTTS, allowing users to hear the synthesized speech.
- It's lightweight and easy to use, making it suitable for integrating with various Python applications requiring audio playback functionality.

5.2.4 Text to Image generation:

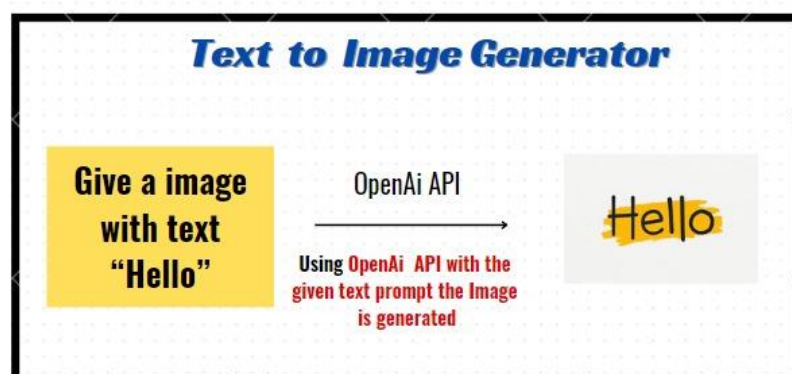


Figure 13. Text to Image Genrator

## Open AI Package:

The OpenAI package for text-to-image generation provides access to advanced machine learning models capable of generating realistic images based on textual descriptions. Here's a detailed breakdown of what this package offers:

1. **State-of-the-Art Models:** OpenAI develops and maintains cutting-edge text-to-image generation models trained on large-scale datasets. These models leverage deep learning architectures, such as Generative Adversarial Networks (GANs) or Transformer-based models, to translate textual descriptions into corresponding visual representations.
2. **Natural Language Understanding:** The text-to-image generation models in the OpenAI package are proficient in understanding natural language descriptions. They can interpret complex textual inputs, including detailed descriptions of scenes, objects, and actions, and generate corresponding images that align with the provided text.
3. **Semantic Consistency:** The generated images aim to maintain semantic consistency with the input text, ensuring that the visual content accurately reflects the meaning and context conveyed in the textual descriptions. This semantic alignment enhances the interpretability and relevance of the generated images.
4. **Realism and Diversity:** OpenAI's text-to-image generation models strive to produce realistic and diverse images that resemble natural photographs. By learning from diverse datasets, these models can capture a wide range of visual styles, compositions, and object appearances, resulting in varied and visually appealing output.
5. **Customization and Control:** Users can customize the generated images by providing specific textual prompts or adjusting model parameters. This flexibility allows for fine-tuning the visual output to match specific preferences or requirements, such as altering the style, composition, or attributes of the generated images.

## 5.3 TESTING

### 5.3.1 UNIT TESTING

#### 1. Language translation

Input:

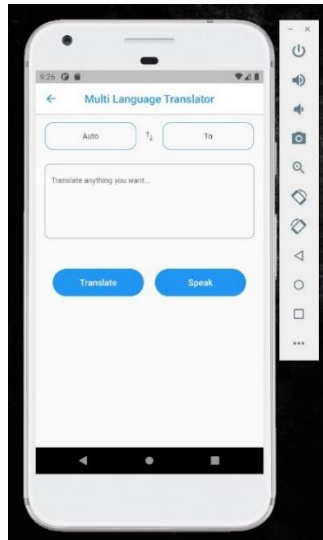


Figure 14. Sample Input Text

Output:

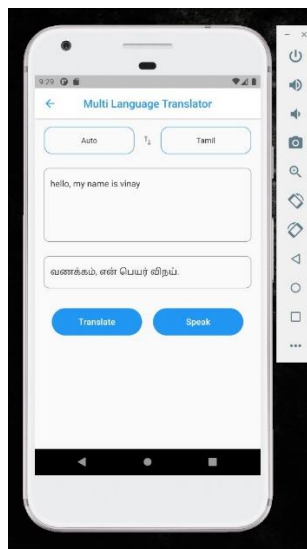


Figure 15. Sample Translation Output

## 2. Text Detection in Image

Input:

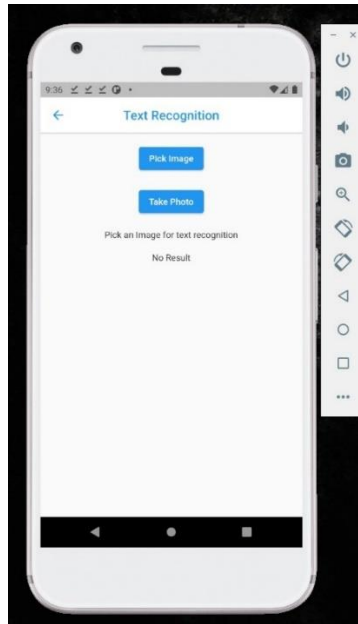


Figure 16. Sample Input Image Interface

Output:

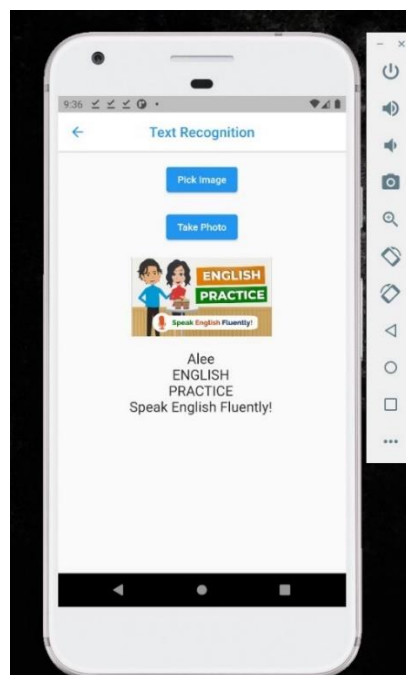


Figure 17. Sample Text Output



### 3. Speech to Text Translation:

Input:

The input for the module is provided by a human user through verbal interaction. The individual articulates commands or prompts into the system's microphone, initiating the processing of the input. Subsequently, the system employs speech recognition algorithms to transcribe the spoken words into textual data. This textual representation serves as the basis for further processing or action within the system, enabling seamless interaction between the user and the technology. This mechanism facilitates intuitive and efficient communication with the system, enhancing user experience and usability.

Output:

```
PS C:\Users\svina\OneDrive\Desktop\Capstone Project\Text Detection Project> & C:/Users/svina/AppData/Local/Programs/Python/Python310/python.exe "c:/Users/svina/OneDrive/Desktop/Capstone Project/Text Detection Project/Speech Translation.py"
pygame 2.5.2 (SDL 2.28.3, Python 3.10.6)
Hello from the pygame community. https://www.pygame.org/contribute.html
Speak Now!
hello my name is Vinay
வணக்கம் எனது பெயர் வினாய்
PS C:\Users\svina\OneDrive\Desktop\Capstone Project\Text Detection Project>
```

Figure 18. Speech to Text Output

### 4. Text to Speech:

Input:

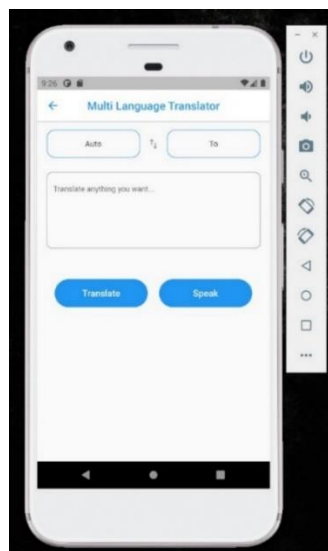


Figure 19. Sample input text

Output:

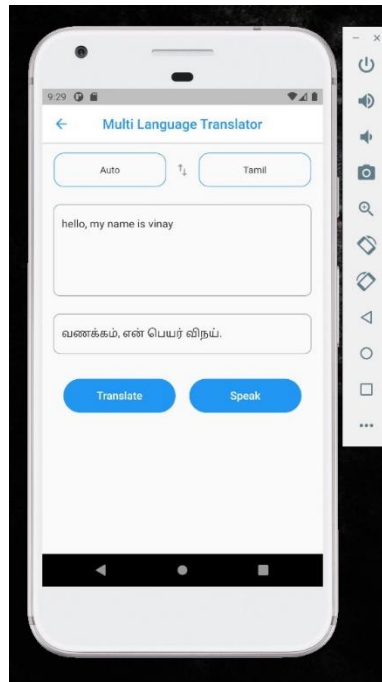


Figure 20. Sample Output Audio

## 5. Text to Image Generation:

Input and Output:

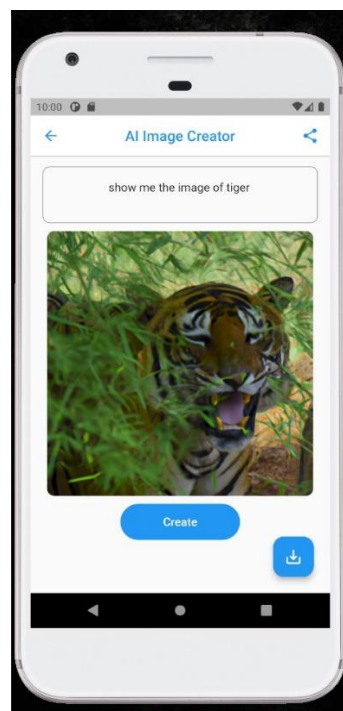


Figure 21. Sample Image Generation Output

## AI Chatbot Assistant:

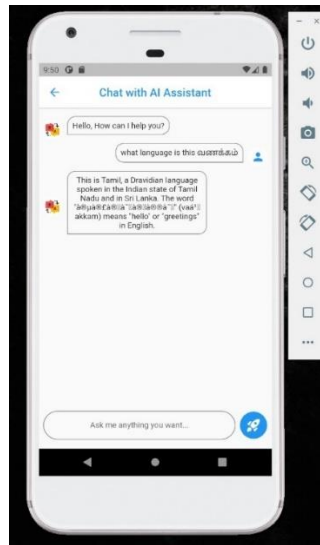


Figure 22. Sample AI bot Assistance

### 5.3.2 INTEGRATION TESTING:

Once the System is integrated, featuring an intuitive user interface crafted for simplicity and effectiveness, our application empowers users to effortlessly accomplish diverse tasks, enhancing efficiency and accessibility across myriad domains and contexts. We have successfully amalgamated the functionalities of speech recognition, image text extraction, language translation, image generation and text-to-speech conversion into a unified application framework.

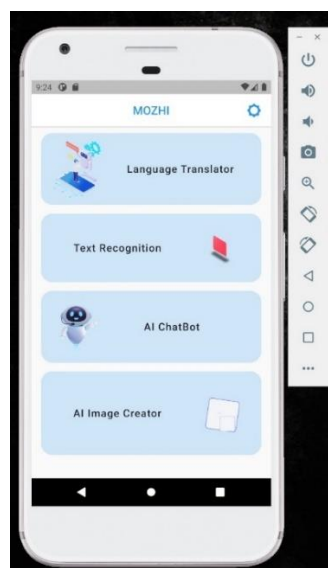


Figure 23. Integration Testing Output

## 6. PROJECT DEMONSTRATION

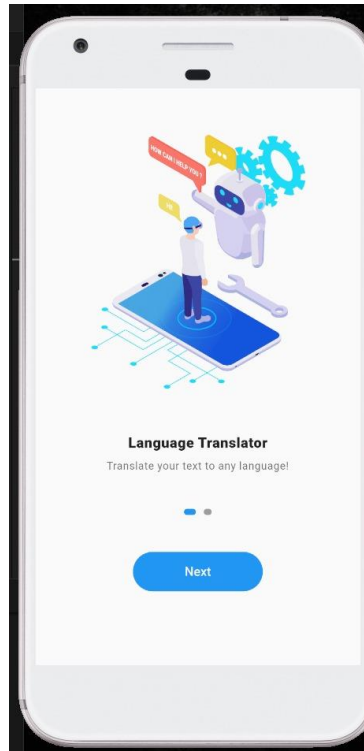


Figure 24. Screen Loader Page 1

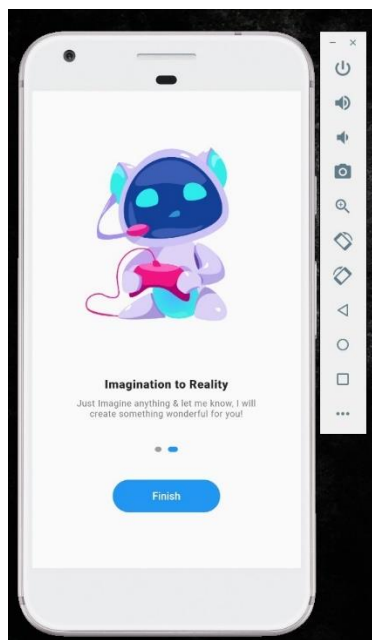


Figure 25. Screen Loader Page 2

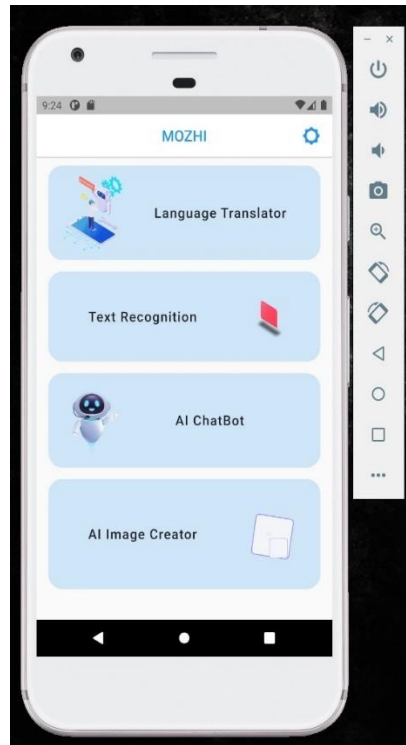


Figure 26. Home Page

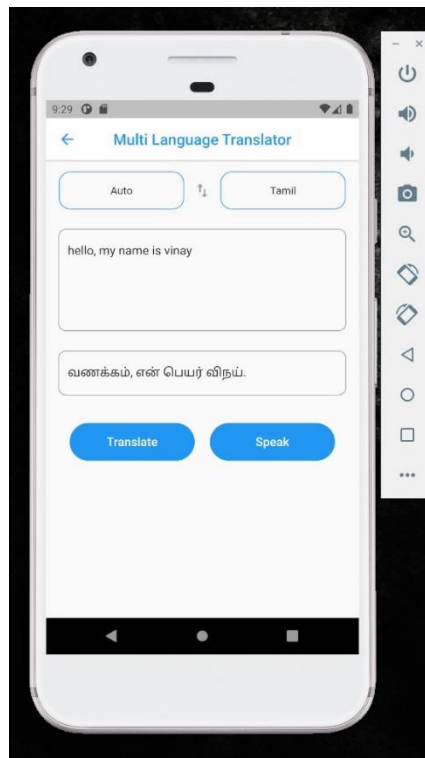


Figure 27. Language Translator Component

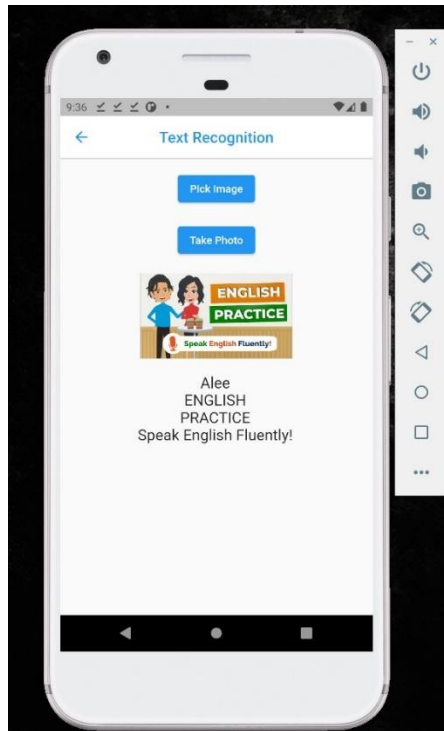


Figure 28. Text Recognition Component

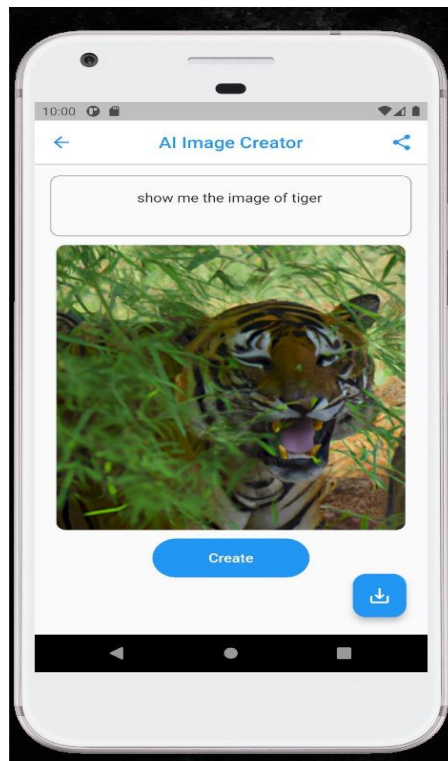


Figure 29. AI Image Generator Component

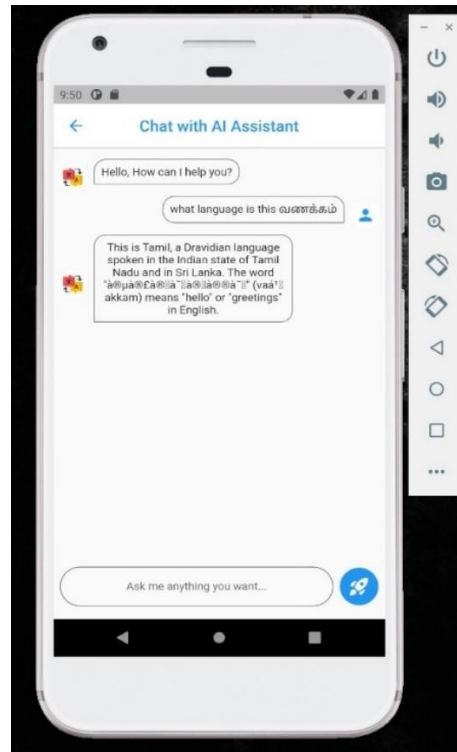


Figure 30. Chatbot Component


## 7. RESULTS AND DISCUSSION

This section showcases the performance metrics acquired from both our own evaluation experiments and those reported in relevant studies. These metrics offer insights into the effectiveness and accuracy of the algorithms and methodologies utilized in each module of our system.

### 1. Language translation:

The process begins with loading the "PRDECT-ID Dataset.csv" dataset, which contains Indonesian customer reviews along with corresponding emotions labeled as a separate column. Preprocessing involves tokenization, stop word removal, and stemming using the Sastrawi library. The dataset is then split into training and testing sets.

The preprocessed text is vectorized using CountVectorizer, and logistic regression is employed to train a model on the training data. Predictions are made on the test data, and accuracy, as well as a classification report containing precision, recall, F1-score, and support for each class, are printed.



```
Accuracy: 0.5740740740740741
Classification Report:
              precision    recall  f1-score   support

   Anger           0.57       0.34       0.43        120
    Fear           0.37       0.42       0.39         80
   Happy           0.63       0.75       0.68        120
    Love           0.67       0.61       0.64        100
   Sadness         0.60       0.70       0.64        120

 accuracy                   0.57         540
 macro avg           0.57       0.57       0.56         540
 weighted avg        0.58       0.57       0.57         540
```

Figure 31. Predictions made on the Test Data

Two additional datasets, "googletranslate.csv" and "gptandgtranslate.csv," containing translations to English by Google Translate and a combination of ChatGPT and Google Translate, are loaded. The translated texts are preprocessed similarly to the original dataset and vectorized using the same CountVectorizer instance. Predictions are made using the logistic regression model, and the predicted emotions are added to the respective datasets.



The performance of both translation methods is compared by printing the translated texts along with their predicted emotions. Classification reports, containing precision, recall, F1-score, and support, are printed for each translation method.

	precision	recall	f1-score	support
Anger	0.57	0.14	0.23	120
Fear	0.26	0.16	0.20	80
Happy	0.34	0.51	0.40	120
Love	0.22	0.52	0.31	99
Sadness	0.30	0.12	0.17	120
accuracy			0.29	539
macro avg	0.34	0.29	0.26	539
weighted avg	0.35	0.29	0.26	539

Figure 32. Classification Report of the Google Translate and Chat GPT Component

	precision	recall	f1-score	support
Anger	0.33	0.07	0.12	120
Fear	0.22	0.15	0.18	80
Happy	0.25	0.36	0.29	120
Love	0.22	0.55	0.31	99
Sadness	0.49	0.14	0.22	120
accuracy			0.25	539
macro avg	0.30	0.25	0.22	539
weighted avg	0.31	0.25	0.22	539

Figure 33. Classification Report of the Google Translate Component.

Overall, the process involves preprocessing the original and translated texts, training a logistic regression model on the original text, making predictions on the translated texts, and evaluating the performance using classification reports and confusion matrices. The comparative analysis enables us to evaluate the precision of translations and discern any disparities between the original and translated emotions. The findings unequivocally demonstrate that the amalgamated model utilizing ChatGPT and Google Translate yields superior outcomes compared to the standalone utilization of Google Translate

## 2. Text Detection from Image:

In accordance with the evaluation report conducted by MP Goncalves in 2022, an assessment was made regarding the performance of the ML Kit Text Recognition package. Analysis was conducted on a dataset comprising 1255 images, revealing the package's capability to analyze 9202 words and 41120 characters. The resulting distribution among various classes of ground truth (GT) instances, including Horizontal, Multi-Oriented, and Curved, was delineated. It was noted that the distribution of characters and words exhibited minimal deviation, indicating a commendable character composition across word instances.

However, discernible disparities emerged in the recognition accuracy when comparing the performance across different instance classes. Notably, the package yielded inferior results for curved and multi-oriented instances in contrast to horizontal ones, as indicated by the normalized distance metrics. Despite achieving a relatively lower error rate of approximately 44% in horizontal recognition, the observed deficiencies underscored areas warranting improvement.

Furthermore, insights gleaned from the research conducted by Sangwon Hwang, Jisun Lee, et al., elucidate the challenges encountered in utilizing Google's ML Kit v1.4 for text recognition in mobile augmented reality applications. The authors selected this particular text recognition model owing to its perceived suitability for deployment within the target mobile environment. However, the experimental findings revealed instances of failure, particularly in accurately detecting text on packages due to the idiosyncratic styles employed therein.

For instance, the authors observed instances where the ML Kit Text Recognition module failed to discern text accurately, attributing such discrepancies to the distinct stylistic variations present in the textual content. These findings underscore the nuanced challenges inherent in implementing text recognition technologies, particularly in contexts where diverse typographical conventions and formats are encountered.



Figure 34. ML Kit Text Recognition failing to recognize curved texts

As we may see in the blue rectangles, some letters overlap adjacent letters. Also, some letters are not in normal typeface.

### 3. The Usage of Open AI API for Image Generation and AI Chat bot Assistance

To Understand ChatGPT's ability to understand and comprehend information, we referred the paper "Can ChatGPT Pass High School Exams on English Language Comprehension?"[19] by Joose C.F. de Winter. In that study, ChatGPT was used to complete national high school exams in the Netherlands on the topic of English reading comprehension. ChatGPT achieved a mean grade of 7.3 on the Dutch scale of 1 to 10—comparable to the mean grade of all students who took the exam in the Netherlands, 6.99.

However, ChatGPT occasionally required re-prompting to arrive at an explicit answer; without these nudges, the overall grade was 6.5. On a positive note, ChatGPT holds the potential to foster innovation in the realm of education. Possible applications encompass aiding the development of writing skills, facilitating comprehension through step-by-step explanations, speeding up information delivery via summarization of texts, and enhancing engagement through personalized feedback.

Thus, we understand that While the OpenAI API offers powerful capabilities for chatbot and image generation, it may have limitations in terms of customization and control. We may not be able to fine-tune the underlying models or algorithms to suit your specific use case or preferences. Customizing the behavior or output of the chatbot or image generation system beyond the capabilities provided by the API may require additional development effort or the use of alternative solutions.

Furthermore, pre-trained models used by the OpenAI API may exhibit biases inherent in the training data, leading to potentially biased or unfair outcomes in chatbot responses or generated images. We must consider the ethical implications of deploying AI systems powered by external APIs, including issues related to fairness, transparency, accountability, and inclusivity. Updates, changes, or deprecation of the OpenAI API may impact the compatibility and functionality of your application. We must adapt our codebase to accommodate new API versions or features, which could require ongoing maintenance and testing efforts.

## 8. SUMMARY

The project aimed to develop an advanced language translation system integrating speech recognition, image text extraction, language translation, and text-to-speech conversion into a unified application. The system's objective was to facilitate seamless communication across linguistic barriers with a user-friendly interface featuring an intuitive user interface crafted for simplicity and effectiveness, the application empowered users to effortlessly accomplish diverse tasks, enhancing efficiency and accessibility across multiple domains and contexts.

Key tasks included developing text extraction from images by using an efficient mechanism for extracting text from images was developed, utilizing Pytesseract and cv2 libraries, implementing speech recognition utilizing the speech recognition library and pygame to accurately translate audio inputs into text, enabling language translation powered by the OpenAI API, was integrated. This addition marked a significant advancement, allowing the system not only to translate text across languages but also to generate visual representations corresponding to the translated text, and facilitating text-to-speech conversion using the GTTS (Google Text-to-Speech) library was employed in conjunction with the Playsound library to facilitate the conversion of textual data into audible speech. The functionalities of speech recognition, image text extraction, language translation, image generation, and text-to-speech conversion were amalgamated into a unified application framework.

Overall, this synthesis was meticulously engineered to ensure seamless interoperability and optimal performance within a unified system architecture. By consolidating these capabilities, a versatile solution was delivered that addressed a myriad of user requirements, augmenting efficiency and accessibility across diverse domains and contexts.

## 9. REFERENCES

- [1] Patil, D., Chaudhari, S.B. and Shinde, S., 2021, March. Novel technique for script translation using NLP: performance evaluation. In 2021 International Conference on Emerging Smart Computing and Informatics (ESCI) (pp. 728-732). IEEE.
- [2] Reddy, M.V. and Hanumanthappa, M., 2020. NLP challenges for machine translation from English to Indian languages. *International Journal of Computer Science and Informatics*, 3(1), p.35
- [3] Canedo-Rodriguez, A., Kim, S., Kim, J.H. and Blanco-Fernandez, Y., 2009, March. English to Spanish translation of signboard images from mobile phone camera. In *IEEE Southeastcon 2021* (pp. 356-361). IEEE.
- [4] Das, S.B., Panda, D., Mishra, T.K. and Patra, B.K., 2023. Statistical machine translation for indic languages. *arXiv preprint arXiv:2301.00539*
- [5] Mejía-Peréz, K., Córdova-Esparza, D.M., Terven, J., Herrera-Navarro, A.M., GarcíaRamírez, T. and Ramírez-Pedraza, A., 2022. Automatic recognition of Mexican Sign Language
- [6] Ramesh, A., Parthasa, V.B., Haque, R. and Way, A., 2020, December. Investigating lowresource machine translation for English-to-Tamil. In *Proceedings of the 3rd Workshop on Technologies for MT of Low Resource Languages* (pp. 118-125).
- [7] Zhang, Y., Mahfoodh, O.H.A. and Tan, D.A.L., 2024. A Corpus-based Evaluation of English-Mandarin Cultural References between Fansubbing and Official Subtitling. *Journal of Intercultural Communication*, pp.109-119.
- [8] Sebastian, M.P., 2023. Malayalam Natural Language Processing: Challenges in Building a Phrase-Based Statistical Machine Translation System. *ACM Transactions on Asian and Low-Resource Language Information Processing*, 22(4), pp.1-51.
- [9] Phatthiyaphaibun, W., Chaovavanich, K., Polpanumas, C., Suriyawongkul, A., Lowphansirikul, L., Chormai, P., Limkonchotiwat, P., Suntornitip, T. and Udomcharoenchaikit, C., 2023. Pythainlp: Thai natural language processing in python. *arXiv preprint arXiv:2312.04649*.
- [10] Rahali, A. and Akhloufi, M.A., 2023. End-to-end transformer-based models in textual based NLP. *AI*, 4(1), pp.54-110.

- [11] Wang, L., Lyu, C., Ji, T., Zhang, Z., Yu, D., Shi, S. and Tu, Z., 2023. Document-level machine translation with large language models. *arXiv preprint arXiv:2304.02210*.
- [12] Tonja, A.L., Maldonado-Sifuentes, C., Castillo, D.A.M., Kolesnikova, O., CastroSánchez, N., Sidorov, G. and Gelbukh, A., 2023. Parallel Corpus for Indigenous Language Translation: Spanish-Mazatec and Spanish-Mixtec. *arXiv preprint arXiv:2305.17404*.
- [13] Jiao, W., Huang, J.T., Wang, W., He, Z., Liang, T., Wang, X., Shi, S. and Tu, Z., 2023, December. ParroT: Translating during chat using large language models tuned with human translation and feedback. In *Findings of the Association for Computational Linguistics: EMNLP 2023* (pp. 15009-15020).
- [14] Xie, Y., Yu, C., Zhu, T., Bai, J., Gong, Z. and Soh, H., 2023. Translating natural language to planning goals with large-language models. *arXiv preprint arXiv:2302.05128*.
- [15] Anandika, A., Chakravarty, S. and Paikaray, B.K., 2023. Named entity recognition in Odia language: a rule-based approach. *International Journal of Reasoning-based Intelligent Systems*, 15(1), pp.15-21.
- [16] Zakraoui, J., Saleh, M., Al-Maadeed, S. and Jaam, J.M., 2021. Improving text-to-image generation with object layout guidance. *Multimedia Tools and Applications*, 80(18), pp.27423-27443.
- [17] Zhang, Z. and Schomaker, L., 2022. Divergan: An efficient and effective single-stage framework for diverse text-to-image generation. *Neurocomputing*, 473, pp.182-198.
- [18] Hwang, S., Lee, J. and Kang, S., 2022. Enabling product recognition and tracking based on text detection for mobile augmented reality. *IEEE Access*, 10, pp.98769-98782.
- [19] de Winter, J.C., 2023. Can ChatGPT pass high school exams on English Language Comprehension?. *International Journal of Artificial Intelligence in Education*, pp.1-16.

## 10. APPENDIX A - SAMPLE CODE

### TranslatorContoller.dart

```
import 'dart:convert';
import 'dart:developer';

import 'package:flutter/material.dart';
import 'package:get/get.dart';

import '../apis/apis.dart';
import '../helper/my_dialog.dart';
import 'image_controller.dart';

class TranslateController extends GetxController {
  final textC = TextEditingController();
  final resultC = TextEditingController();

  final from = ".obs", to = ".obs";
  final status = Status.none.obs;

  Future<void> translate() async {
    if (textC.text.trim().isNotEmpty && to.isNotEmpty) {
      status.value = Status.loading;

      String prompt = "";

      if (from.isNotEmpty) {
        prompt =
          'Can you translate given text from ${from.value} to ${to.value}:\n${textC.text}';
      } else {
        prompt = 'Can you translate given text to ${to.value}:\n${textC.text}';
      }

      log(prompt);

      final res = await APIs.getAnswer(prompt);
      resultC.text = utf8.decode(res.codeUnits);

      status.value = Status.complete;
    } else {
      status.value = Status.none;
      if (to.isEmpty) MyDialog.info('Select To Language!');
      if (textC.text.isEmpty) MyDialog.info("Type Something to Translate!");
    }
  }

  void swapLanguages() {
    if (to.isNotEmpty && from.isNotEmpty) {
      final t = to.value;
      to.value = from.value;
      from.value = t;
    }
  }
}
```

```

Future<void> googleTranslate() async {
  if (textC.text.trim().isEmpty && to.isEmpty) {
    status.value = Status.loading;

    resultC.text = await APIs.googleTranslate(
      from: jsonLang[from.value] ?? 'auto',
      to: jsonLang[to.value] ?? 'en',
      text: textC.text);

    status.value = Status.complete;
  } else {
    status.value = Status.none;
    if (to.isEmpty) MyDialog.info('Select To Language!');
    if (textC.text.isEmpty) {
      MyDialog.info('Type Something to Translate!');
    }
  }
}

```

```
late final lang = jsonLang.keys.toList();
```

```

final jsonLang = const {
  // 'Automatic': 'auto',

  'Chinese (Simplified)': 'zh-cn',
  'Chinese (Traditional)': 'zh-tw',
  'Corsican': 'co',
  'Croatian': 'hr',
  'Czech': 'cs',
  'Danish': 'da',
  'Dhivehi': 'dv',
  'Dogri': 'doi',
  'Dutch': 'nl',
  'English': 'en',
  'Esperanto': 'eo',
  'Estonian': 'et',
  'Ewe': 'ee',
  'Filipino (Tagalog)': 'tl',
  'Finnish': 'fi',
  'French': 'fr',
  'Frisian': 'fy',
  'Galician': 'gl',
  'Georgian': 'ka',
  'German': 'de',
  'Greek': 'el',
  'Guarani': 'gn',
  'Gujarati': 'gu',
  'Haitian Creole': 'ht',
  'Hausa': 'ha',
  'Hawaiian': 'haw',
  'Hebrew': 'iw',
  'Hindi': 'hi',
  'Hmong': 'hmn',
  'Hungarian': 'hu',
  'Icelandic': 'is',
  'Igbo': 'ig',

```



```

'Ilocano': 'ilo',
'Indonesian': 'id',
'Irish': 'ga',
'Italian': 'it',
'Japanese': 'ja',
'Javanese': 'jw',
'Kannada': 'kn',
'Kazakh': 'kk',
'Khmer': 'km',
'Kinyarwanda': 'rw',
'Konkani': 'gom',
'Korean': 'ko',
'Krio': 'kri',
'Kurdish (Kurmanji)': 'ku',
'Kurdish (Sorani)': 'ckb',
'Kyrgyz': 'ky',
'Lao': 'lo',
'Latin': 'la',
'Latvian': 'lv',
'Tamil': 'ta',
'Tatar': 'tt',
'Telugu': 'te',
'Thai': 'th',
'Tigrinya': 'ti',
'Tsonga': 'ts',
'Turkish': 'tr',
'Turkmen': 'tk',
'Twi (Akan)': 'ak',
'Ukrainian': 'uk',
'Urdu': 'ur',
'Uyghur': 'ug',
'Uzbek': 'uz',
'Vietnamese': 'vi',
'Welsh': 'cy',
'Xhosa': 'xh',
'Yiddish': 'yi',
'Yoruba': 'yo',
'Zulu': 'zu'
};
}

```

### Image Controller.dart

```

import 'dart:developer';
import 'dart:io';

import 'package:dart_openai/dart_openai.dart';
import 'package:flutter/material.dart';
import 'package:gallery_saver_updated/gallery_saver.dart';
import 'package:get/get.dart';
import 'package:http/http.dart';
import 'package:path_provider/path_provider.dart';
import 'package:share_plus/share_plus.dart';

import '../apis/apis.dart';

```

```

import '../helper/global.dart';
import '../helper/my_dialog.dart';

enum Status { none, loading, complete }

class ImageController extends GetxController {
  final textC = TextEditingController();

  final status = Status.none.obs;

  final url = "".obs;

  final imageList = <String>[].obs;

  Future<void> createAIImage() async {
    if (textC.text.trim().isEmpty) {
      OpenAI.apiKey = apiKey;
      status.value = Status.loading;

      OpenAIImageModel image = await OpenAI.instance.image.create(
        prompt: textC.text,
        n: 1,
        size: OpenAIImageSize.size512,
        responseFormat: OpenAIImageResponseFormat.url,
      );
      url.value = image.data[0].url.toString();

      status.value = Status.complete;
    } else {
      MyDialog.info('Provide some beautiful image description!');
    }
  }

  void downloadImage() async {
    try {
      //To show loading
      MyDialog.showLoadingDialog();

      log('url: $url');

      final bytes = (await get(Uri.parse(url.value))).bodyBytes;
      final dir = await getTemporaryDirectory();

      final file = await File('${dir.path}/ai_image.png').writeAsBytes(bytes);

      log('filePath: ${file.path}');
      //save image to gallery
      await GallerySaver.saveImage(file.path, albumName: appName)
        .then((success) {
          //hide loading
          Get.back();

          MyDialog.success('Image Downloaded to Gallery!');
        });
    } catch (e) {
      //hide loading
    }
  }
}

```

```

    Get.back();
    MyDialog.error('Something Went Wrong (Try again in sometime)!');
    log('downloadImageE: $e');
  }
}

void shareImage() async {
  try {
    //To show loading
    MyDialog.showLoadingDialog();

    log('url: $url');

    final bytes = (await get(Uri.parse(url.value))).bodyBytes;
    final dir = await getTemporaryDirectory();
    final file = await File('${dir.path}/ai_image.png').writeAsBytes(bytes);

    log('filePath: ${file.path}');

    //hide loading
    Get.back();

    await Share.shareXFiles([XFile(file.path)],
      text:
        'Check out this Amazing Image created by Ai Assistant App by Vinay Vikkranth');
  } catch (e) {
    //hide loading
    Get.back();
    MyDialog.error('Something Went Wrong (Try again in sometime)!');
    log('downloadImageE: $e');
  }
}

Future<void> searchAiImage() async {
  //if prompt is not empty
  if (textC.text.trim().isEmpty) {
    status.value = Status.loading;

    imageUrl.value = await APIs.searchAiImages(textC.text);

    if (imageUrl.isEmpty) {
      MyDialog.error('Something went wrong (Try again in sometime)');

      return;
    }

    url.value = imageUrl.first;

    status.value = Status.complete;
  } else {
    MyDialog.info('Provide some beautiful image description!');
  }
}
}

```

```

import 'dart:developer';
import 'dart:io';

import 'package:dart_openai/dart_openai.dart';
import 'package:flutter/material.dart';
import 'package:gallery_saver_updated/gallery_saver.dart';
import 'package:get/get.dart';
import 'package:http/http.dart';
import 'package:path_provider/path_provider.dart';
import 'package:share_plus/share_plus.dart';

import '../apis/apis.dart';
import '../helper/global.dart';
import '../helper/my_dialog.dart';

enum Status { none, loading, complete }

class ImageController extends GetxController {
  final textC = TextEditingController();

  final status = Status.none.obs;

  final url = "".obs;

  final imageList = <String>[].obs;

  Future<void> createAIImage() async {
    if (textC.text.trim().isEmpty) {
      OpenAI.apiKey = apiKey;
      status.value = Status.loading;

      OpenAIImageModel image = await OpenAI.instance.image.create(
        prompt: textC.text,
        n: 1,
        size: OpenAIImageSize.size512,
        responseFormat: OpenAIImageResponseFormat.url,
      );
      url.value = image.data[0].url.toString();

      status.value = Status.complete;
    } else {
      MyDialog.info('Provide some beautiful image description!');
    }
  }

  void downloadImage() async {
    try {
      //To show loading
      MyDialog.showLoadingDialog();

      log('url: $url');

      final bytes = (await get(Uri.parse(url.value))).bodyBytes;
      final dir = await getTemporaryDirectory();

```

```

final file = await File('${dir.path}/ai_image.png').writeAsBytes(bytes);

log('filePath: ${file.path}');
//save image to gallery
await GallerySaver.saveImage(file.path, albumName: appName)
    .then((success) {
        //hide loading
        Get.back();

        MyDialog.success('Image Downloaded to Gallery!');
    });
} catch (e) {
    //hide loading
    Get.back();
    MyDialog.error('Something Went Wrong (Try again in sometime)!');
    log('downloadImageE: $e');
}
}

void shareImage() async {
    try {
        //To show loading
        MyDialog.showLoadingDialog();

        log('url: $url');

        final bytes = (await get(Uri.parse(url.value))).bodyBytes;
        final dir = await getTemporaryDirectory();
        final file = await File('${dir.path}/ai_image.png').writeAsBytes(bytes);

        log('filePath: ${file.path}');

        //hide loading
        Get.back();

        await Share.shareXFiles([XFile(file.path)],
            text:
                'Check out this Amazing Image created by Ai Assistant App by Vinay Vikkranth');
    } catch (e) {
        //hide loading
        Get.back();
        MyDialog.error('Something Went Wrong (Try again in sometime)!');
        log('downloadImageE: $e');
    }
}

Future<void> searchAiImage() async {
    //if prompt is not empty
    if (textC.text.trim().isNotEmpty) {
        status.value = Status.loading;

        imageUrl.value = await APIs.searchAiImages(textC.text);

        if (imageUrl.isEmpty) {
            MyDialog.error('Something went wrong (Try again in sometime)');
        }
    }
}

```

```
        return;
    }

    url.value = imageUrl.first;

    status.value = Status.complete;
} else {
    MyDialog.info('Provide some beautiful image description!');
}
}
}
```



# Cross-Cultural Nuanced Translation with Emotion Preservation Using Emotion-Tagged Parallel Corpora

Name : Yerramsetty Sai Naga Sabarish, Vinay Vikkranth S, Vineeth Krishna S K Guide's Name: Chandra Mohan B  
Reg no : 20BCE2370, 20BCE2059, 20BDS0387 SCOPE

## Introduction

In an increasingly interconnected world, effective cross-cultural communication is vital. However, traditional language translation systems often struggle to convey the nuances of human expression. To bridge this gap, our project proposes an advanced translation system that integrates speech recognition, image text extraction, language translation, text to image generator and text-to-speech conversion functionalities into a unified application framework. With a focus on user experience and seamless interoperability, our goal is to deliver a versatile solution that enhances efficiency and accessibility across various domains and contexts.

## Motivation

We're driven by the demand for advanced language translation systems, integrating speech recognition, image text extraction, language translation, text-to-speech conversion, and text-to-image generator. Our goal: empower seamless communication across languages and mediums.

## Scope of the Project

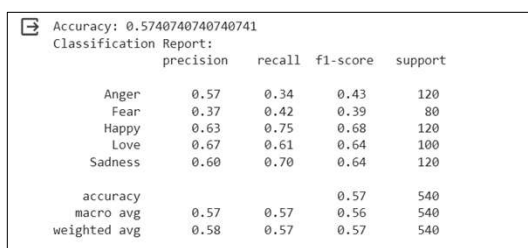
The scope of our project is to meticulously develop and deploy an integrated application that seamlessly combines speech recognition, image text extraction, language translation, text to image generator, and text-to-speech conversion functionalities. This entails a comprehensive approach covering requirement elicitation, system design, module implementation, interface development, testing, deployment, evaluation, and ongoing maintenance. We aim to gather detailed requirements from users and stakeholders, design a detailed system architecture, implement and integrate individual modules, develop an intuitive user interface, conduct thorough testing, deploy the application on a suitable platform, gather user feedback for continuous improvement, and establish a system for maintenance and support. By following this methodology, our goal is to deliver a robust and user-friendly application that effectively addresses the diverse needs of users across various contexts.

## Methodology

The project employed a systematic methodology to develop an advanced language translation system, integrating speech recognition, image text extraction, language translation, text-to-speech conversion, and text-to-image generation functionalities into a unified application. Key tasks included efficient text extraction from images using Pytesseract and cv2, accurate speech-to-text translation with the speech recognition library and pygame, language translation with Google Trans, and text-to-speech conversion with GTTS and Playsound libraries and using OpenAI Api we have made Text to image generator. Integration of these components into a cohesive framework was facilitated by rigorous testing to ensure smooth interoperability and optimal performance. The focus on enhancing user experience through feature refinement and performance optimization resulted in a versatile solution that enhances efficiency and accessibility across various domains and contexts.

## Results

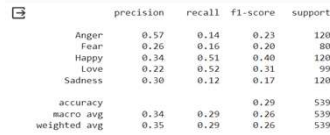
The evaluation of the language translation module demonstrated superior performance of the amalgamated model utilizing ChatGPT and Google Translate over standalone utilization of Google Translate, as evidenced by precision, recall, F1-score, and support metrics. Text detection from images revealed commendable character composition but highlighted recognition accuracy disparities across different instance classes, particularly in curved and multi-oriented instances. Insights from utilizing OpenAI API for image generation and AI chatbot assistance underscored its potential for fostering innovation in education despite potential limitations in customization and biases inherent in pre-trained models. These findings emphasize the effectiveness and challenges of leveraging advanced technologies to enhance communication and user experience across diverse domains and contexts.



Accuracy: 0.5740740740740741				
Classification Report:				
	precision	recall	f1-score	support
Anger	0.57	0.34	0.43	120
Fear	0.37	0.42	0.39	80
Happy	0.63	0.75	0.68	120
Love	0.67	0.61	0.64	100
Sadness	0.60	0.70	0.64	120
accuracy			0.57	540
macro avg	0.57	0.57	0.56	540
weighted avg	0.58	0.57	0.57	540

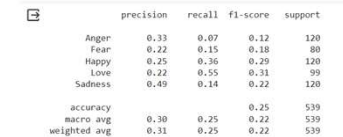
Figure 1.1 .Predictions made on the Test Data

## Results



	precision	recall	f1-score	support
Anger	0.57	0.34	0.23	120
Fear	0.26	0.16	0.20	80
Happy	0.34	0.51	0.40	120
Love	0.22	0.52	0.31	99
Sadness	0.30	0.12	0.17	120
accuracy	0.34	0.29	0.29	539
macro avg	0.34	0.29	0.26	539
weighted avg	0.35	0.29	0.26	539

Figure 1.2 Classification Report of the Google Translate and Chat GPT Component



	precision	recall	f1-score	support
Anger	0.33	0.07	0.12	120
Fear	0.22	0.15	0.18	80
Happy	0.25	0.36	0.29	120
Love	0.22	0.55	0.31	99
Sadness	0.49	0.14	0.22	120
accuracy	0.30	0.25	0.25	539
macro avg	0.30	0.25	0.22	539
weighted avg	0.31	0.25	0.22	539

Figure 1.3. Classification Report of the Google Translate Component.

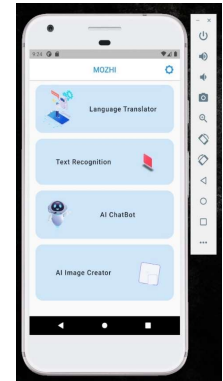


Figure 1.4 Home Page of the MoZhi App

## Conclusion

In conclusion, the development of the advanced language translation system represents a significant achievement in bridging linguistic barriers and enhancing communication across various domains and contexts. Through meticulous engineering and integration of key functionalities such as speech recognition, image text extraction, language translation, text-to-speech conversion, and text-to-image generation, the unified application offers users a seamless and intuitive experience. By addressing diverse user requirements and ensuring interoperability within a unified system architecture, the solution delivers enhanced efficiency and accessibility, marking a substantial step forward in facilitating effective communication in an increasingly interconnected world.

## References

- [1] Patil, D., Chaudhari, S.B. and Shinde, S., 2021, March. Novel technique for script translation using NLP: performance evaluation. In 2021 International Conference on Emerging Smart Computing and Informatics (ESCI) (pp. 728-732). IEEE.
- [2] Reddy, M.V. and Hanumanthappa, M., 2020. NLP challenges for machine translation from English to Indian languages. Int rnational Journal of Computer Science and Informatics, 3(1), p.35
- [3] Canedo-Rodriguez, A., Kim, S., Kim, J.H. and Blanco-Fernandez, Y., 2009, March. English to Spanish translation of signboard images from mobile phone camera. In IEEE Southeastcon 2021 (pp. 356-361). IEEE.
- [4] Das, S.B., Panda, D., Mishra, T.K. and Patra, B.K., 2023. Statistical machine translation for indic languages. arXiv preprint arXiv:2301.00539
- [5] Mejía-Peréz, K., Córdova-Esparza, D.M., Terven, J., Herrera-Navarro, A.M., GarcíaRamírez, T. and Ramírez-Pedraza, A., 2022. Automatic recognition of Mexican Sign Language
- [6] Ramesh, A., Parthasa, V.B., Haque, R. and Way, A., 2020, December. Investigating lowresource machine translation for English-to-Tamil. In Proceedings of the 3rd Workshop on Technologies for MT of Low Resource Languages (pp. 118-125).
- [7] Zhang, Y., Mahfoodh, O.H.A. and Tan, D.A.L., 2024. A Corpus-based Evaluation of English-Mandarin Cultural References between Fansubbing and Official Subtitling. Journal of Intercultural Communication, pp.109-119.
- [8] Sebastian, M.P., 2023. Malayalam Natural Language Processing: Challenges in Building a Phrase-Based Statistical Machine Translation System. ACM Transactions on Asian and Low-Resource Language Information Processing, 22(4), pp.1-51.
- [9] Phatthiyaphaibun, W., Chaovanich, K., Polpanumas, C., Suriyawongkul, A., Lowphansirikul, L., Chormai, P., Limkonchotiwat, P., Suntorntip, T. and Udomcharoenchaikit, C., 2023. Pythainlp: Thai natural language processing in python. arXiv preprint arXiv:2312.04649.
- [10] Rahali, A. and Akhloufi, M.A., 2023. End-to-end transformer-based models in textual based NLP. AI, 4(1), pp.54-110\
- [11] Wang, L., Lyu, C., Ji, T., Zhang, Z., Yu, D., Shi, S. and Tu, Z., 2023. Document-level machine translation with large language models. arXiv preprint arXiv:2304.02210.
- [12] Tonja, A.L., Maldonado-Sifuentes, C., Castillo, D.A.M., Kolesnikova, O., CastroSánchez, N., Sidorov, G. and Gelbukh, A., 2023. Parallel Corpus for Indigenous Language Translation: Spanish-Mazatec and Spanish-Mixtec. arXiv preprint arXiv:2305.17404.