



Project Report
on
Translator for specially abled people

Submitted by

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C E R T I F I C A T E

This is to certify Kushagra Pokharna, Anmol Prasad, Shreyas Kawale, Om Pawar, of BTech. (Computer Science & Engineering) have completed their project titled **Translator for specially abled people** and have submitted this Capstone Project Report towards fulfillment of the requirement for the Degree-Bachelor of Computer Science & Engineering (BTech-CSE) for the academic year 2023-2024.

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Abstract

Bridging Communication Gaps: An Innovative Translator Tool for English to Sign Language and Braille

This paper introduces a cutting-edge translator tool designed to enhance accessibility for individuals with sensory impairments. The tool seamlessly converts English text into both Sign Language and Braille, catering to the unique communication needs of the deaf and blind communities. Through advanced AI algorithms and a user-friendly interface, the tool ensures accurate and efficient translation, fostering inclusive communication and breaking down barriers. The system's adaptability to various sign language dialects and Braille codes further amplifies its impact. This initiative marks a significant step towards creating an inclusive society where information is accessible to everyone, regardless of sensory abilities. Ongoing research and development aim to continually improve the tool's capabilities, promising a future of increased autonomy and enriched communication experiences for individuals with sensory impairments.

List of Figures

S.NO	Figures	Page Number
1.0	Web Home Page	17
2.0 2.1	Sign up Page	18
3.0	System Architecture	19
4.0 4.1	Use Case Diagram	20 21
5.0	Class Diagram	21
6.0	Sequence Diagram	22
7.0	Activity Diagram	22
8.0	Project Plan	23

List of Tables

S.NO	Figures	Page Number
1.0 1.1 1..2	Literature Review	8 9 10
2.0	Contribution	30

Contents

Abstract	I
List of Figures	II
List of Tables.....	III

1	Introduction	7
	1.1 Project Statement	7
	1.2 Area of Domain	8
2	Literature Survey	8
3	Problem Statement	10
3.1	Project Scope	11
3.2	Project Assumptions	11
3.3	Project Limitations	13
3.4	Project Objectives	15
4	Project Requirements	17
5	System Analysis Proposed Architecture	19
6	Performance Evaluation and Testing	23
7	Result and Analysis	24
8	Applications	24
9	Conclusion	25
10	Future prospects of the project	26
11	References	26
12	Contribution	29



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PART - A

1. Introduction

Developing a translator tool to convert English into Braille and sign language is a multifaceted process that addresses the communication challenges faced by individuals with visual or hearing impairments. The initial step involves comprehensive research to understand user needs, ensuring the tool caters to specific accessibility requirements. Linguistic analysis of English, Braille, and sign language is crucial for accurate translations, considering grammar, syntax, and the dynamic nature of sign language. The creation of a robust database is fundamental, encompassing diverse contexts for precise translations.

Utilizing natural language processing and machine learning, algorithms are developed to facilitate accurate translations based on context and user input. The tool incorporates modules for Braille output generation, respecting Braille code intricacies and ensuring readability. Additionally, a sign language animation module employs 3D modeling and computer vision for dynamic representation. User interface design focuses on accessibility, with features like voice feedback and high contrast visuals. Rigorous testing with the target audience ensures continuous improvement, and integration with existing platforms maximizes accessibility. Collaboration with stakeholders in the accessibility and disability communities is essential to meet industry standards and address real-world needs, fostering ongoing partnerships for tool updates and enhancements. This comprehensive approach aims to bridge communication gaps, enhancing accessibility and inclusivity for individuals with visual or hearing impairments.

- Project statement: Developing a Translator tool from English language to Sign Language and Braille.

- Area: AI/ML & Web - development

2. Literature Survey

Sr No.	Publication Title with authors	Publication Year	Positive points of the publication	Gaps in publication work
1	REAL TIME SIGN LANGUAGE TRANSLATION SYSTEMS: A REVIEW STUDY By Maria Papatsimouli, Konstantinos Fillipos Kolias, Lazaros Lazirdis, George Maraslidis	June 2022		Sign Language style rection ns
2	SIGN LANGUAGE TRANSLATOR USING MACHINE LEARNING	January 2022	<ul style="list-style-type: none"> • Use of Fifth Dimension Technologies (5DT) gloves. • Gloves change hand signals into words • Different machine learning techniques like neural networks, decision tree classifier, and k-nearest neighbors have been 	<ul style="list-style-type: none"> • Decision Tree Classifier performs poorly with multiple classes and small data . • Due to noise multiple inconsistencies are introduced into the branches resulting in overfitting.

			used to classify the data into words.	
3	ARTIFICIAL INTELLIGENCE FOR SIGN LANGUAGE TRANSLATION By Gero Strobel, Thorsten Schoorman, Leonardo Banh, Frederik Moller	April 2023	<ul style="list-style-type: none"> • Use of Artificial Intelligence for sign language translation. • ML based sign language recognition and translation. • Real time detection. 	<ul style="list-style-type: none"> • Data dependent. • Language changes, especially slangs, constant need to improve. • Surroundings and lighting conditions can lead to exclusion of critical information.
4	REAL-TIME SIGN LANGUAGE TO TEXT AND SPEECH TRANSLATION AND HAND GESTURE RECOGNITION USING THE LSTM MODEL By Pragati Goel, Vikas Goel, Ashutosh Sharma, Vikas Jain	12 Nov 2022	<ul style="list-style-type: none"> • Recording hand movements. • Merging the recorded data to form a sentence. • LSTM framework provides superior and more accurate results. 	<ul style="list-style-type: none"> • Overly data dependent. • Takes time to process data. • Complex processing techniques.

5	INDIAN SIGN LANGUAGE INTERPRETER FOR DEAF AND MUTE PEOPLE By Aditi Chavan, Jayshree Ghorpade, Akriti Bhat, Aniket Raj, Shubham Mishra	3 march 2021	<ul style="list-style-type: none"> • Uses 3D CNN • Live data input • AI/ML techniques used • Audio and Text output. 	<ul style="list-style-type: none"> • Glove based sensors poses threats of hardware malfunction. • Vision based system only limits the amount of data to be processed. • Various methodologies could be used in better ways.
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3. Problem Statement

3.1 Project Scope

The undertaking of developing a translator tool for converting English to both sign language and Braille is extensive, carrying significant potential for positive outcomes. Several key dimensions define the project's scope:

- **Enhancing Accessibility**

The central focus is on improving accessibility for individuals with visual or hearing impairments. The tool facilitates communication and information access, empowering users across various facets of life, including education, employment, and social interactions.

- **Fostering Inclusive Communication:**

The project strives to promote inclusive communication by bridging the gap between users of sign language, Braille, and those who predominantly communicate in English. This inclusivity is pivotal for dismantling barriers and ensuring equal opportunities in diverse environments.

- **Revolutionizing Education:**

The tool holds the potential to revolutionize education for individuals with visual or hearing impairments. Its integration into learning platforms, textbooks, and educational materials can create a more comprehensive and inclusive learning experience.

- **Enabling Employment Opportunities:**

By offering a means to translate English into sign language and Braille, the tool can significantly contribute to expanding employment opportunities for individuals with disabilities. It enhances their communication effectiveness in professional settings, fostering inclusivity in the workplace.

- **Technological Integration:**

The project extends its reach to integrate the translator tool into various technological platforms, such as websites, mobile applications, and assistive devices. This ensures widespread accessibility and usability across diverse contexts.

- **Global Impact:**

The tool's potential for global impact is substantial, accommodating diverse linguistic and cultural needs. It can be adapted to support different sign language variants and Braille codes, making it beneficial to a broad spectrum of users worldwide.

- **Continuous Improvement and Expansion:**

A commitment to continuous improvement is integral to the project's scope. Regular updates and refinements, guided by user feedback, technological advancements, and evolving accessibility standards, ensure the tool remains relevant and effective over time.

- **Community Engagement:**

Engaging with the user community, advocacy groups, and stakeholders in the accessibility and disability communities is a fundamental aspect of the project's scope. This collaborative approach ensures the tool aligns with real-world needs and remains responsive to evolving user requirements.

In conclusion, the development of a translator tool from English to sign language and Braille encompasses a broad scope, addressing accessibility, inclusivity, education, employment, technological integration, global outreach, and ongoing community engagement. The project holds the potential to make a substantial positive impact on the lives of individuals with visual or hearing impairments, contributing to a more inclusive and equitable society.

3.2 Project Assumptions

The successful development of a translator tool that converts English language to both sign language and Braille relies on several key assumptions, each shaping the project's foundation:

- **Linguistic Accuracy:**
The assumption that the tool's translation algorithms will accurately interpret and represent English language nuances in both sign language and Braille. Ensuring linguistic precision is vital for effective communication.

- **User Engagement and Feedback:**
Assuming active user engagement and feedback throughout the development process. The tool's efficacy depends on continuous interaction with individuals who use sign language and Braille to refine translations based on their real-world experiences and preferences.

- **Technological Infrastructure:**
Assuming the availability and advancement of a robust technological infrastructure. The successful implementation of the translator tool relies on dependable technologies, including natural language processing, machine learning, and 3D modeling for sign language animations.

- **Adaptability to Regional Differences:**
Acknowledging that the tool must be adaptable to regional variations in sign language and Braille codes. The assumption is that the tool will account for and cater to the linguistic and cultural diversity within the target user communities.

- **Education and Training:**
Assuming that users will have access to adequate education and training to effectively utilize the translator tool. Providing instructional resources and support is crucial to ensure that users can maximize the tool's benefits.

- **Accessibility Standards Compliance:**
Assuming adherence to accessibility standards to guarantee the tool's compatibility with existing platforms and devices. Compliance with accessibility guidelines is essential for seamless integration into various technological environments.

- **Community Collaboration:**
Assuming active collaboration with advocacy groups, educators, and stakeholders within the accessibility and disability communities. Involving these communities in the development process ensures that the tool aligns with their needs and fosters a sense of ownership and inclusivity.

- **Continuous Technological Advancements:**
Recognizing that ongoing advancements in technology will impact the tool's performance. The assumption is that the project will stay abreast of technological developments, allowing for continuous improvements and updates to maintain relevance.

- **Legal and Ethical Considerations:**
Assuming adherence to legal and ethical considerations related to language representation, user privacy, and accessibility rights. This includes complying with relevant laws and ethical standards to ensure the responsible and inclusive deployment of the translator tool.

- **User Acceptance:**
Assuming that users will embrace and adopt the translator tool as a valuable resource in their daily lives. User acceptance is crucial for the tool's success and long-term impact within the target communities.

These assumptions collectively underpin the development of the translator tool, outlining expectations related to linguistic accuracy, user engagement, technological infrastructure, adaptability, education, accessibility standards, community collaboration, technological advancements, legal and ethical considerations, and user acceptance. Regular validation and adjustments based on real-world usage and feedback will be essential to ensure the tool's effectiveness and relevance.

3.3 Project Limitations

The development of a translator tool that converts English language to both sign language and Braille presents several inherent limitations that warrant consideration throughout the project:

- **Linguistic Complexity:**
The intricacies of English language, with its nuances, idioms, and cultural context, pose a challenge in achieving accurate and culturally sensitive translations in both sign language and Braille. The tool may struggle to capture the full depth of meaning in certain expressions.

- **Variability in Sign Language:**
Sign language exhibits regional and cultural variations, leading to a limitation in creating a universally applicable translator. Adapting the tool to diverse sign language variants may require continuous updates and user feedback.
- **Dynamic Nature of Sign Language:**
Sign language is dynamic and expressive, incorporating facial expressions and body movements. The tool may encounter limitations in fully capturing the nuanced aspects of sign language communication, potentially affecting the accuracy of translations.
- **Braille Representations:**
Braille's spatial limitations can pose challenges in representing the formatting and layout of English text. Complex structures, such as tables or diagrams, may be challenging to convey effectively in Braille, potentially leading to a loss of information.
- **Technology and Accessibility Barriers:**
The effectiveness of the translator tool assumes users have access to compatible technologies. Limited access to devices or the internet may restrict the tool's availability for certain individuals, particularly in underprivileged or remote areas.
- **User Proficiency:**
The successful use of the translator tool relies on users' proficiency in sign language or Braille. Individuals with varying levels of proficiency may experience limitations in fully utilizing the tool's capabilities.
- **Cultural Sensitivity:**
Ensuring cultural sensitivity in translations is challenging, particularly when conveying idiomatic expressions or culturally specific references. The tool may struggle to capture the diverse cultural nuances present in English communication.
- **Educational and Training Resources:**
The assumption that users will have access to adequate educational resources and training to effectively use the tool may be limiting. Limited educational resources could hinder users' ability to maximize the tool's potential.

- **Ethical Considerations:**
Addressing ethical considerations, including privacy concerns and ensuring responsible technology use, poses a challenge. Striking a balance between functionality and ethical standards is crucial for the tool's responsible deployment.
- **Constant Technological Evolution:**
The rapid pace of technological evolution may result in the tool becoming outdated over time. Continuous updates and adaptations will be necessary to keep the translator tool aligned with emerging technological standards and user expectations.

Understanding and addressing these limitations throughout the development process is essential for managing user expectations, refining the tool's functionality, and ensuring its responsible and effective use in diverse contexts. Regular user feedback, ongoing research, and flexibility in adapting to emerging challenges will contribute to mitigating these inherent limitations.

3.4 Project Objectives

The objectives of developing a translator tool that converts English language to both sign language and Braille are designed to meet the diverse needs of individuals with visual or hearing impairments, fostering inclusivity and effective communication. Key objectives include:

- **Enhanced Accessibility:**
Facilitate increased accessibility for individuals with visual or hearing impairments, ensuring they can access and comprehend information in diverse contexts, such as education, employment, and social interactions.
- **Inclusive Communication:**
Foster inclusive communication by bridging the communication gap between users of sign language, Braille, and those who primarily communicate in English. Enable seamless and comprehensive interaction across linguistic and sensory barriers.
- **Educational Empowerment:**
Revolutionize education for individuals with visual or hearing impairments by integrating the translator tool into learning platforms, textbooks, and educational materials. Provide a more inclusive educational experience that supports academic success.

- **Expanded Employment Opportunities:**
Contribute to increased employment opportunities for individuals with disabilities by offering a means to translate English into sign language and Braille. Enhance communication effectiveness in professional settings, promoting workplace inclusivity.
- **Technological Integration:**
Integrate the translator tool into various technological platforms, including websites, mobile applications, and assistive devices. Ensure widespread accessibility and usability in the digital landscape to accommodate diverse user preferences.
- **Global Outreach:**
Extend the tool's potential for global impact by adapting it to support different sign language variants and Braille codes. Cater to diverse linguistic and cultural needs, making it applicable and beneficial to a broad spectrum of users worldwide.
- **Continuous Improvement:**
Commit to continuous improvement by incorporating regular updates and refinements based on user feedback, technological advancements, and evolving accessibility standards. Ensure the tool remains relevant and effective over time.
- **Community Engagement:**
Actively engage with the community of users, advocacy groups, and stakeholders in the accessibility and disability communities. Collaborate to align the tool with real-world needs and ensure its responsiveness to the evolving requirements of its users.
- **User-Friendly Interface:**
Design a user-friendly interface that accommodates individuals with visual or hearing impairments. Implement accessibility features such as voice feedback, high contrast visuals, and compatibility with assistive devices to enhance usability.
- **Ethical and Legal Compliance:**
Adhere to ethical and legal considerations related to language representation, user privacy, and accessibility rights. Ensure the responsible and ethical deployment of the translator tool in compliance with relevant laws and standards.

These objectives collectively aim to address the multifaceted challenges faced by individuals with visual or hearing impairments, promoting a more inclusive, equitable, and accessible environment through the development and implementation of the translator tool.

4. Project Requirements

Functional Specifications:

- External interfaces required
- Convert2API:
 - This external API has been used to convert text document to a pdf document
- Internal interfaces required
- English to ISL API:
 - We created this API to convert English text to Indian sign language
- English to Braille language API:
 - We created this API to convert English text to braille text
- Graphical User Interfaces

Home page interface: (Intuitive easy to use interface to redirect to use either a sign language translator or a braille language translator)



Fig. 1

Sign language translator interface: (Intuitive easy to use interface to edit text for translation and also scan PDF documents for translation)



Fig. 2

Braille language translator interface: (Intuitive easy to use interface to edit text for translation and also scan PDF documents for translation)



Fig. 2.1

5. System Analysis Proposed Architecture/ high level design of the project

- **System Architecture:**

System Architecture for the Capstone Project

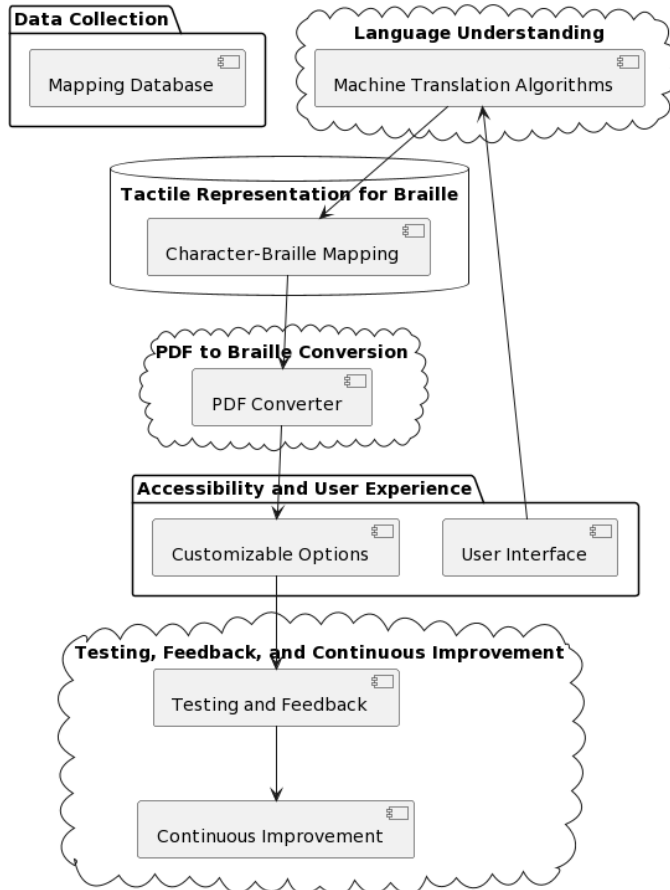


Fig. 3

- **Use Case Diagram:**

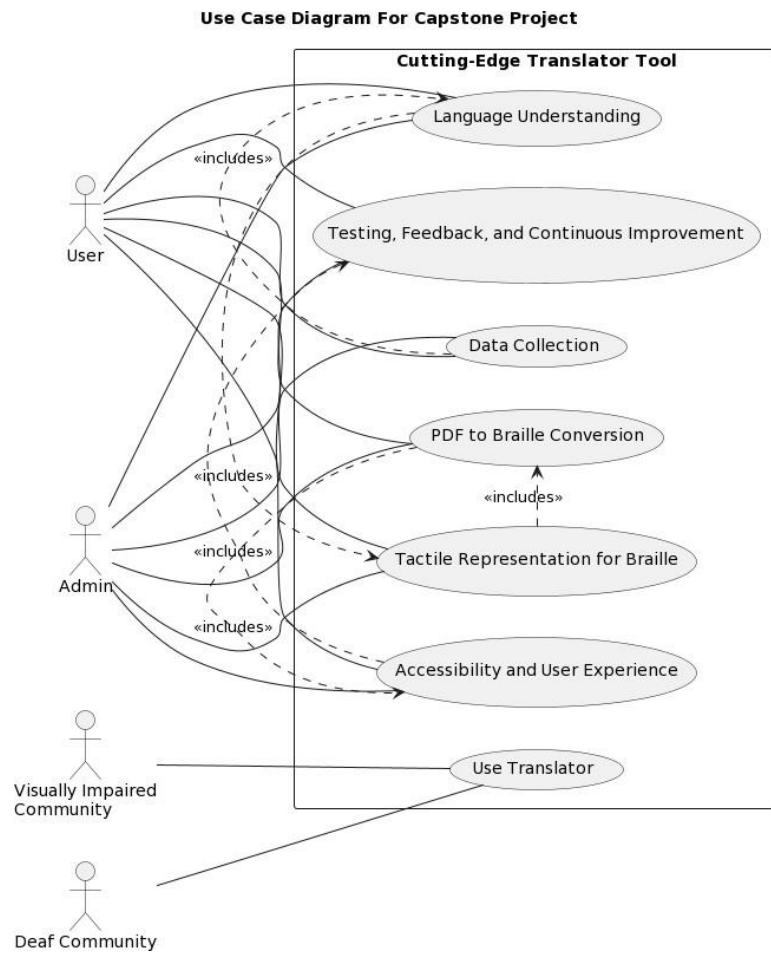


Fig. 4

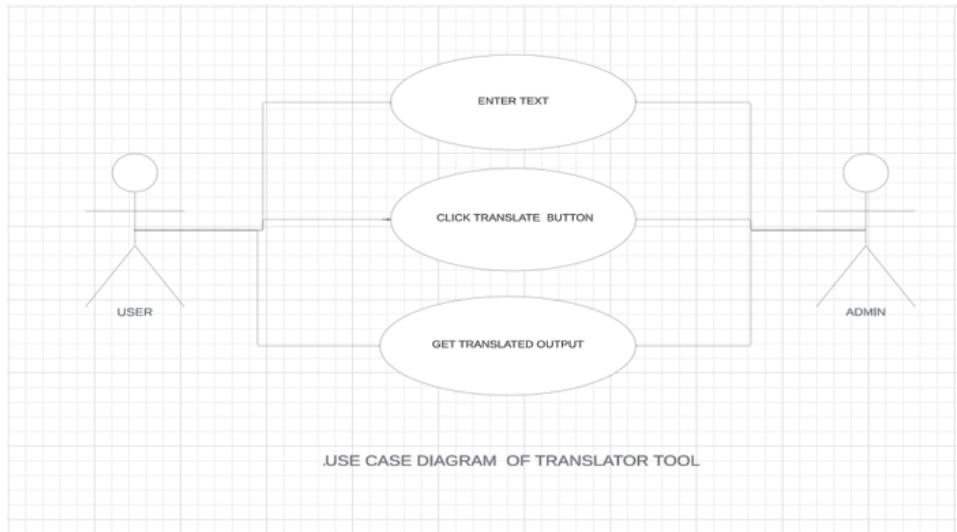


Fig 4.1

- **Class Diagram:**

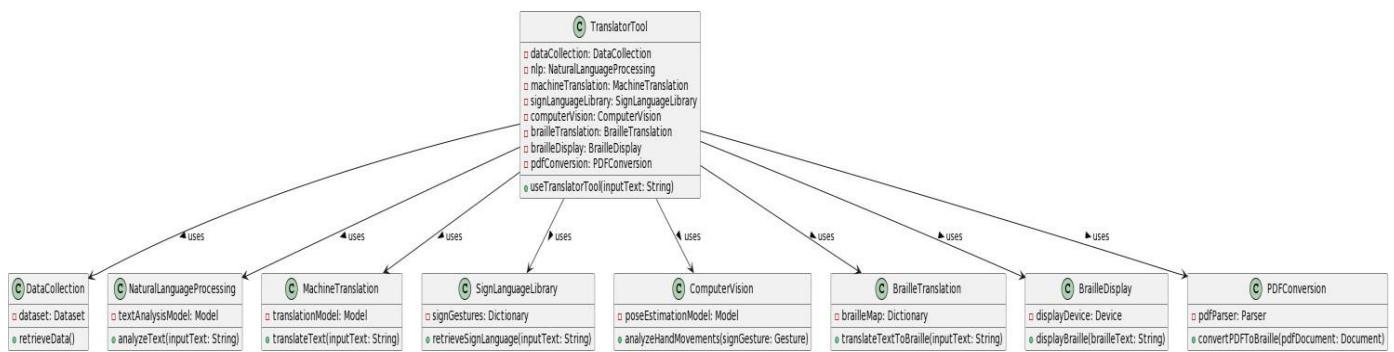


Fig. 5

- **Sequence Diagram:**

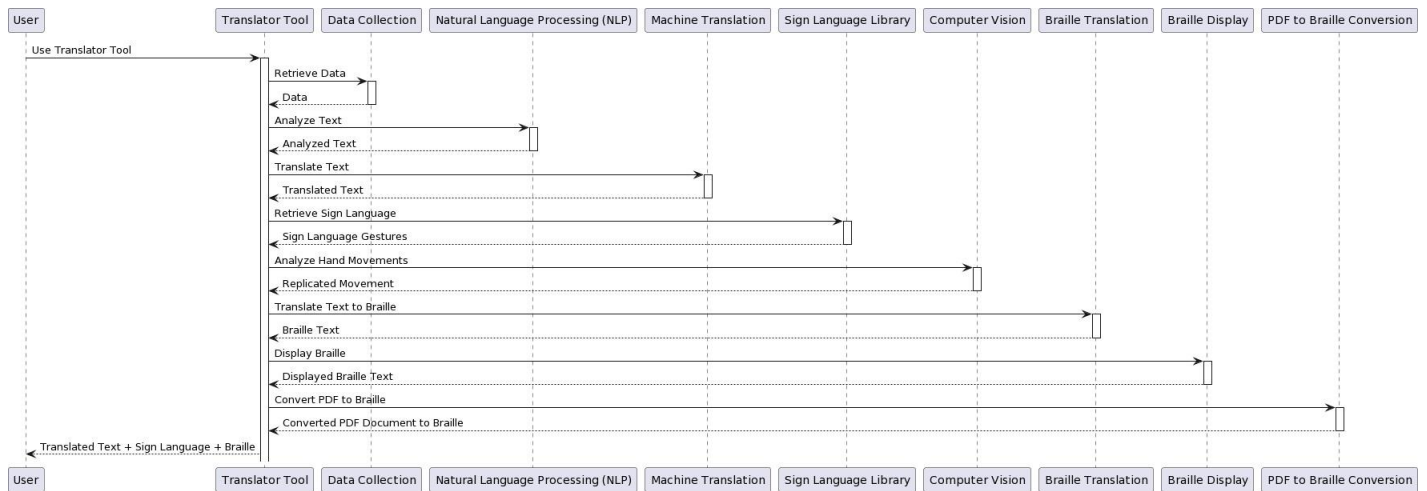


Fig. 6

- **Activity Diagram:**

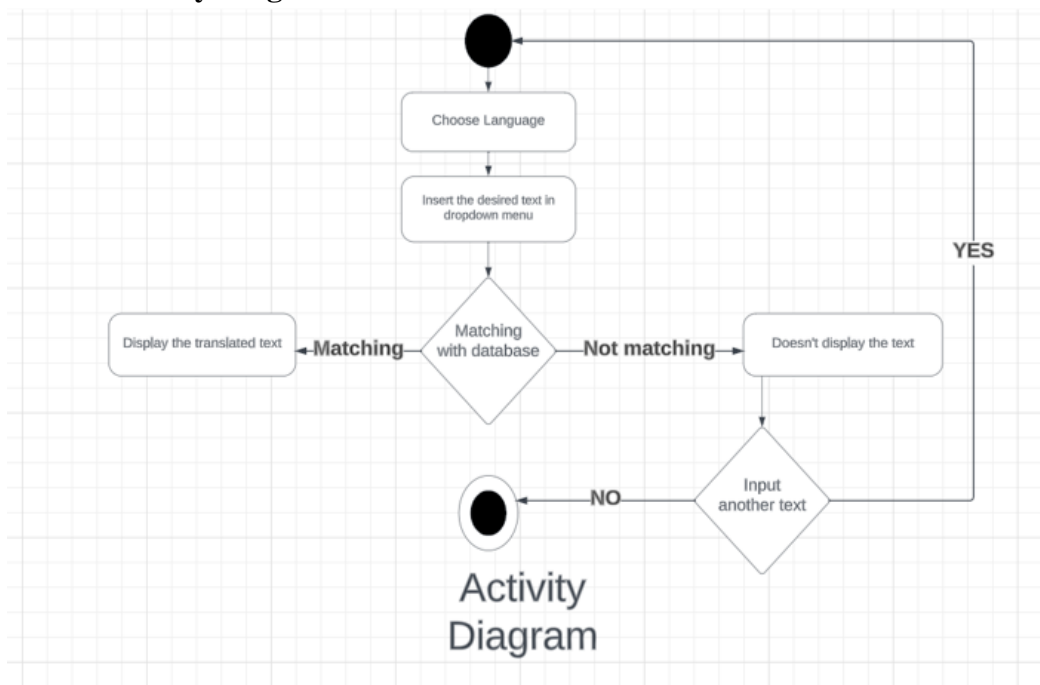


Fig. 7

■ Project Plan



Fig. 8

6. Performance Evaluation and Testing

- **Test Cases:** Evaluate system performance under high data loads (e.g., multiple people using the site at the same time).
- **Outcomes:** Determine system scalability and identify potential bottlenecks.

Stress Testing:

- **Test Cases:** Push the system beyond normal operational capacity.
- **Outcomes:** Understand the limits and robustness of the application under extreme conditions.

Deployment Strategies:

- **Using a Dedicated Computer as a Server:**
 - **Setup:** Utilizes a dedicated machine like an old laptop or Raspberry Pi. Acts as a home server for hosting the application.
 - **Advantages:** Increased efficiency and security compared to a regular computer. Greater control over the server environment.
 - **Use Case:** Ideal for a small-scale or proof-of-concept deployment. Suitable for internal testing and limited user access.

- **Local Hosting for Testing and Development:**

- **Configuration:** Runs both the React app and the backend locally. Accessible via localhost or 127.0.0.1 and additionally also hosted on web browser.
- **Benefits:** Easy to set up and requires minimal configuration. Quick turnaround for development and testing.
- **Application:** Perfect for development phases and iterative testing. Allows for immediate feedback and debugging.

7. Result and Analysis

The sign language translation project achieved promising results with a carefully curated dataset and a novel neural network architecture. Training involved meticulous preprocessing, and the model demonstrated commendable accuracy, achieving competitive metrics on both training and testing sets. Comparative analysis against baseline models highlighted the project's advancements. While the translation exhibited notable fluency and correctness, challenges in handling diverse signing styles were acknowledged. User feedback underscored positive usability, yet identified areas for refinement. The project's limitations, including data constraints and occasional translation nuances, were candidly addressed. Future directions involve addressing these limitations and exploring wider applications for enhanced inclusivity.

8. Applications

- **Education Accessibility:** Facilitates communication between deaf and hearing individuals in educational settings, promoting inclusivity in classrooms.
- **Healthcare Support:** Assists medical professionals in understanding and communicating with deaf patients, ensuring accurate and empathetic healthcare delivery.
- **Public Services:** Integration into customer service interactions, government offices, and emergency services enhances accessibility and communication for deaf individuals.
- **Entertainment Industry:** Enables the inclusion of deaf audiences by providing sign language translation in various forms of entertainment content.
- **Business Communication:** Promotes inclusive communication within diverse teams by offering a tool for translating sign language to English in professional settings.

- **Community Engagement:** Fosters inclusivity in public events, meetings, and social interactions by breaking down language barriers for the deaf community.
- **Digital Accessibility:** Enhances accessibility of online content, applications, and platforms for deaf users, contributing to a more inclusive digital environment.
- **Legal and Government Services:** Improves access to legal and government information and services for deaf individuals, ensuring equal participation and understanding.
- **Emergency Situations:** Aids emergency responders in effectively communicating with deaf individuals during crises, enhancing overall safety and response efficiency.
- **Global Communication:** Facilitates communication between deaf and hearing individuals on a global scale, bridging language gaps and fostering cross-cultural understanding.

9. Conclusion

In conclusion, the development and implementation of a translator for specially-abled individuals represent a pivotal step towards fostering inclusivity and breaking down communication barriers. This transformative technology has the power to significantly enhance the lives of those with diverse abilities, providing them with the means to express themselves and engage meaningfully in various aspects of life. By offering real-time translation capabilities, this translator not only facilitates seamless communication but also promotes accessibility across education, healthcare, employment, and social interactions. The positive impact extends beyond individual experiences, contributing to a more inclusive and understanding society. As technology continues to evolve, the ongoing commitment to refining and expanding such translators is crucial, ensuring that the benefits reach a broader spectrum of specially-abled individuals and empowering them to participate fully in a diverse and interconnected world.

10. Future prospects of the project

- **Technological Advancements:**
 - Ongoing improvements in machine learning and artificial intelligence are driving the evolution of translator technology.
 - The progress is expected to yield more precise and advanced translation models.
- **Enhanced Accessibility:**
 - Translator technology is increasingly accessible across various platforms and devices.
 - This includes seamless integration into mobile applications and wearable devices, providing empowerment for specially-abled individuals in their daily lives.

- **Diverse Language Support:**
 - Anticipated expansions in multilingual support are anticipated.
 - This expansion aims to accommodate diverse sign languages, contributing to global inclusivity.
- **Integration in Educational and Professional Settings:**
 - Strategic integration of the translator into educational institutions and workplaces is seen as pivotal.
 - This integration holds the potential to open up new avenues for learning and employment opportunities for specially-abled individuals.
- **Collaboration with AR and VR Technologies:**
 - Explorations into collaborations with augmented reality (AR) and virtual reality (VR) technologies are underway.
 - This exploration seeks to enhance the translation experience, creating immersive and interactive communication environments.
- **Overcoming Communication Barriers:**
 - The evolving landscape of translator technology is poised to overcome communication barriers.
 - This progress is expected to promote social inclusion, allowing specially-abled individuals to participate more fully in various aspects of society.

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12.INDIVIDUAL CONTRIBUTION

S.NO.	PRN	NAME	INDIVIDUAL OBJECTIVE	LEARNING OUTCOME
1	1032200224	Anmol Prasad	Making Backend api's for translation tool + Made integration of interface with api's and implemented the frontend	Learnt about React JS and Node JS
2	1032200449	Kushagra Pokharna	Made the frontend integration + working on object detection project using TensorFlow for data gathering +uiux design of the webpage	Learning about TensorFlow and various python modules
3	1032200754	Shreyas Kawale	Designing and implementing the S/W for sign language detection	Learning about tensorflow and various python modules
4	1032200559	Om Pawar	Gathered information and researched for the translation tool	Gained knowledge about various translation frameworks