TALKING FINGERS

A PROJECT REPORT

Submitted by,

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Under the guidance of,

Ms. Josephine R.

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

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(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

BENGALURU

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PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report **“TALKING FINGERS”** being submitted by Abi Roshan, Muhammad Hasnain Akram Khan, Pranav Pradeep & Huzaifa Fathima bearing roll number(s) 20211CAI0033, 20211CAI0029, 20211CAI0073 & 20211CAI0178 in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering Artificial Intelligence and Machine Learning is a bonafide work carried out under my supervision.

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **TALKING FINGERS** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Science and Engineering Artificial Intelligence and Machine Learning**, is a record of our own investigations carried under the guidance of **Josephine R, Assistant Professor, School of Computer Science Engineering, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

This project introduces a comprehensive system that bridges the communication gap for individuals relying on Indian Sign Language (ISL) by converting spoken input into a cohesive ISL video response. The methodology begins with speech-to-text conversion, followed by sentence restructuring, parsing, and text refinement through lemmatization and stop word filtering. The refined text is then transformed into ISL syntax, and corresponding video clips are retrieved from a local database and merged into a seamless video output. This system leverages natural language processing, deep learning, and multimedia synthesis to create an accessible, efficient, and impactful solution for inclusive communication.

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INTRODUCTION

1. Challenges Faced by the Deaf-Mute Community in India

1.1 Accessibility Issues

1.1.1 Geographic and Educational Barriers

In India, individuals who are deaf or mute continue to face significant challenges in accessing education, employment opportunities, and communication resources. This issue is exacerbated by the limited number of schools equipped with sign language interpreters. The few such institutions that do exist are primarily concentrated in urban centers, leaving rural areas with even scarcer access to information and educational support. This geographic disparity further compounds the difficulties faced by the hearing-impaired population, creating an urgent need for solutions to bridge these gaps.

1.1.2 Need for Accessible Platforms

Addressing this concern requires the development of initiatives that can reduce the stark imbalance between the hearing-impaired population and the availability of qualified sign language interpreters. Furthermore, it is crucial to empower individuals with hearing and speech disabilities by providing platforms that facilitate self-education and learning of sign language. To meet this need, the proposed solution is an innovative, user-friendly, and time-efficient online platform designed specifically for deaf and mute individuals. Such a platform would serve as an effective tool for both communication and learning, enabling greater independence for this community.

1.2 The Role of Sign Language

Sign languages are not universal. Each country often has its unique version of sign language, and this proposal specifically targets the Indian population. Learning to read and write presents significant difficulties for many hearing-impaired individuals. Even for those who manage to acquire literacy skills, interpreting the full context of spoken communication remains a challenge. This issue is especially pronounced in scenarios involving non-verbal sounds or actions, which are often critical to conveying meaning.

1.3 Importance of Visual Cues in Communication

Many deaf-mute individuals rely on either sign language or lip-reading as primary modes of communication. Among these, sign language is generally preferred because it incorporates hand movements, lip movements, and facial expressions. These additional visual cues provide a richer context, allowing for more effective and meaningful communication. By offering a platform tailored to the unique needs of the Indian hearing-impaired population, this initiative aims to close critical gaps in accessibility and foster a more inclusive society.

CHAPTER-2

LITERATURE SURVEY

In paper [1] recent efforts have focused on translating speech to ISL using NLP techniques. Dasgupta et al. proposed a system that converts English text to ISL structure, but it struggled with handling the unique syntax of ISL.

TESSA (Speech-to-BSL System): One of the early systems designed to translate speech into British Sign Language (BSL) in specific domains, like post-office services. The system relied on predetermined phrases, which limited its application to specific scenarios.[2]

ViSiCAST (BSL Translation System): A more advanced system translating spoken English into BSL, it used a syntactic parser and incorporated sign language grammar through HamNoSys notation. It was part of a broader effort to improve accessibility for the hearing-impaired in public service settings.

This paper investigates the development of an end-to-end system for translating spoken language into Indian Sign Language (ISL) to facilitate real-time communication between the hearing-impaired community and the general population. [3] The authors propose a solution using Microsoft Kinect for motion capture and Unity3D for creating 3D animations of ISL gestures using Blender. Their approach includes recording motion data, mapping gestures onto 3D models, and implementing a speech-to-text system integrated with an ISL parser to enable seamless translation via an Android application. The paper also highlights the lack of ISL resources and the need for further research in gesture recognition and database development.

In paper [4] the authors developed a two-way communication system as opposed to our approach which is only one-way i.e, human speech to Indian Sign Language. The authors were able to achieve an accuracy of 99.78% using CNN(Convolutional Neural Networks). They imply that more efforts and research must be put into the field of NLP in order to convert human speech to sign languages of various origins.

In paper [5], a model was developed by the authors which is used to convert sign language to English and Malayalam by leveraging Arduino UNO, microcontroller and Flex sensor used for measuring resistance corresponding to the bend radius of the hands.This system allows users to use both their hands in order to depict the hand signs. The accuracy for this system was around 90% after testing it with multiple users. While this system translates hand signs to text or speech, this could prove to be useful as the other half of a two-way communication system.

In paper [6], research on Indian Sign Language (ISL) interpretation employs various techniques for gesture recognition and sentence formation. Early models used background subtraction, blob analysis, and classifiers like Haar Cascade and SVM for static and dynamic gestures. Hybrid approaches, such as combining CNNs with feature extraction techniques like SIFT, improved accuracy and robustness. NLP techniques, including grammar rules, part-of-speech tagging, and BERT-based grammar correction, enhance the generation of meaningful sentences. Despite advancements, work specific to ISL remains limited, highlighting the need for scalable systems to support effective communication for individuals with speech and hearing impairments.

In paper [7], the authors focus on converting hand gestures into text using image processing and feature extraction techniques. Skin-color-based segmentation is widely used, with HSI color models providing better accuracy compared to RGB models. Methods like distance transform identify hand centroids, and algorithms detect finger positions and angles to classify gestures. Hybrid approaches combining multiple algorithms enhance robustness. ISL recognition primarily involves two-hand gestures, making segmentation and finger detection challenging but crucial. While progress has been made in recognizing single-hand alphabets, improving robustness for two-hand gestures and incorporating learning algorithms remain areas for future exploration.

In paper [8], vision-based approaches without external devices are preferred to maintain natural gestures. PCA (Principal Component Analysis) is commonly employed for dimensionality reduction and feature extraction, enabling efficient recognition of ISL alphabets. Techniques such as Otsu-based segmentation, morphological filtering, and Euclidean distance for gesture comparison enhance accuracy. The integration of preprocessing, feature extraction, and PCA-based recognition converts ISL gestures into text and voice outputs.

In paper [11], the authors develop a bidirectional sign language translation system aimed at facilitating seamless communication for individuals with hearing and speech impairments. It proposes a mobile application that can perform real-time translation from sign language to speech and vice versa. The system employs a combination of Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) for sign language recognition, and Unity3D for rendering 3D animations of sign language gestures. By ensuring high portability and accessibility through smartphones without the need for additional hardware, the solution seeks to bridge the communication gap and promote greater social inclusion for differently-abled individuals. It achieved an accuracy level of 97% where it managed to identify 194 out of 200 samples correctly.

This paper explores the development and evaluation of a novel auditory feature extraction method for robust automatic speech recognition (ASR) in noisy environments, using Gammatone filter-based features.[12] The research focuses on implementing Gammatone filters purely in the time domain, unlike traditional frequency-domain approaches, to improve both precision and computational efficiency. Experimental results on Mandarin speech data demonstrate significant performance gains in various noise conditions when compared with standard features such as Mel Frequency Cepstral Coefficients (MFCC) and Perceptual Linear Prediction (PLP). The study highlights the potential of time-domain Gammatone features for enhancing ASR systems, especially in real-world noisy scenarios.

In paper [13] the authors develop a machine translation system designed to convert Malayalam text into Indian Sign Language (ISL) using synthetic animation. The system leverages the Hamburg Notation System (HamNoSys) as an intermediate representation for translating signs, allowing users to input Malayalam text and generate corresponding ISL animations via a 3D avatar. It includes a Sign Editor module to enrich the database by adding new words in HamNoSys format, and a Translator module for converting Malayalam text into sign animations. The tool aims to promote sign language education in Kerala, supporting both hearing-impaired individuals and the general public.

This paper discusses a system for translating Russian text into Russian Sign Language (RSL) using semantic and syntactic analyses.[15] It highlights limitations in existing systems and proposes a method to address them by integrating semantic analysis to improve translation quality. The system identifies lexical meanings for words and resolves ambiguities using a database of semantic relationships. It uses a modular approach to analyze sentences morphologically and syntactically, breaking down complex sentences into simpler ones for translation. The research emphasizes creating a robust semantic analysis software unit and suggests enhancements like handling idiomatic expressions and increasing the database of gestures for better accuracy.

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

Limited Datasets: ISL suffers from a lack of large, diverse, and annotated datasets. Unlike languages with written forms, sign languages require video data to capture gestures, facial expressions, and movements.

Non-Linear Grammar: ISL has a different grammatical structure than spoken or written Indian languages, making direct translation challenging.

Bi-Directional Translation: Models that enable two-way communication (from ISL to text/speech and vice versa) are rare and often underdeveloped.

Ability to adapt: No current ISL model has the ability to handle the translation of a word which is not present in its data set.
Limited Datasets: Indian Sign Language (ISL) faces significant challenges due to the absence of large, comprehensive, and well-annotated datasets necessary for effective model training. Unlike spoken or written languages, which rely on text-based corpora, sign languages require extensive video datasets to accurately capture the intricate gestures, facial expressions, and body movements that are integral to communication in ISL.

Non-Linear Grammar: The grammatical structure of Indian Sign Language differs significantly from that of spoken or written Indian languages, which makes direct translation a complex and often impractical task. The unique syntax of ISL, combined with its reliance on visual-spatial grammar, requires translation models to account for these structural differences to ensure accuracy and naturalness in communication.

Bi-Directional Translation: Translation systems capable of facilitating two-way communication between Indian Sign Language and text or speech remain underdeveloped and rare. The lack of robust models capable of translating both from ISL to spoken languages and from text or speech into ISL limits their practical utility in real-world scenarios.

Adaptability to Unseen Vocabulary: Existing Indian Sign Language translation models lack the ability to adapt dynamically when encountering words or concepts that are not included in their training data. This limitation poses significant challenges in handling new or context-specific vocabulary, making the systems less versatile and less effective in diverse communication settings.

CHAPTER-4
PROPOSED METHODOLOGY

Speech Input: This step involves receiving spoken input directly from the user. By allowing users to communicate naturally through speech, this functionality ensures a more accessible and user-friendly experience for individuals seeking to convey their messages effectively.

Speech to Text Conversion: Once the spoken input is received, it is converted into text format using advanced speech-to-text technology. This conversion is critical for further processing, as it enables the system to analyze the user's intent and structure the message for subsequent stages.

Modify and Parse Sentence Structure: The converted text is then analyzed to identify and restructure its grammatical composition. This step enhances clarity and understanding by modifying the sentence structure where necessary, ensuring that the message is coherent and suitable for further transformation into ISL syntax.

Lemmatization: At this stage, individual words within the sentence are reduced to their base or root forms. Lemmatization ensures that variations of a word (e.g., "running," "ran") are standardized, improving the accuracy of the subsequent ISL syntax generation.

Stop Word Filtering: Commonly used words that do not contribute significant meaning to the sentence, such as "the," "is," or "and," are identified and removed. This step streamlines the input by isolating the key words that are most relevant to the intended message.

Generate ISL Syntax: Using the filtered keywords, the system creates a syntax structure that is aligned with Indian Sign Language (ISL). This step transforms the text into a format that adheres to ISL grammar and conveys the intended meaning effectively.

Retrieve YouTube Links: The system then searches for corresponding ISL video clips from a locally stored database. These clips represent the individual signs or concepts identified in the generated ISL syntax, ensuring that the output is accurate and contextually appropriate.

Merge Video Clips: After retrieving the relevant video clips, they are combined into a cohesive video sequence. This merging process ensures that the final output forms a smooth and coherent response that aligns with the original spoken input.

Final Result Display: The completed ISL video response is then displayed to the user. This final result enables deaf-mute individuals to access information or communicate effectively using ISL, fulfilling the original intent of the spoken input.

CHAPTER-5
OBJECTIVES

•**Develop a Real-Time Speech-to-ISL Translation System**

Convert spoken English into ISL with proper syntax handling.

•**Enhance Translation Accuracy and Minimize Latency**

Improve translation speed and accuracy by optimizing noise removal, speech recognition, and video merging techniques.

•**Create an Educational Tool for ISL Learning**

Design the system to serve as an educational platform where users can learn ISL through interactive and intuitive video outputs(Speech_to_Indian_Sign_Language).

•**Provide an Accessible and User-Friendly Interface**

Develop a web-based interface that can be used by individuals with varying technical skills, ensuring ease of access for both hearing and hearing-impaired users

•**Ability to handle missing vocabulary in the dataset**

Existing ISL translation models work on a fixed dataset which causes an error with words outside its vocabulary. The proposed model should have the ability to recognise and store these missing words in order to update the dataset.

CHAPTER-6

SYSTEM DESIGN & IMPLEMENTATION

1. System Design:

To convert spoken language (speech) into corresponding Indian Sign Language gestures, through machine learning(NLP) and mapping techniques.

Key Components:

Speech Recognition: Converts spoken words into text. Employs the library Speech Recognition API.

Text Processing: Processes the recognized text to extract meaningful data and simplify it for gesture mapping.

ISL Conversion: Maps processed text to pre-defined ISL video clips.

User Interface: Provides interactivity or visual representation for the user, showing signs through video clips.

Workflow:

- Input is given as speech via a microphone.
- Speech-to-text conversion is performed.
- The text undergoes preprocessing (e.g., tokenization, removing irrelevant words).
- A mapping algorithm translates text into corresponding ISL gestures.
- The output is displayed.

2. System Implementation:

Speech Recognition Integration:

- A cell mentions speech recognition, using a library like speech_recognition.

Preprocessing:

- Text normalization (e.g., removing stopwords or unnecessary words).
- Simplifies text for easier mapping.

Mapping to ISL:

- A dictionary or ML model links text to ISL representations.

Visual Output:

- Shows ISL gestures (videos of signs).

Technology Stack:

Python Libraries: Used libraries include speech_recognition, os, and others for data handling and visualization.

Jupyter Notebook: For iterative development and visualization.

Implementation Highlights:

- Modular, with each stage (speech recognition, text processing, mapping) implemented in a separate function or script.
- User-focused output, ensuring accessibility and usability.

CHAPTER-7
TIMELINE FOR EXECUTION OF PROJECT
(GANTT CHART)

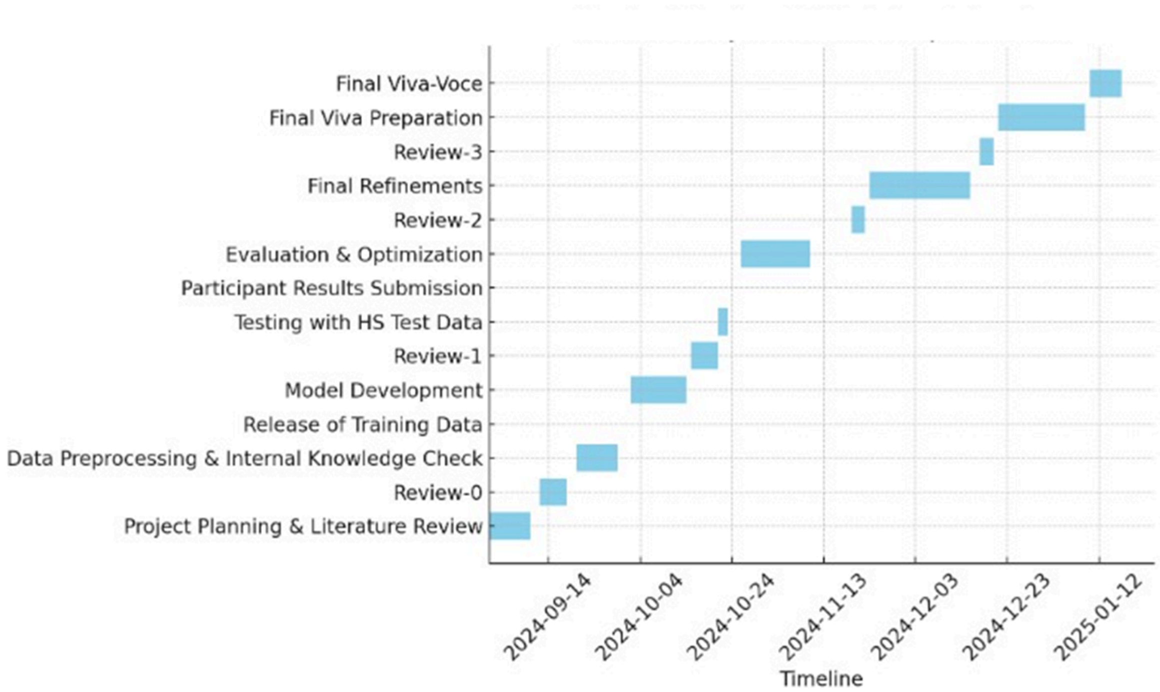

Figure 7.1

CHAPTER-8
OUTCOMES

- Broader Access to Information: The proposed online platform will significantly expand the opportunities for deaf-mute individuals to access a wide array of information and knowledge. By overcoming traditional barriers to communication, it will provide them with a more inclusive and equitable avenue for staying informed and engaged. This access is particularly important for their personal development and social integration.

- Enhanced Communication Opportunities: The platform is designed to serve as a bridge between deaf-mute individuals and those who can hear. By offering tools that facilitate seamless interaction, it will enable more effective communication, fostering better understanding and collaboration between these groups. This improvement in communication will help reduce misunderstandings and strengthen social bonds.

- Advancements in Education: For deaf-mute students, the platform will be a critical resource for learning Indian Sign Language (ISL) and improving their overall educational experiences. By providing an interactive and accessible way to acquire knowledge, it will support their academic growth and help address the significant gaps in traditional educational resources available to them.

- Empowering the Deaf-Mute Community: Through the provision of a self-learning platform, this initiative aims to empower individuals within the deaf-mute community to take charge of their education and skill development. By fostering greater independence, it will reduce their dependence on the limited resources currently available, allowing them to participate more fully in various aspects of society and lead more self-sufficient lives.

CHAPTER-9

RESULTS AND DISCUSSIONS

The developed model successfully achieves the objective of facilitating seamless communication through Indian Sign Language (ISL) translation. The system begins by accurately capturing and processing audio input from the user, leveraging advanced speech-to-text conversion technology to transcribe spoken words into text format with high precision. This transcription forms the foundation for subsequent linguistic transformations.

The text is then effectively converted into ISL syntax, adhering to the grammatical structure and conventions unique to ISL. The model further demonstrates its utility by retrieving corresponding ISL video clips from a curated YouTube directory. These video clips, representing individual words or concepts, are systematically merged to form a cohesive video output. The final result is a smooth and coherent ISL video translation that faithfully represents the input speech.

This seamless pipeline, from audio input to the generation of a complete ISL video, underscores the model’s robustness and reliability. The result showcases the potential of integrating speech recognition, natural language processing, and multimedia synthesis to enhance accessibility for deaf-mute individuals. The system's ability to merge multiple video segments into a unified output ensures that the intended message is conveyed effectively and naturally, making it a practical and impactful solution for real-world use.

CHAPTER-10
CONCLUSION

The project successfully demonstrates the potential of integrating advanced technologies like speech recognition, natural language processing, and multimedia synthesis to bridge the communication gap for the deaf-mute community. By converting spoken language into Indian Sign Language (ISL) videos, the system provides an accessible and user-friendly solution for facilitating effective communication.

The pipeline, which includes speech-to-text conversion, ISL syntax generation, and the retrieval and merging of video clips, performs reliably, ensuring accuracy and coherence in the final output. This innovative approach not only highlights the possibilities of leveraging AI and deep learning for inclusivity but also sets a strong foundation for future enhancements, such as expanding the ISL video database or improving the handling of complex linguistic variations.

Overall, this project is a significant step toward empowering individuals with speech and hearing impairments, enabling greater accessibility and inclusion in communication.

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APPENDIX-A

PSEUDOCODE

```
def convert_isl(parsetree):
  dict = {}
  parenttree= ParentedTree.convert(parsetree)
  for sub in parenttree.subtrees():
    dict[sub.treeposition()]=0
  #"-----------------------------------------------"
  isltree=Tree('ROOT',[])
  i=0
  for sub in parenttree.subtrees():
    if(sub.label()=="NP" and dict[sub.treeposition()]==0 and
dict[sub.parent().treeposition()]==0):
      dict[sub.treeposition()]=1
      isltree.insert(i,sub)
      i=i+1

    if(sub.label()=="VP" or sub.label()=="PRP"):
      for sub2 in sub.subtrees():
        if((sub2.label()=="NP" or sub2.label()=='PRP') and
dict[sub2.treeposition()]==0 and
dict[sub2.parent().treeposition()]==0):
          dict[sub2.treeposition()]=1
          isltree.insert(i,sub2)
          i=i+1

  for sub in parenttree.subtrees():
    for sub2 in sub.subtrees():
      if(len(sub2.leaves())==1 and dict[sub2.treeposition()]==0 and
dict[sub2.parent().treeposition()]==0):
          dict[sub2.treeposition()]=1
          isltree.insert(i,sub2)
          i=i+1

  return isltree
```

```
def text_to_isl(sentence):
  pattern = r'[^\w\s]'

# Remove the punctuation marks from the sentence
  sentence = re.sub(pattern, '', sentence)
  englishtree=[tree for tree in sp.parse(sentence.split())]
  parsetree=englishtree[0]
  #print(parsetree)
  isl_tree = convert_isl(parsetree)
  words=parsetree.leaves()
  lemmatizer = WordNetLemmatizer()
  ps = PorterStemmer()
  lemmatized_words=[]
  for w in words:
    #w = ps.stem(w)
   lemmatized_words.append(lemmatizer.lemmatize(w))
   islsentence = ""
   for w in lemmatized_words:
    if w not in stopwords_set:
      islsentence+=w
      islsentence+=" "
  #islsentence = clean(words)
  islsentence = islsentence.lower()
  isltree=[tree for tree in sp.parse(islsentence.split())]
  return islsentence
```

```
from moviepy.editor import *
import os

def cut_vid(filename,yt_name,start_min,start_sec,end_min,end_sec):
  clip = VideoFileClip(os.path.join(yt_path,yt_name+'.mp4'))
  clip1 = clip.subclip((start_min,start_sec),(end_min,end_sec))

clip1.write_videofile(os.path.join('/content/NLP_dataset',filename+'.m
p4'),codec='libx264')
```

```
def text_to_vid(input_text):
  NLP_videos = pd.read_csv('/content/drive/MyDrive/NLP_videos.csv')
  root_path = '/content/NLP_dataset'
  yt_path = '/content/yt'
  videos = []
  clips=[]
  sentence = text_to_isl(input_text)
  print(sentence)
  words = sentence.split()
  for i in words:
    if (NLP_videos['Name'].eq(i)).any():
      idx = NLP_videos.index[NLP_videos['Name'] == i].tolist()
      get_yt(NLP_videos['Link'].iloc[idx[0]],yt_path)

cut_vid(i,NLP_videos['yt_name'].iloc[idx[0]],NLP_videos['start_min'].i
loc[idx[0]],NLP_videos['start_sec'].iloc[idx[0]],NLP_videos['end_min']
.iloc[idx[0]],NLP_videos['end_sec'].iloc[idx[0]])
      videos.append(os.path.join(root_path,i+'.mp4'))
    else:
      for letter in i:
        idx = NLP_videos.index[NLP_videos['Name'] == letter].tolist()
        #print(letter,idx)
        get_yt(NLP_videos['Link'].iloc[idx[0]],yt_path)

cut_vid(letter,NLP_videos['yt_name'].iloc[idx[0]],NLP_videos['start_mi
n'].iloc[idx[0]],NLP_videos['start_sec'].iloc[idx[0]],NLP_videos['end_
min'].iloc[idx[0]],NLP_videos['end_sec'].iloc[idx[0]])
        videos.append(os.path.join(root_path,letter+'.mp4'))
  for i in videos:
    clip = VideoFileClip(i)
    clips.append(clip)

  final = concatenate_videoclips(clips, method="compose")
  final.write_videofile("merged.mp4")
```

APPENDIX-B

SCREENSHOTS

```
print(speech)

I like drinking coffee
```

```
[ ] text_to_vid(speech)

i like drinking coffee
[youtube] Extracting URL: https://youtu.be/f7XWdoOSSNw
[youtube] f7XWdoOSSNw: Downloading webpage
[youtube] f7XWdoOSSNw: Downloading ios player API JSON
[youtube] f7XWdoOSSNw: Downloading mweb player API JSON
[youtube] f7XWdoOSSNw: Downloading player 03dbdfab
[youtube] f7XWdoOSSNw: Downloading m3u8 information
[info] f7XWdoOSSNw: Downloading 1 format(s): 135+140
[download] Destination: /content/yt/me.f135.mp4
[download] 100% of  158.97KiB in 00:00:00 at 334.16KiB/s
[download] Destination: /content/yt/me.f140.m4a
[download] 100% of   88.77KiB in 00:00:00 at 209.87KiB/s
[Merger] Merging formats into "/content/yt/me.mp4"
Deleting original file /content/yt/me.f135.mp4 (pass -k to keep)
Deleting original file /content/yt/me.f140.m4a (pass -k to keep)
Moviepy - Building video /content/NLP_dataset/i.mp4.
MoviePy - Writing audio in iTEMP_MPY_wvf_snd.mp3
MoviePy - Done.
Moviepy - Writing video /content/NLP_dataset/i.mp4

Moviepy - Done !
Moviepy - video ready /content/NLP_dataset/i.mp4
```

APPENDIX-C

ENCLOSURES

1. Journal publication/Conference Paper Presented Certificates of all students.


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p-ISSN: 2320-9798

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Publication

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3. Details of mapping the project with the Sustainable Development Goals (SDGs).

- SDG 3 - Good Health and Well-Being: Enhancing accessibility for individuals with hearing impairments supports their mental health and well-being by promoting inclusion and reducing isolation.
- SDG 4 - Quality Education: Our project can help improve education for deaf individuals by enabling better communication and access to information.
- SDG 8 - Decent Work and Economic Growth: Enhancing communication can create more inclusive work environments, providing equal opportunities for deaf individuals.
- SDG 10 - Reduced Inequalities: Your project directly addresses inequality by empowering deaf individuals and fostering inclusivity.
- SDG 11 - Sustainable Cities and Communities: Bridging communication gaps contributes to building inclusive communities.