CHRIST (Deemed to be University)
School of Engineering and Technology, Bangalore – 560074.
Department of Computer Science and Engineering

Design and development of teaching and learning tool using sign language translator to enhance the learning skills for students with hearing and verbal impairment.

by

Meenakshi SA-2162058
Mehwish Sultana-2162060
Saniya Thomas-2162064
6BTCS-AIML

2023-2024
Conducted at:
Dr. S.R. Chandrasekhar Institute of Speech and Hearing
Bangalore, Karnataka, India

In partial fulfillment of the requirements of **Service Learning (CS – 681)** in Bachelor of Technology in Computer Science and Engineering [AIML] at CHRIST (Deemed to be University), Bangalore, Karnataka, India.

Faculty In-Charge **Head of Department**

Abstract

This project presents a comprehensive solution aimed at addressing communication barriers faced by individuals with verbal and hearing impairments, focusing particularly on Indian Sign Language (ISL). Through collaboration with the Dr. S.R. Chandrasekhar Institute of Speech and Hearing, a multidisciplinary approach was employed to develop a web-based application facilitating real-time Sign-to-Text and Text-to-Sign Language conversion. Leveraging advanced technologies including machine learning, computer vision, and animation, the system ensures accurate representation and interpretation of ISL gestures and movements. Key components include dataset collection, animation creation, model development, evaluation, and validation, culminating in the creation of a user-friendly interface accessible across devices. By bridging the gap between sign language and text, the project promotes communication accessibility, enhances educational opportunities, and fosters social inclusion for individuals with disabilities. The report discusses the methodology, results, limitations, and future scope of the project, highlighting its significance in advancing assistive technology and promoting inclusive practices in education and society.

List of figures

Chapter 1: Introduction

1.1 Background about the topic

The background of this project revolves around addressing the challenges faced by individuals with verbal and hearing impairments, particularly within the context of Indian Sign Language (ISL). Communication is fundamental to human interaction, yet individuals with verbal and hearing impairments often encounter barriers that hinder their ability to effectively communicate with others. These barriers can significantly impact their access to education, employment, social interactions, and overall quality of life.

In many educational settings, individuals with verbal and hearing impairments face limited access to learning materials and instructional methods that cater to their specific needs. Traditional communication tools may not adequately accommodate their preferred mode of communication, which is often sign language. As a result, these individuals may struggle to fully engage in classroom activities, participate in discussions, and access educational content. Furthermore, the shortage of qualified sign language interpreters and educators exacerbates the challenges faced by individuals with verbal and hearing impairments. This shortage limits their access to essential services, such as medical appointments, legal proceedings, and educational programs, further marginalizing them within society.

Recognizing these challenges, this project aims to develop a comprehensive teaching and learning tool using sign language translation to enhance the communication skills and learning outcomes of individuals with verbal and hearing impairments. By leveraging advanced technologies such as machine learning, computer vision, and animation, the project seeks to bridge the gap between sign language users and non-sign language users, thereby promoting communication accessibility and empowering individuals with disabilities.Through this project, the team endeavors to create an inclusive communication system that facilitates Sign-to-Text and Text-to-Sign Language conversion in real-time. By doing so, they hope to provide individuals with verbal and hearing impairments with the necessary tools to participate fully in educational, social, and professional contexts, ultimately promoting their integration and inclusion within society.

1.2 Problem Statement

Limited education access for Indian students with verbal and hearing impairments due to ineffective communication tools and teacher shortages leads to unequal learning opportunities. Our study aims to develop an application to break communication barriers, fostering inclusivity and aligning with SDG 4's vision for equitable education.

1.3 Objectives

- Dataset Collection: Gather a comprehensive dataset of Indian Sign Language (ISL) gestures from Dr. S.R. Chandrasekhar Institute Of Speech and Hearing to serve as the foundation for animation and model training.
- Animation Creation: Utilize Blender animation Tool to generate equivalent animations of the dataset, ensuring accurate representation of ISL gestures and movements.
- Model Development: Employ computer vision techniques including Long Short-Term Memory (LSTM), MediaPipe, and OpenCV for precise gesture detection. Augment this with Natural Language Processing (NLP) techniques for seamless translation between sign language and text.
- Evaluation: Assess the performance and effectiveness of the developed model through rigorous evaluation, considering metrics such as accuracy, speed, and usability.
- Validation: Validate the model's capabilities and reliability through real-world testing scenarios, involving individuals proficient in ISL as well as those new to the language, to ensure its suitability for diverse users.

1.4 Scope of the project

- Designing and implementing a versatile 3D tool for animating avatars that accurately represent ISL gestures.
- Developing a Sign-to-Text and Text-to-Sign conversion system that leverages machine learning algorithms for improved accuracy.
- Creating a user-friendly web application interface to facilitate real-time communication between sign language users and non-sign language users.
- Utilizing the MediaPipe library for extracting key points from sign language gestures and facial expressions to ensure faithful representation of ISL.

1.5 Community Profile

Community Name: Dr. S.R. Chandrasekhar Institute of Speech and Hearing

Location: Bangalore, Karnataka, India

Overview:

- Established institution dedicated to speech and hearing sciences.
- Founded by Dr. S.R. Chandrasekhar, a leading figure in the field.
- Provides diagnostic, therapeutic, and rehabilitative services.

- Offers academic programs, research initiatives, and community outreach.

Services:

- **Clinical Services**: Diagnosis, therapy, and rehabilitation for speech and hearing disorders.
- **Education and Training:** Undergraduate and postgraduate programs, workshops, and seminars.
- **Research and Development:** Advancing knowledge and developing innovative techniques.
- **Community Outreach:** Awareness campaigns and collaborations for early intervention.

Impact:

- Leading institution in the field.
- Recognized for excellence in education, research, and clinical services.
- Contributing to the advancement of speech and hearing sciences nationally and globally.

1.6 Organization of the report

The report is organized into several chapters, each focusing on different aspects of the project:

- **Chapter 1**: Introduction (current chapter)
- **Chapter 2:** Literature Review
- **Chapter 3:** Methodology
- **Chapter 4:** Conclusion

Chapter 2. Literature Survey

Tools that translate text to sign language and sign language to text could help close the communication gap between individuals with disabilities and the general public. India's population with serious auditory impairment is approximately 6.3%. Text-to-sign language translation systems have been the subject of extensive research in the past few years.Studies have been conducted to convert speech and text to Indian sign language. Existing models receive voice input in six regional Indian languages and generate a series of gestures using Wavelet-based Mel Frequency Cepstral Coefficients with GMM, text translation via LSTM, and sign language mapping. [1]. In artificial animation, the HamNoSys structure acts as a mediatory representation for signs.A SiGML file is generated for every word that is inputted. The Avatar can animate a word with SiGML, but we still need to teach it how to perform a specific motion. [2]. CNN is used in a machine learning model to recognize and convert sign language to text.[3]. In order to enhance communication, a deep learning-based program that uses the "Google text to speech" API to transform sign language into text is frequently utilized [4].In the glove-based sign-to-content/voice interpreting framework, a glove equipped with flex sensors and an Arduino Nano interface performs sign acknowledgment. The sign is interpreted by an internal program designed for the Arduino Nano, which then outputs the appropriate characters in the correct order both verbally and physically. The Arduino Nano's ADC highlight creates these fundamental flags by converting them into digital signals[5]. The model can recognize and classify hand signs, learn from limited training data, and translate those signals into text thanks to recent advancements in machine learning techniques. [6].Kinect for Windows V2 is another program for translating voice to sign language and sign language to speech. The algorithm recognizes the movements picked up by the Kinect detector by comparing the gestures that are executed with the taught gestures that were previously stored in the database. Once the motion has been recognized, it is translated into text and a three-dimensional animation, and mapped to the related keyword. To convert voice to text, an external library can be utilized; it takes a word or sentence as input and extracts the keywords. Next, the system will use the term to search the database for the sign or gesture. Unity3D uses a data structure to link its gesture animations to a 3D model via a data structure. [7]These models aid in bridging the communication gap that exists between the general public and the community of people with speech and hearing impairments. Nevertheless, issues like context-sensitive interpretation, hardware dependence, real-time processing, and diverse datasets still need to be addressed, which calls for the creation of more robust and all-encompassing apps for effective sign language communication.

Chapter 3: Methodology

The web application project aims to enhance communication accessibility by providing both sign-to-text and text-to-sign translations. Developed with a focus on Indian Sign Language (ISL), it utilizes a comprehensive dataset curated in collaboration with the Dr. S. R. Chandrasekhar Institute Of Speech And Hearing. The text-to-sign conversion process employs Natural Language Processing (NLP) techniques, matching input text to corresponding sign language actions or letter representations for seamless translation. Conversely, the sign-to-text conversion system utilizes advanced computer vision and machine learning methodologies, including keypoint detection and LSTM models, to accurately interpret sign language gestures in real-time. Integrated with Mediapipe, TensorFlow, Keras, and OpenCV, the application offers an interactive and inclusive platform for individuals with hearing or verbal impairments, bridging communication barriers effectively.

1) Web Application Development

The project entails the development of a web application facilitating both sign-to-text and text-to-sign translations, thereby enhancing communication accessibility. Utilizing HTML, CSS, and JavaScript, the frontend was designed to deliver an interactive user interface. The backend operations were managed through the Django framework, ensuring smooth communication between the user interface and underlying processes.

2) Data Collection Process

Collaborating with the Dr. S. R. Chandrasekhar Institute Of Speech And Hearing, a dataset comprising various words enacted in Indian Sign Language (ISL) was curated. The institute contributed by collecting gestures for each word and elucidating the nuances of each action. For the text-to-sign application, a dataset of short animated video clips depicting each word was gathered. These clips featured a 3D human avatar enacting the associated action, stored as short video sequences, with each clip corresponding to a single word.

3) Text-to-Sign Conversion Procedure

The frontend of the web application was developed using HTML, CSS, and JavaScript, while the backend was powered by the Django framework. Users input English text into a provided text box, which is then sent to the server-side for preprocessing using Python. Natural Language Processing (NLP) tasks are executed using the NLTK library, which considers the grammatical and syntactic rules of sign languages, respecting their unique syntax and grammar. Video clips of words from the dataset are matched to the existing sign language actions database and played sequentially. If a video clip for a word is unavailable, clips of the word's letters are utilized instead. These clips are then streamed to the web application for sequential playback.

4) Sign-to-Text Conversion Process

The primary aim of the project is to develop a system capable of real-time detection and translation of sign language, facilitating communication for individuals with hearing or verbal impairments. Implemented entirely in Python, the system leverages various libraries and frameworks, including Mediapipe, TensorFlow, Keras, and OpenCV, to achieve its objectives. The dataset, comprising video recordings of various Indian sign language gestures, was provided and validated by the Dr. S. R. Chandrasekhar Institute Of Speech And Hearing.

Holistic keypoints are extracted from the dataset using the Mediapipe library, which detects keypoints from both hands and facial expressions. This information is crucial for accurately interpreting sign language gestures, as facial expressions and hand movements are essential components of sign language communication. To predict specific sign language actions, an LSTM machine learning model is employed, trained using TensorFlow and Keras. The LSTM model, well-suited for sequence prediction tasks, effectively interprets the dynamic and sequential nature of sign language gestures. Upon training, the model weights are saved in an HDF5 file. OpenCV is integrated into the project for real-time predictions and interactions, ensuring seamless video input processing and immediate user feedback, vital for effective sign language communication.

3.1 Architecture

Text-to-Sign Conversion

Figure 1, the text-to-sign section of the web application operates as follows:The frontend of the web application was developed using HTML, CSS, and JavaScript, while the backend was powered by the Django framework. Users input English text into a provided text box, which is then sent to the server-side for preprocessing using Python. Natural Language Processing (NLP) tasks are executed using the NLTK library, which considers the grammatical and syntactic rules of sign languages, respecting their unique syntax and grammar. Video clips of words from the dataset are matched to the existing sign language actions database and played sequentially. If a video clip for a word is unavailable, clips of the word's letters are utilized instead. These clips are then streamed to the web application for sequential playback.

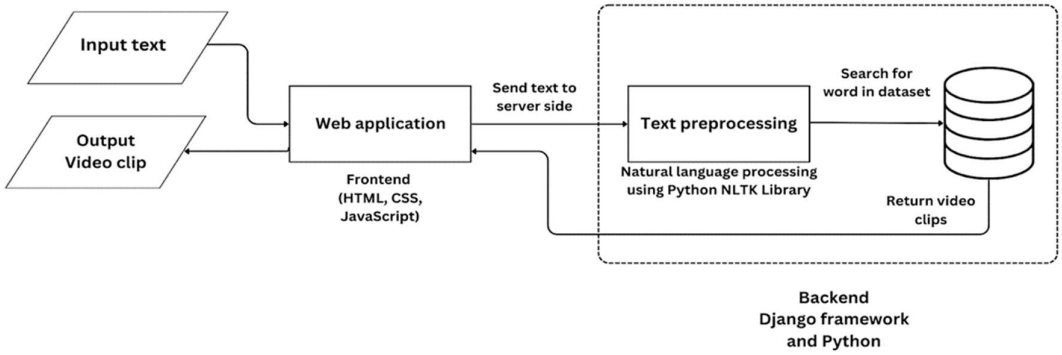


Fig. 1. Web application Flowchart (*Working of text to sign application*)

Sign-to-Text Conversion

In Figure 2, the training process for the LSTM model utilizing Mediapipe and OpenCV for holistic keypoint extraction involves the following steps:The primary aim of the project is to develop a system capable of real-time detection and translation of sign language, facilitating communication for individuals with hearing or verbal

impairments. Implemented entirely in Python, the system leverages various libraries and frameworks, including Mediapipe, TensorFlow, Keras, and OpenCV, to achieve its objectives. The dataset, comprising video recordings of various Indian sign language gestures, was provided and validated by the Dr. S. R. Chandrasekhar Institute Of Speech And Hearing.Holistic keypoints are extracted from the dataset using the Mediapipe library, which detects keypoints from both hands and facial expressions. This information is crucial for accurately interpreting sign language gestures, as facial expressions and hand movements are essential components of sign language communication. To predict specific sign language actions, an LSTM machine learning model is employed, trained using TensorFlow and Keras. The LSTM model, well-suited for sequence prediction tasks, effectively interprets the dynamic and sequential nature of sign language gestures. Upon training, the model weights are saved in an HDF5 file. OpenCV is integrated into the project for real-time predictions and interactions, ensuring seamless video input processing and immediate user feedback, vital for effective sign language communication.

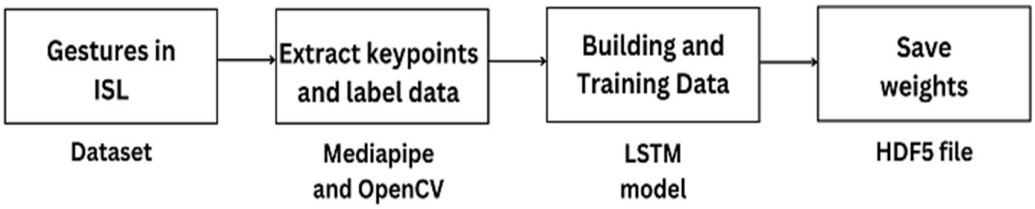


Fig. 2. Training flowchart (*Training*)

Fig. 3. Detection Flowchart (Live prediction)

3.2 Components

The sign to text application works as a web application that runs on all devices including mobiles tablets etc. This makes the accessibility of the application more convenient to the users.

3.3 Software and Hardware Requirements

Hardware Requirement:

- NVIDIA® GPU card with CUDA® architectures 3.5, 5.0, 6.0, 7.0, 7.5, 8.0 and higher.
- For GPUs with unsupported CUDA® architectures, or to avoid JIT compilation from PTX, or to use different versions of the NVIDIA® libraries.
- Packages do not contain PTX code except for the latest supported CUDA® architecture, fails to load on older GPUs when CUDA_FORCE_PTX_JIT=1 is set.

Software Requirements:

- Python 3.9–3.11
- pip version 19.0 or higher for Linux (requires manylinux2014 support) and Windows. pip version 20.3 or higher for macOS.
- Windows Native Requires Microsoft Visual C++ Redistributable for Visual Studio 2015, 2017 and 2019.

3.4 Description of the project

The proposed system is a groundbreaking assistive technology solution for individuals with verbal impairments.The system is designed for the students with verbal and hearing impairments by enabling real-time Sign-to-Text and Text-to-Sign Language conversion, with a specific focus on the Indian Sign Language (ISL).The project aligns to the United Nations Sustainable Development Goal (SDG) of Quality Education .On the receiving end, the system excels at Text-to-Sign Language conversion, allowing non-sign language users to interact naturally with sign language users through textual input transformed into sign language animations and Sign-to-Text conversion where the information from the sign language users is converted to text which ensures smooth communication .The system leverages cutting-edge technologies, MediaPipe for holistic keypoint extraction encompassing hand and facial movements, and Long Short-Term Memory (LSTM) architecture powered by Tensorflow and Keras for accurate sign language interpretation. It combines two components: OpenCV and MediaPipe, which enable real-time detection and tracking of Indian Sign Language (ISL) gestures, and Natural Language Processing (NLP) techniques to transform text into expressive ISL gestures.This comprehensive approach ensures nuanced aspects of sign language, such as facial expressions and hand movements, are faithfully represented.This bidirectional capability allows individuals with verbal impairments to comprehend and articulate information effectively. The application's crowning achievement is a lifelike avatar created using Blender, which acts as a visual interpreter for ISL, providing an immersive and engaging user experience. This application has profound societal implications, promoting education, employment, and

social integration for individuals with verbal impairments. It promotes diversity and ensures equal opportunities for everyone to express their ideas. The study represents the pinnacle of assistive technology, uniting computer vision, NLP, and avatar technology to facilitate seamless communication between ISL and text.A user-friendly web application, developed using HTML, CSS, and JavaScript, enhances accessibility and intuitive usage for real-time communication.

3.5 Results and Screenshots

Conversion of Text To Indian Sign Language

In Fig.4, the project underscores the importance of sign language for individuals with hearing and verbal impairments. The project leverages a dataset obtained through collaboration with the Dr. S. R. Chandrasekhar Institute Of Speech And Hearing, encompassing a diverse range of sign language components. This dataset serves as the cornerstone for an innovative text-to-sign language conversion system, driven by Natural

Language Processing and animation technology. The resultant web application, crafted using HTML, CSS, and JavaScript, holds practical implications in healthcare, business, and education, acting as a valuable tool for promoting inclusive communication.

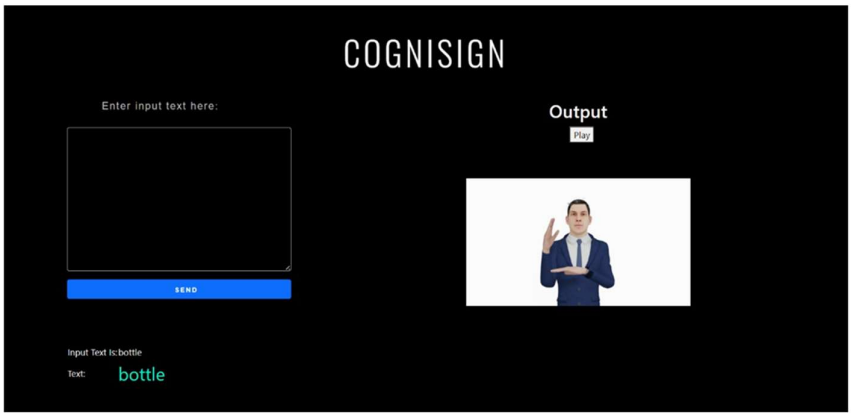


Fig. 4. Webpage (*Text-to-Sign Conversion webpage)*

Conversion of Indian Sign Language to Text

In Fig.5, the screenshot showcases the primary interface of a text-to-sign translation application. Within the image, a user demonstrates the ISL (Indian Sign Language) sign for the word "thanks." The application employs the OpenCV library's "puttext" method to showcase the model's prediction, prominently displayed in the blue rectangle. Notably, the model's prediction is remarkably precise and accurate.

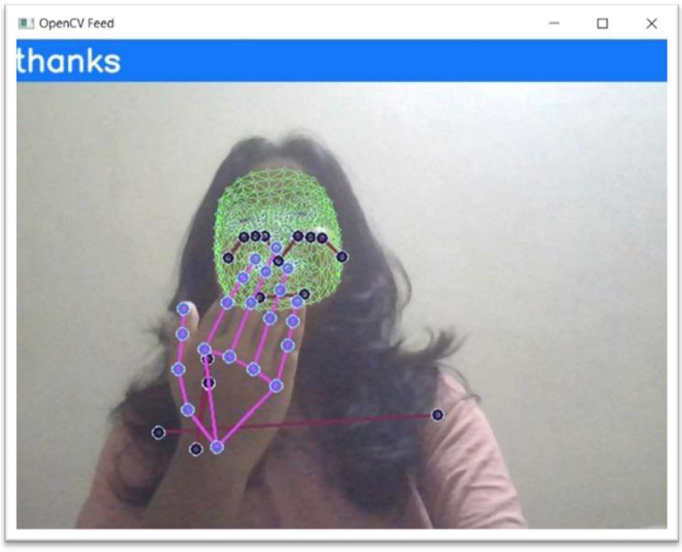


Fig. 5. Sign Language Detection (*Sign-to-Text Conversion output)*

Chapter 4: Conclusion

4.1 Learning Outcome

The community stands to gain significantly from the implementation of this project. Firstly, it addresses a critical need for individuals with verbal and hearing impairments by providing them with enhanced communication access. This access is crucial for their social interactions, educational pursuits, and professional endeavors, thereby fostering their overall inclusion and participation in society.

Moreover, the project improves learning opportunities for these individuals, particularly students, by offering a comprehensive teaching and learning tool using sign language translation. By bridging the gap between sign language and text, it enables more effective communication in educational settings, allowing students with disabilities to engage fully with their peers and educational materials.

Furthermore, the project empowers individuals with disabilities by equipping them with tools to express themselves more freely and interact with others more confidently. This empowerment not only enhances their quality of life but also promotes their independence and self-advocacy.

Additionally, the project aligns with the United Nations Sustainable Development Goal (SDG) of Quality Education by promoting inclusive educational practices and ensuring that individuals with disabilities have equal access to educational opportunities.

Lastly, by promoting communication accessibility and inclusivity, the project contributes to the broader goal of community integration for individuals with disabilities. It fosters a more inclusive and supportive community where individuals of all abilities can participate fully and contribute meaningfully to social and economic development.

In essence, the implementation of this project holds immense potential to positively impact the lives of individuals with verbal and hearing impairments, promote inclusive education, and foster greater community cohesion and integration.

The culmination of this project has resulted in significant advancements in addressing communication barriers for individuals with verbal and hearing impairments, specifically focusing on Indian Sign Language (ISL). Through the development of a comprehensive system for Sign-to-Text and Text-to-Sign Language conversion, powered by state-of-the-art technologies like MediaPipe, LSTM, and TensorFlow, several key learnings have emerged:

- Successful creation and implementation of a user-friendly web application facilitating bidirectional sign language interpretation.

- Achievement of high precision and reliability in sign language detection and translation, ensuring effective communication accessibility.
- Improved understanding of the nuances and challenges involved in developing inclusive communication tools for individuals with disabilities.

4.2 Limitations and Challenges

While the project marks a significant milestone in enhancing communication accessibility, it also encountered certain limitations and challenges:

- Variability in sign language gestures across regions and communities may affect the system's universal applicability.
- Reliance on machine learning algorithms introduces the possibility of errors or misinterpretations, especially in complex sign language expressions.
- Accessibility barriers related to technology infrastructure and device compatibility may restrict the reach of the developed system in certain contexts.

4.3 Future Scope

Looking ahead, there are several avenues for future exploration and enhancement within the realm of sign language interpretation and communication accessibility:

- Continued refinement and optimization of machine learning algorithms to enhance accuracy and adaptability to diverse sign language variations.
- Integration of additional features such as real-time feedback mechanisms to improve user experience and effectiveness.
- Expansion of the system's capabilities to support multiple sign languages and dialects, catering to diverse linguistic and cultural needs.
- Collaboration with stakeholders from various disciplines to address broader issues of accessibility and inclusion for individuals with disabilities.

References

[1] J. Peguda, V. S. S. Santosh, Y. Vijayalata, A. D. R. N and V. Mounish, "Speech to Sign Language Translation for Indian Languages," 2022 8th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2022, pp. 1131-1135, doi: 10.1109/ICACCS54159.2022.9784996.

[2] M. S. Nair, A. P. Nimitha and S. M. Idicula, "Conversion of Malayalam text to Indian sign language using synthetic animation," 2016 International Conference on Next Generation Intelligent Systems (ICNGIS), Kottayam, India, 2016, pp. 1-4, doi: 10.1109/ICNGIS.2016.7854002.

[3] M. Kavitha, A. Chatterjee, S. Shrivastava and G. Sarkar, "Formation of Text from Indian Sign Language using Convolutional Neural Networks," 2022 International Conference on Innovative Computing, Intelligent Communication and Smart Electrical Systems (ICSES), Chennai, India, 2022, pp. 1-5, doi: 10.1109/ICSES55317.2022.9914214.

[4] S. R, S. R. Hegde, C. K, A. Priyesh, A. S. Manjunath and B. N. Arunakumari, "Indian Sign Language to Speech Conversion Using Convolutional Neural Network," 2022 IEEE 2nd Mysore Sub Section International Conference (MysuruCon), Mysuru, India, 2022, pp. 1-5, doi: 10.1109/MysuruCon55714.2022.9972574.

[5] G. Sabaresh and A. Karthi, "Design and implementation of a sign-to-speech/text system for deaf and dumb people," 2017 IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI), Chennai, India, 2017, pp. 1840-1844, doi: 10.1109/ICPCSI.2017.8392033.

[6] S. Pal, S. Ruhella, S. Sinha and A. Goel, "Sign Language to Text Classification using One-Shot Learning," 2023 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS), Erode, India, 2023, pp. 833-837, doi: 10.1109/ICSCDS56580.2023.10104608.

[7] M. Ahmed, M. Idrees, Z. ul Abideen, R. Mumtaz and S. Khalique, "Deaf talk using 3D animated sign language: A sign language interpreter using Microsoft's kinect v2," 2016 SAI Computing Conference (SAI), London, UK, 2016, pp. 330-335, doi: 10.1109/SAI.2016.755600.

A. Community Profile

Community Name: Dr. S.R. Chandrasekhar Institute of Speech and Hearing

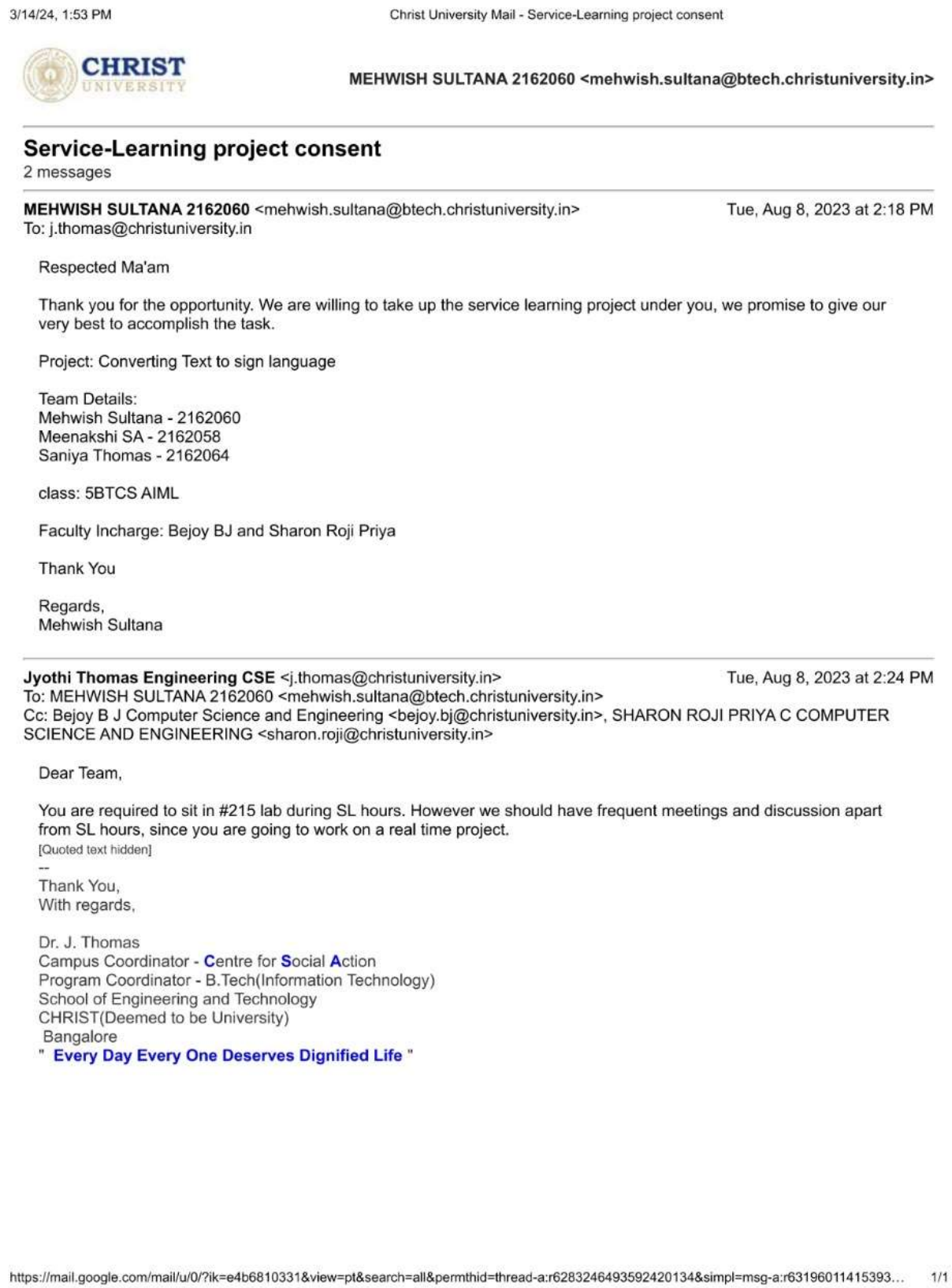
Location: Bangalore, Karnataka, India

The Bangalore Speech and Hearing Trust (BSHT) stands as a beacon of compassion and expertise, dedicated to serving individuals with speech and hearing disabilities since its establishment in 1978. Under the visionary leadership of Dr. S.R. Chandrasekhar, BSHT has evolved into a comprehensive organization offering a wide array of services aimed at rehabilitation, education, and research. Through its four constituent units, including the S.R. Chandrasekhar Institute of Speech and Hearing, the College of Speech and Hearing, Sunaad School for the Hearing Impaired, and the SRC BNG Research Center, BSHT addresses the diverse needs of its community with unwavering commitment and professionalism.

At the heart of BSHT's mission lies a deep-seated dedication to enhancing the quality of life for individuals with speech and hearing disabilities. The organization's clinical and rehabilitation services provided through the S.R. Chandrasekhar Institute of Speech and Hearing offer vital support, including hearing evaluations, therapy for speech and language disorders, and specialized rehabilitation programs. Additionally, the College of Speech and Hearing nurtures the next generation of professionals in the field through rigorous academic programs and research opportunities, ensuring a sustainable impact on the community's well-being.

BSHT's impact extends far beyond its immediate services, fostering a culture of inclusivity and empowerment for individuals with disabilities. Through innovative initiatives such as integrating technology into education at Sunaad School for the Hearing Impaired and conducting cutting-edge research at the SRC BNG Research Center, BSHT continues to push boundaries and set new standards in the field. With a steadfast commitment to excellence and a relentless pursuit of its mission, BSHT remains a cornerstone of support and advocacy for the hearing impaired community in Bangalore and beyond, embodying the spirit of compassion and innovation.

B. Confirmation Letter:



3/14/24, 1:53 PM Christ University Mail - Service-Learning project consent

CHRIST UNIVERSITY

MEHWISH SULTANA 2162060 <mehwish.sultana@btech.christuniversity.in>

Service-Learning project consent

2 messages

MEHWISH SULTANA 2162060 <mehwish.sultana@btech.christuniversity.in> Tue, Aug 8, 2023 at 2:18 PM
To: j.thomas@christuniversity.in

Respected Ma'am

Thank you for the opportunity. We are willing to take up the service learning project under you, we promise to give our very best to accomplish the task.

Project: Converting Text to sign language

Team Details:
Mehwish Sultana - 2162060
Meenakshi SA - 2162058
Saniya Thomas - 2162064

class: 5BTCS AIML

Faculty Incharge: Bejoy BJ and Sharon Roji Priya

Thank You

Regards,
Mehwish Sultana

Jyothi Thomas Engineering CSE <j.thomas@christuniversity.in> Tue, Aug 8, 2023 at 2:24 PM
To: MEHWISH SULTANA 2162060 <mehwish.sultana@btech.christuniversity.in>
Cc: Bejoy B J Computer Science and Engineering <bejoy.bj@christuniversity.in>, SHARON ROJI PRIYA C COMPUTER SCIENCE AND ENGINEERING <sharon.roji@christuniversity.in>

Dear Team,

You are required to sit in #215 lab during SL hours. However we should have frequent meetings and discussion apart from SL hours, since you are going to work on a real time project.
[Quoted text hidden]
--
Thank You,
With regards,

Dr. J. Thomas
Campus Coordinator - **C**entre for **S**ocial **A**ction
Program Coordinator - B.Tech(Information Technology)
School of Engineering and Technology
CHRIST(Deemed to be University)
Bangalore
" **Every Day Every One Deserves Dignified Life** "

https://mail.google.com/mail/u/0/?ik=e4b6810331&view=pt&search=all&permthid=thread-a:r6283246493592420134&simpl=msg-a:r63196011415393… 1/1

C. Project Completion Letter

CHRIST UNIVERSITY

MEHWISH SULTANA 2162060 <mehwish.sultana@btech.christuniversity.in>

Appreciation

1 message

drsrc priyankakalyan <drsrc.priyankakalyan@speechear.org> Thu, Mar 14, 2024 at 1:47 PM
To: "mehwish.sultana@btech.christuniversity.in" <mehwish.sultana@btech.christuniversity.in>

Dear Service Learning Team,

I hope this email finds you in good spirits.

I am writing to express our heartfelt gratitude for the exceptional work done by Mehwish Sultana - 2162060 , Saniya Thomas - 2162064, and Meenakshi SA - 2162058, students from Christ University, on the service learning project in collaboration with the Dr. S.R chandrasekhar institute of speech and hearing. Their dedication and commitment to this project have been truly commendable.

Throughout the duration of the project, the team has exhibited a high level of professionalism and enthusiasm. They have delivered expected results, which will help the students with verbal and hearing impairments.

We would also like to extend our sincere appreciation to Dr. Jyothi Thomas, Professor at Christ University, for her invaluable guidance and support in facilitating the development of this project.

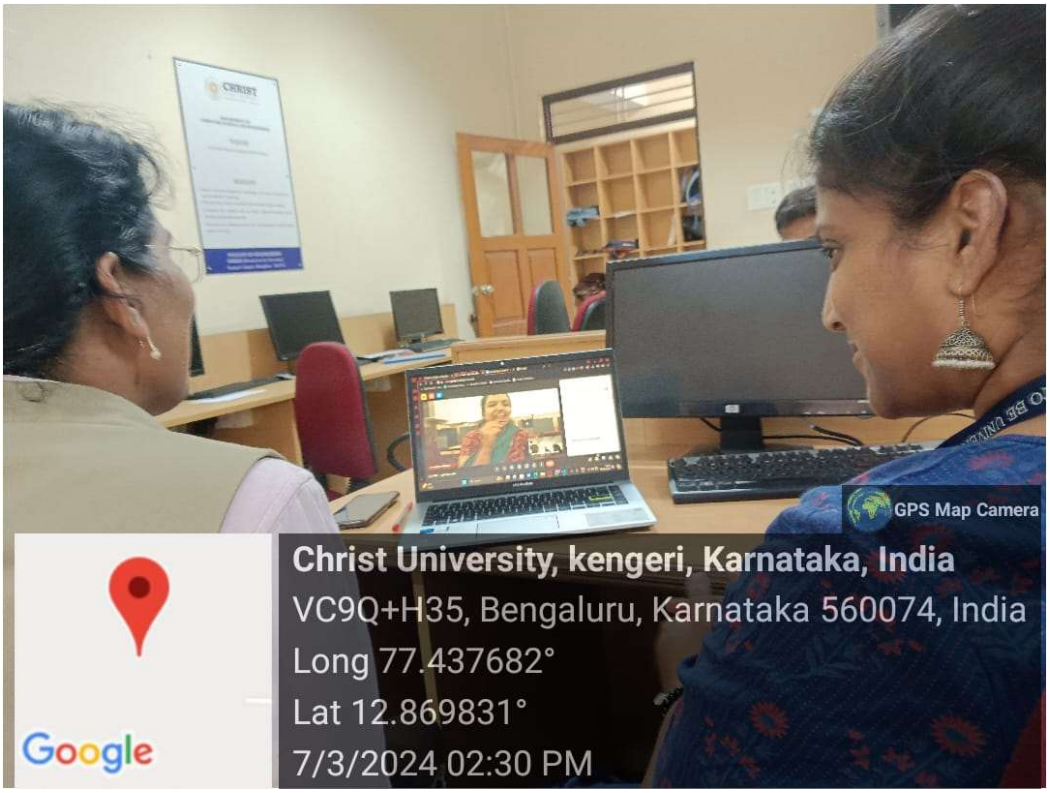
We acknowledge the efforts put forth by the entire team involved in this project, and we are grateful for the opportunity to collaborate with Christ University. We look forward to the possibility of future collaborations that will further advance our shared objectives.

Thank you once again for your dedication and hard work.

Warm regards,

Priyanka Kalyan
Sign language co-ordinator
Dr. S.R chandrasekhar institute of speech and hearing
9967426336

D. Relevant documents of meeting



E. Presentation Certificate:

State Institute for Transformation of Karnataka
(State Policy and Planning Commission)

CHRIST
(DEEMED TO BE UNIVERSITY)
BANGALORE · INDIA

CERTIFICATE

OF PARTICIPATION

This certificate is proudly presented to

Meenakshi SA

For securing Second place in Youth Sustainnovation Challenge 2024
conducted on 14th February 2024 at
CHRIST(Deemed to be University), Kengeri Campus

Dr Mary Anita E A
Associate Dean
SoET, CHRIST(Deemed to be University)

Prof M. V. Rajeev Gowda
Vice Chairman
State Institute for Transformation of Karnataka
(State Policy and Planning Commission)


CHRIST
(DEEMED TO BE UNIVERSITY)
BANGALORE - INDIA
GOVERNMENT OF KARNATAKA
State Institute for Transformation of Karnataka
(State Policy and Planning Commission)
CERTIFICATE
OF PARTICIPATION
This certificate is proudly presented to
Saniya Thomas
For your participation in Youth Sustainnovation Challenge 2024 on 14th
February 2024 at CHRIST(Deemed to be University), Kengeri Campus
Dr Mary Anita E A
Associate Dean
SoET, CHRIST(Deemed to be University)
Prof M. V. Rajeev Gowda
Vice Chairman
State Institute for Transformation of Karnataka
(State Policy and Planning Commission)