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HAND SIGN LANGUAGE RECOGNITION USING AUGMENTED REALITY & MACHINE LEARNING

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ABSTRACT

Effective communication is a cornerstone of human interaction, fostering societal cohesion and development. Throughout history, communication has evolved from primitive drawings to complex languages, shaping our society's fabric. However, amidst this progression, individuals with speech and hearing impairments have often faced significant challenges in communication. Despite constituting a minority, their needs are paramount and must not be overlooked. Recognizing the diverse classification of languages into verbal and non-verbal forms, it becomes evident that non-verbal languages play a crucial role, especially for Individuals with Hearing and Speech Impairments (IWSHI). These individuals rely on non-verbal communication methods to interact with the world around them, yet they often face barriers due to the lack of understanding and accessibility. To address this challenge, the HSLR app serves as a transformative tool, enabling IWSHI to communicate confidently. Leveraging technologies such as Augmented Reality (AR) and Machine Learning (ML), our app facilitates real-time recognition of hand signs, providing instantaneous translations for seamless communication. Additionally, the integration of AR technology enhances the user experience, offering immersive and interactive sign-language communication platforms. The MediaPipe model used in real-time achieves high accuracy in recognizing sign language due to the ample dataset we provided.

KEY WORDS: *Hand Sign Language Recognition (HSLR), Augmented Reality (AR), Machine Learning (ML), American Sign Language (ASL), Computer Vision, MediaPipe*

1. INTRODUCTION

People with Speech and also Hearing Disabilities run into considerable interaction obstacles, especially those that do not recognize indication language or motions. This absence of understanding typically brings about obstacles to reliable communication, preventing social incorporation as well as engagement. Creating an option to help with smooth interaction in between IWSHI and also people without hearing problems positions a significant difficulty. In reaction to this immediate requirement the Hand Sign Language Recognition making use of AR-ML (HSLR) job arised as a groundbreaking effort to get over these interaction obstacles.

At the heart of the HSLR job exists a dedication to leveraging sophisticated innovations to deal with the distinct demands of the hearing-impaired neighbourhood. By using Hand Sign Language Recognition (HSLR) modern technology the job uses advanced computer system vision as well as artificial intelligence methods to spot together with acknowledge indicator motions in real-time. With meticulous assimilation of modern indicator discovery abilities, the system makes sure specific acknowledgment, introducing reliable interaction in between IWSHI plus their equivalents.

Additionally influenced by the symbiotic mix in between Augmented Reality (AR) as well as Machine Learning (ML) the HSLR job intends to revamp the landscape of indicator language interaction. Past plain acknowledgment, the system provides real-time comments empowering customers to refine their indication language abilities with self-confidence as well as performance. The smooth assimilation of AR innovation boosts the translation as well as finding out procedure, promoting an immersive coupled with appealing setting for reliable interaction. Fundamentally the HSLR job provides an appealing service to link the interaction void, fostering inclusivity, as well as encouraging individuals to interact with complete confidence via indication language.

2. LITERATURE SURVEY

The examination of Hand Sign Language Recognition through AR-ML (HSLR) in literary works commences with an exploration of gesture-based interactions crucial for individuals with speech and hearing impairments to communicate effectively in everyday life. These interactions predominantly rely on coordinated hand movements, facial expressions, and body language, collectively forming visual languages. Despite the existence of over 300 distinct sign languages globally, only a

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small fraction of individuals are proficient in any of them. This limited proficiency poses challenges for individuals with special needs to easily communicate with others. Hand Sign Language Recognition (HSLR) technology addresses this challenge by enabling communication without the necessity of knowledge of authorized languages, translating movements into spoken languages such as English. In 2022, a study on Sign Language Recognition and Response via Virtual Reality introduced an innovative approach using virtual reality with a Leap Motion controller. While it achieved success in cross-platform development and advanced graphics potential, complexity in establishing basic grammatical structures emerged as a limitation. In 2021, an Efficient Approach for Interpretation of Indian Sign Language utilizing Machine Learning focused on gesture-to-text conversion but fell short in real-time interaction. The same year witnessed the notable Sign Language Detection from Hand Gesture Images using Deep Multi-layered Convolution Neural Network, achieving a rigorous test accuracy of 99.89% despite lacking real-time capabilities. In 2020, SIGN LANGUAGE RECOGNITION USING TEMPLATE MATCHING TECHNIQUE presented a camera-based system but encountered sustainability challenges for real-time conversations. In 2019, A Sign Language Translator Application with Augmented Reality employing Text and Image Recognition and On the development of a web extension for text verification on Google Chrome explored practical applications. SignCol: Open-Source Software for Collecting Sign Language Gestures described an open-source software while Sign Languages to Speech Conversion Prototype using the SVM Classifier introduced a glove model distinguishing ASL and ISL. In 2017, Hand Gesture Recognition Using Machine Learning and the Myo Armband highlighted innovative techniques with the Myo armband along with Machine Learning Techniques for Indian Sign Language Recognition focused on classification. The proposed system in Proposed System for Sign Language Recognition emphasized responsiveness and robustness but faced limitations in response time and lack of ISL support. Overall, the literature survey underscores a rich array of research exploring diverse approaches, technologies, and applications within the realm of Hand Sign Language Recognition using AR-ML.

3. METHODOLOGY

Directory entails a thorough method to attending to the interaction obstacles dealt with by people with speech and also hearing problems with Hand Sign Language Recognition (HSLR). The initial step included putting together a varied dataset making up different words as well as alphanumeric personalities in American Sign Language (ASL). This dataset functioned as the structure for educating our version to acknowledge and also analyze indicator language motions properly. Furthermore, to make certain the efficiency of our version, we utilized a pre-trained design to recognize crucial things such as Fingers, Palm, Hand, and also Face important for exact hand motion acknowledgment. Ultimately, we set out on the version training stage making use of an Object Detection Algorithm customized especially for indicator language analysis. Leveraging the set up dataset our version discovered to connect various hand motions with their equivalent linguistic significances. This training procedure targeted to improve the design's precision coupled with performance in acknowledging ASL motions in real-time situations.

Parallel with version growth, information purchase played an essential duty in making certain the system's efficiency. Utilizing Python plus OpenCV we recorded photos in real-time making use of a mobile phone's electronic camera, creating the basis of our indicator language dataset. Each alphabet in ASL was stood for by a collection of photos, recorded at normal periods to include a variety of hand motions. These photos were carefully arranged along with saved preparing the succeeding version training coupled with examination.

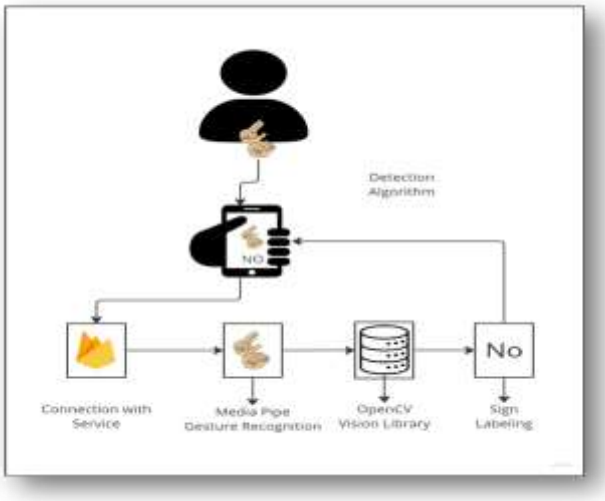

Fig 1. Flowchart of HSLR AR-ML

n the real-time application situation individuals start the Hand Sign Language Recognition utilizing our mobile application created in Kotlin. The system catches the individual's hand motions with the tool's electronic camera, using Pose Estimation to identify finger exposure, bends coupled with joints for exact acknowledgment. The design after that contrasts these real-time motions with the pre-labeled dataset, offering precise translations of the indicator language right into message. The suggested system's formula makes certain smooth assimilation of things discovery, hand motion acknowledgment plus translation supplying an user-friendly coupled with straightforward mobile application user interface that encourages people with speech as well as hearing disabilities to interact successfully in real-time. Extensive screening continuous customer comments devices as well as release with incorporated AR-ML innovation even more improvements the system's strength and also access adding to bridging the interaction void for people with speech along with hearing disabilities.

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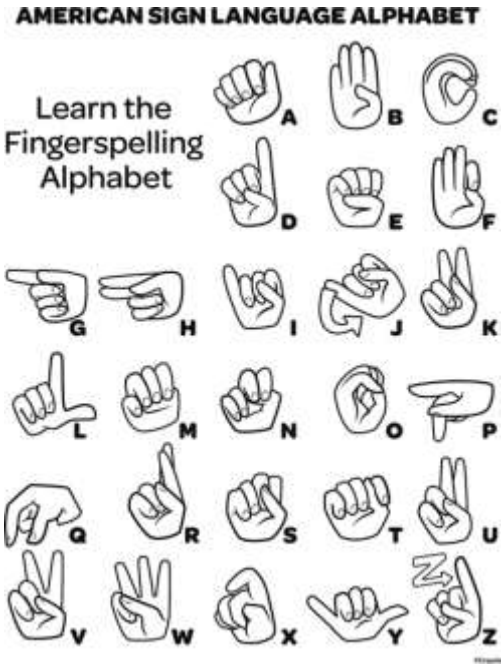

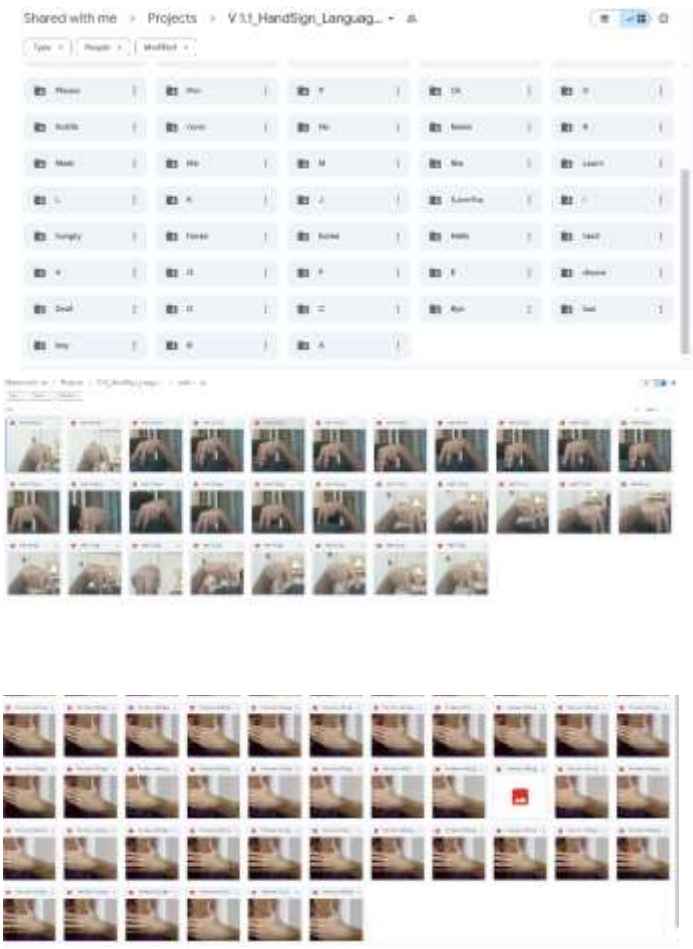

application that can check the hand motions done by IWSHI individuals so that offer translation of their motions. For this we made use of opencv for recognizing Hand and also Fingers.

Algorithm: In the beginning, we constructed a Dataset including numerous words and also alphanumeric personalities in Sign Language. After that we found an Mediapipe Algorithm is ideal to educate the design that can determine the items in this instance Fingers Palm Hand and also Face. Then we trained a Model based upon that Algorithm with a dataset ideal for determining items. After this was done, we trained the Model based upon comparable Object Detection Algorithm, that can recognize the indicator language. Examination the Model based upon various real-time Hand Gestures was performed. In real-time, feed the fractional hand includes right into the indicator language acknowledgment version. The version must forecast the indication being carried out and also equate it right into message outcome. Then, we established a user-friendly mobile application user interface that check or discover indicator from the tool's cam as well as shows the acknowledged indicator language outcome in real-time. We carefully evaluated the algorithm under different problems consisting of various hand alignments, signers, lights, etc.

Methods Used: SSD (Single Shot Detection) MOBILE INTERNET, CNN, MediaPipe.

4.1 Execution Results

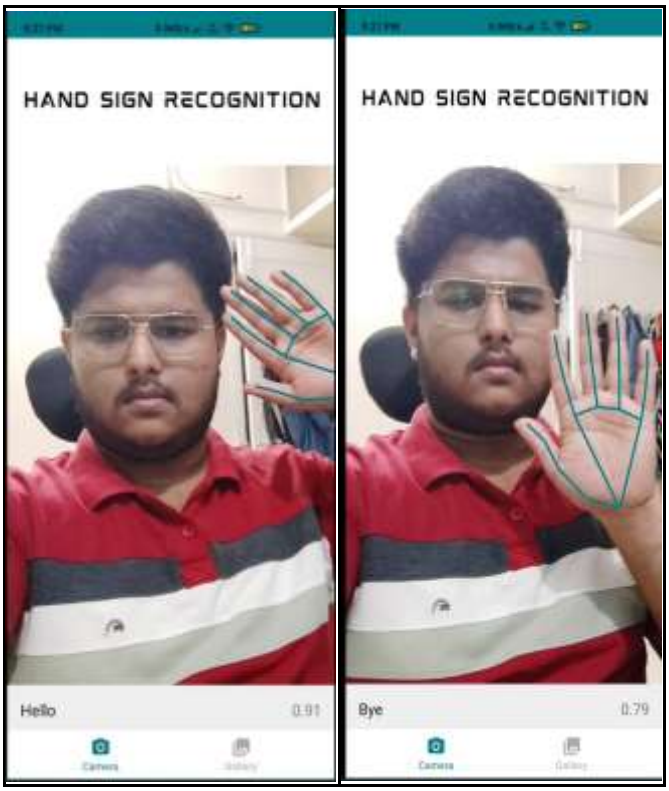

Fig 4.1- Execution (Hello Gesture) **Fig 4.2- Execution (Bye)**

4. IMPLEMENTATION

Our Job intends to link the interaction space in between normal individuals and the individuals with speech and hearing disabilities. To do this we are intended to produce a live

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Fig 4.3- Execution (Thank-You) Fig 4.4- Execution (Learn)

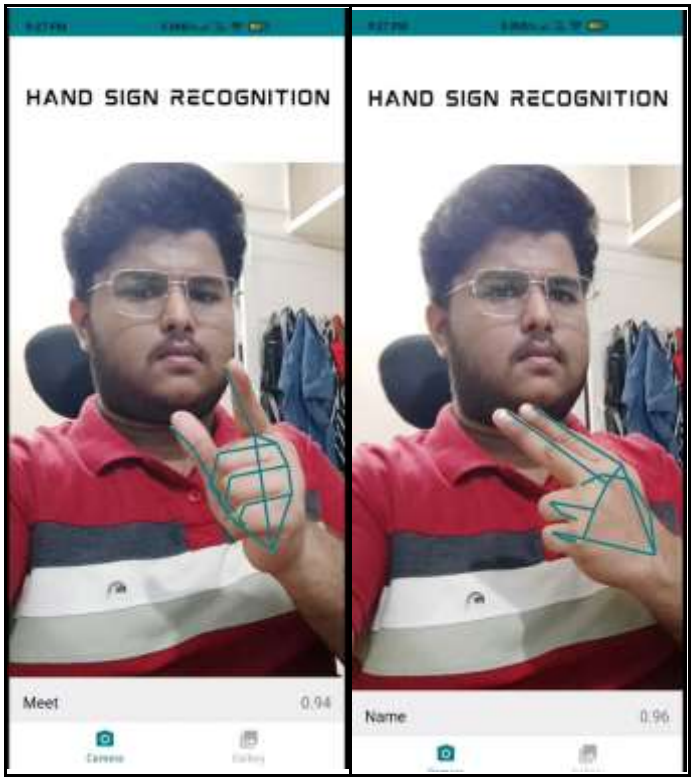

Fig 4.5- Execution (Meet) Fig 4.6- Execution (Name)

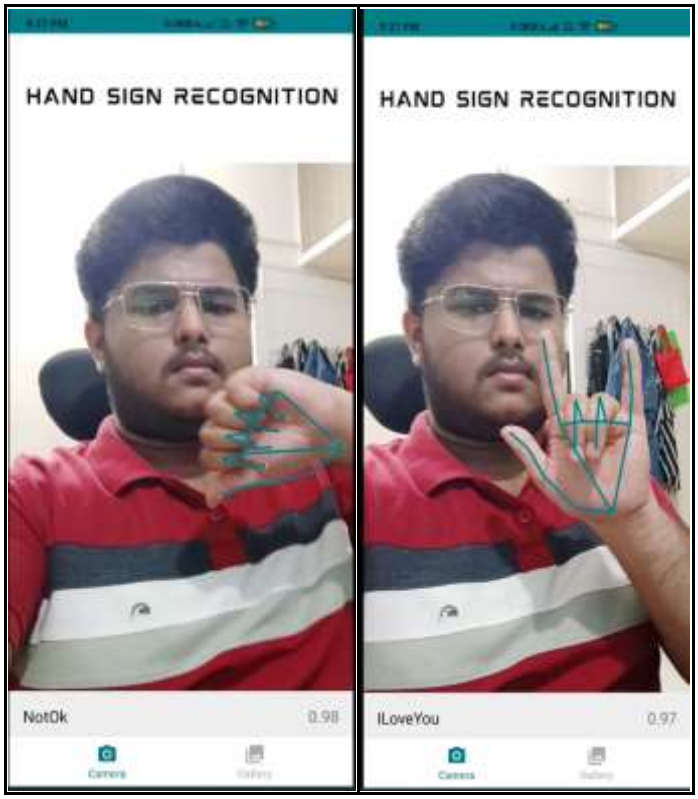

Fig 4.7- Execution (Not Ok) Fig 4.8- Execution (Love you)

5. CONCLUSION

The development of a real-time sign language detection system using AR-ML holds the promise of transforming communication for individuals with speech and hearing impairments. By seamlessly integrating object detection with real-time translation, this cutting-edge technology enables the immediate recognition and interpretation of sign language motions, promoting inclusivity and access. With a robust data collection, user-friendly mobile application, and ongoing optimization, it has the potential to revolutionize the lives of its users by providing a means for efficient and instant communication, ultimately fostering understanding and bridging communication barriers.

6. FUTURE SCOPE

In the future, Hand Sign Language Recognition using AR-ML can evolve and expand its impact by broadening its language recognition to include various sign languages, developing mobile applications for broader accessibility, enhancing features to cater to diverse user needs, integrating robust feedback systems, promoting educational use, compatibility with AR-VR equipment, fostering collaborations with relevant organizations, and advancing research for more accurate Hand Sign Language Recognition. This project's potential extends beyond addressing communication barriers, promising inclusivity, education, accessibility, and empowerment for individuals with speech and hearing disabilities.

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REFERENCES

1. *M Aarthi and P Vijayalakshmi, "Sign Language to Speech Conversion", Fifth International Conference on Recent Trends In Information Technology, 2016.*
2. *V. N. T. Truong, C. K. Yang and Q. V. Tran, "A translator for American sign language to text and speech", 2016 IEEE 5th Global Conference on Consumer Electronics, pp. 1-2, 2016.*
3. *V. Anuja and Bindu V Nair, "A Review on Indian Sign Language Recognition", International Journal of computer Applications, pp. 33-38, July 2013.*
4. *S. Kumara Krishnan, V. Prasanna Venkatesan, V.Suriya Ganesh, D.P.Sai Prassanna, K.Sundara Skandan, "Sign Language Recognition and Response via Virtual Reality", International Journal for Multidisciplinary Research, April 2023.*
5. *"An Efficient Approach for Interpretation of Indian Sign Language using Machine Learning" Authors: Dhivyasri S, Krishnaa Hari K B, Akash M, Sona M, Divyapriya S, Dr. Krishnaveni V Affiliations: Department of ECE, PSG College of Technology, Coimbatore, India Conference: 2021 3rd International Conference on Signal Processing and Communication (ICPSC), 2021.*
6. *Soma Shrenika, Myneni Madhu Bala, "SIGN LANGUAGE RECOGNITION USING TEMPLATE MATCHING TECHNIQUE", University College London, July 05,2020.*
7. *Manandhar, S., Bajracharya, S., Karki, S., & Jha, A. K. (n.d.). SCITECH Nepal, Vol. 14, No. 1 "Hand Gesture Vocalizer for Dumb and Deaf People"*
8. *Serai, D., Dokare, I., Salian, S., Ganorkar, P., & Suresh, A. (2017). Proposed system for " sign language recognition". In 2017 International Conference on Computation of Power, Energy, Information and Communication (ICCPEIC) (pp. 1870-1873). IEEE.*
9. *Dutta, K. K., & Bellary, S. A. S. (2017)." Machine learning techniques for Indian sign language recognition". In International Conference on Current Trends in Computer, Electrical, Electronics and Communication (ICCTCEEC-2017) (pp. 1-6).*
10. *Bhadra, R. and Kar, S., 2021. Sign Language Detection from Hand Gesture Images using Deep Multi-layered Convolution Neural Network. In 2021 IEEE Second International Conference on Control, Measurement and Instrumentation (CMI), India.*
11. *Chandra, M. M., Rajkumar, S., & Kumar, L. S. (2019). Sign Languages to Speech Conversion Prototype using the SVM Classifier. In 2019 2nd International Conference on Communication and Electronics Systems (ICCES) (pp. 1371-1375). IEEE.*
12. *Srivastava, S., Gangwar, A., Mishra, R., & Singh, S. (2021). "Sign Language Recognition System using TensorFlow Object Detection API."*
13. *Sameer Metkar, Shubham More, Durgesh Kolhe, Omkar Mandavkar, Prof. Aarti Abhyankar "Sign Language Recognition using Machine Learning" (IJSREM) April 2023*