**Haldia Institute of Technology**

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Project Title:

***Machine Learning based Sign Language Recognition***

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**Abstract:** Sign language recognition software that uses camera hardware will emerge as a game changer. This device is a fresh way to bridge the communication gap between the deaf and hearing communities. The software translates sign language gestures collected by a webcam using computer vision algorithms, transforming them into text or speech. It allows for real-time, accurate recognition, promoting seamless interaction and inclusivity. This development represents a huge step towards a more inclusive and equitable society by improving accessibility, education, and social inclusion for the deaf and hard of hearing.

***Introduction***

Communication is an essential aspect of human existence as it serves as a foundation for our interactions, relationships, and understanding of the world. Unfortunately, for millions of people worldwide who are deaf or hard of hearing, spoken language may not always be an accessible means of expression or comprehension. However, technology has played a critical role in breaking down barriers to promote inclusivity and equal opportunities for everyone. Sign language, a rich and expressive communication form used by the deaf community, has presented a unique challenge when it comes to bridging the gap between the hearing-impaired and the broader society.

Through this software, we will witness remarkable strides in the development of sign language recognition, powered by advances in computer vision and machine learning. By harnessing the capabilities of OpenCV and MediaPipe, these innovative applications will be able to detect and interpret hand gestures, effectively converting sign language into text or speech. This breakthrough technology will have the potential to revolutionize the lives of the deaf and hard of hearing, as well as improve communication in various sectors such as education, healthcare, and accessibility.

**Sign Language Recognition and Computer Vision**

Sign language, with its complex and nuanced hand movements, has traditionally been a challenge for automated recognition systems. However, the advent of computer vision techniques has paved the way for significant progress in this domain. OpenCV, an open-source computer vision library, provides a robust framework for processing and analysing image and video data. Its extensive suite of tools allows for the extraction of meaningful features from visual input, making it a cornerstone of sign language recognition software development.

MediaPipe, on the other hand, is a versatile framework that specializes in hand and pose tracking. Leveraging state-of-the-art machine learning models, MediaPipe can precisely locate and track the position and orientation of the hands within a video stream. This capability is paramount in sign language recognition, as it forms the basis for understanding the intricate movements and configurations that constitute sign language gestures.

**The Significance of Sign Language Recognition Software**

The creation of sign language recognition software utilizing OpenCV and MediaPipe is a significant breakthrough in overcoming communication barriers. This application utilizes computer vision to interpret and translate sign language into real-time text or audible speech. This accomplishment has far-reaching implications for various crucial areas of society.

**Accessibility**: Sign language recognition software fosters greater accessibility for the deaf and hard of hearing, enabling them to communicate more easily with the hearing population. This enhanced accessibility extends to essential services, public spaces, and digital platforms.

**Education**: In the realm of education, these technologies have the potential to revolutionize the learning experience for deaf students. Teachers and students alike can benefit from real-time translation of sign language into written or spoken language, facilitating smoother classroom interactions.

**Healthcare**: Effective communication is a fundamental aspect of healthcare. Sign language recognition software can assist medical professionals in better understanding their patients' needs, symptoms, and concerns, ultimately leading to improved healthcare outcomes.

**Inclusivity**: The use of this technology promotes inclusivity and reduces stigmatization of the deaf and hard-of-hearing community, empowering individuals to participate fully in social and professional contexts.

**Research and Development**: Beyond immediate practical applications, sign language recognition software opens avenues for research in linguistics, cognitive science, and human-computer interaction, offering insights into the richness of sign languages and their cultural significance.

In conclusion, sign language recognition software, driven by the capabilities of OpenCV and MediaPipe, represents a groundbreaking technological advancement. It holds the promise of enhancing communication, accessibility, and inclusivity for the deaf and hard-of-hearing community while offering numerous practical applications across various sectors. As we delve deeper into the possibilities of this transformative technology, it becomes increasingly evident that it has the potential to redefine the way we perceive and interact with the world of sign language.

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