SignPal: An AI-Driven Sign Language Recognition System for Teaching Younger Children Sign Language

Problem Statement:

Communication is key for personal and social development. However, it remains a challenge for those with hearing impairments. Sign language is the most common way in which deaf or hard of hearing individuals communicate, although it can be challenging for younger children to learn sign language. Traditional methods of teaching sign language can be ineffective for younger children as they lack engagement and accessibility.

To address this problem, we are planning to design a software system that converts an inputted video of sign language gestures into digital letters, the goal of this project is to make learning sign language more accessible and engaging for younger children. To do this we are going to use a range of machine learning algorithms and techniques that can recognise certain gestures and convert them into text-based representations. This project aims to make learning sign language simpler and more efficient for younger children.

Our project will tackle a few limitations in the field of sign language recognition and conversion such as the lack of accessibility of resources for younger learners, the inefficiency of traditional methods of learning and the lack of engagement of current learning materials.

Problem Motivation:

The initiative of our project grew as we saw the critical need for more effective systems in the field of sign language learning especially for younger children with no experience of the language. The motivation for this project also came from the challenges faced by the younger children learning sign language such as the accessibility and engagement of the teaching materials as explained above in the problem statement.

During the past few years, the demand for digital learning has grown significantly providing more of a reason to pursue this project as this will improve accessibility as there'll no longer be a need for in person instructors which can greatly limit accessibility for some children.

This project will not only benefit the younger individuals learning the language as it can be used by teachers in classrooms to aid with the teaching, but it can also be used at home by parents to provide a means of communication between parents and their children improving family's quality of life as communication will become easier.

Project Statement:

Project Title:

SignPal: An AI-Driven Sign Language Recognition System for Teaching Younger Children Sign Language

Project Overview:

SignPal is an innovative software engineering project that aims to develop a sign language learning system to aid younger children in learning sign language easily and effectively. The project will use machine learning algorithms and computer vision techniques to create a user-friendly system that will teach young children how to recognise and perform basic sign language gestures and a few common words.

Project Objectives:

1. To design a machine learning based sign language recognition model
2. To create an interactive system for young children that increases their engagement
3. Review and evaluate the system we have created

Project Scope:

In this area will be explained how the project will be carried out and how we hope to reach our goal as a team:

1. **Project Ideation, Solution Design:** Explain the main idea of the project and what the aim of it is and then go on to design a solution that will allow us to achieve our project goal by creating requirements that will be implemented into the system.
2. **Baseline Development**: This is where we will start our project by developing a baseline model for how our system will work I.e., preparing initial dataset and evaluating it. This mission will determine our benchmark and we'll compare our final system to this to see the performance improvement.
3. **Iterative Development:** In this mission we touch on different machine learning models e.g., neural networks which help recognise patterns of hand movement etc., furthermore we'll explore parameter tuning methods that'll help improve predictive performance of our system such as the common grid search method where hyperparameters are defined and all possible combinations are evaluated, and the highest accuracy is selected as the most optimal for the model.
4. **Solution Testing:** Once the iterative development of our system is complete, we'll then test our model extensively according to a specific plan which will include case studies that'll perform certain tests and then report the results back to our back, this

mission aims to identify the flaws in our system so that further improvements can be made enhancing the effectiveness of the overall system.

5. **Additional Data, Mathematical Review:** These missions aim to further enhance the effectiveness of our system by integrating in an additional dataset to the iterative development stage that can convert common phrases for younger children to learn once they're proficient in simple gestures. A mathematical review will provide us with a formula for the machine learning algorithms used in the project with justified reasons and references for solutions.
6. **Solution Review:** Here we will review our solution by comparing it to other solutions in the field in a fair way that ensures we are not biased towards our system and that we point out areas that we may be able to improve on in the future.
7. **Project Management:** The role of the project manager will be to manage plans and schedules for team members to ensure each member is assigned equal missions and in a way that maximises efficiency for example assigning certain missions to the person with the best knowledge of that area to improve the overall performance of the system. It is important to also monitor progress throughout the project so that changes can be made if needed.

Conclusion:

In conclusion, our project proposes a novel approach to using sign language recognition systems to teach young children sign language. By leveraging the power of machine learning and natural language processing, the project aims to create an innovative learning model that can help children with hearing impairments or those who want to learn sign language to communicate more effectively. The project's focus on developing a robust and accurate sign language recognition model that allows for more engagement for young learners represents a unique and valuable contribution to the field. Overall, the project's plan and approach have been carefully designed to address a vital need and have the potential to make a significant impact in improving the lives of individuals with hearing impairments.