Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	05 November 2023
Team ID	Team-591587
Project Name	ASL- Alphabet Image Recognition
Maximum Marks	4 Marks

Technical Architecture:

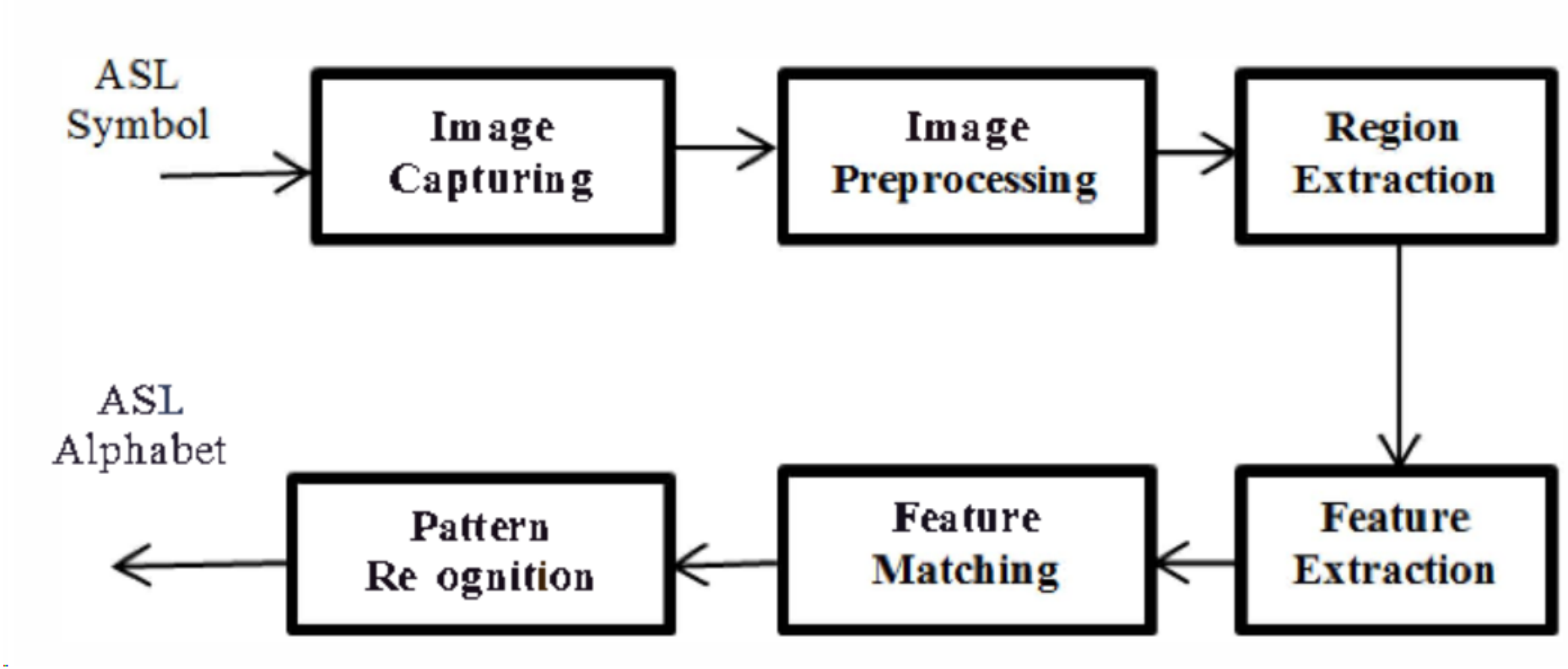

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	Data Collection	Gathering images of ASL alphabetic signs	Cameras, Image Datasets
2.	Preprocessing	Cleaning, resizing, and normalizing images	OpenCV, Image Processing Libraries
3.	Feature Extraction	Identifying key features in the images	Convolutional Neural Networks (CNNs), Feature Detectors

4.	Model Training	Training the recognition model	Deep Learning Frameworks (TensorFlow, PyTorch)
5.	Testing & Validation	Evaluating the model's accuracy	Validation Sets, Metrics (Accuracy, Precision, Recall)
6.	Deployment	Implementing the model for real-time recognition	APIs, Web/App Integration
7.	Augmentation	Increasing dataset diversity through image manipulation	Augmentation Libraries (imgaug, Albumentations)
8.	Hyperparameter Tuning	Optimizing model performance	Grid Search, Random Search, Hyperopt
9.	Transfer Learning	Leveraging pre-trained models for feature extraction	Pre-trained CNNs (VGG, ResNet, MobileNet)
10.	Real-time Detection	Implementing real-time recognition	OpenCV for real-time video processing, Optimized Inference Techniques

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Numerical sequence to categorize or list the characteristics.	An ASL alphabetic image recognition application can identify and interpret hand gestures representing American Sign Language alphabets, including 26 English letters, for translation.	Machine learning algorithms, deep learning models, and computer vision techniques are used in applications to accurately recognize and interpret ASL hand signs, utilizing various platforms and user interfaces.

2.	A sequential number to track or list the characteristics.	The application's core relies on a diverse database of hand signs for each ASL letter, covering various hand shapes, orientations, and movements for robustness and accuracy.	The application aims to improve accessibility by incorporating real-time translation of ASL gestures, Natural Language Processing (NLP) technologies, and integration with other assistive technologies or devices.
3.	A unique identifier for the listed characteristics.	The application's usability relies on its accuracy and performance, which can be maintained through continuous improvement and optimization techniques like transfer learning and data augmentation.	User-friendly interfaces, including mobile devices, web platforms, and specialized hardware, significantly influence application adoption. They should provide clear instructions, feedback, and accessibility features for different abilities.

4.	A numerical indicator for tracking purposes.	The application's reliability relies on its ability to handle diverse environmental conditions, including lighting, backgrounds, and hand orientations, to accurately recognize ASL gestures.	The application requires continuous updates and maintenance to improve accuracy, add new signs, and enhance performance. Implementing a feedback mechanism helps maintain up-to-dateness with evolving ASL sign language patterns.
5.	A sequential identifier for organization.	Scalability is crucial for applications to accommodate a growing user base and technological advancements, handling increased data loads, user requests, and potential integrations with other systems or	Cloud-based solutions and distributed computing enable efficient resource scaling, enabling applications to handle increased user traffic and data volumes, while containerization

		languages.	technologies facilitate seamless deployment across platforms.