

A Project Report on  
**signGuru (An education portal for Sign Language)**

Submitted in partial fulfillment of the requirements for the award  
of the degree of

**Bachelor of Engineering**

in

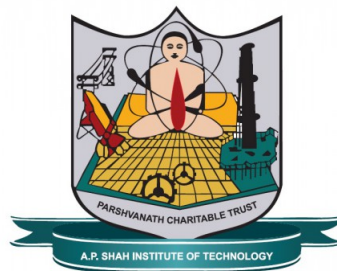
**Computer Engineering**

by

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**Shrenik Jangada(19202003)**  
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Under the Guidance of

**Prof. J.D Gupta**



**Department of Computer Engineering**

**NBA Accredited**

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UNIVERSITY OF MUMBAI

**Academic Year 2021-2022**

## Approval Sheet

This Project Report entitled “*signGuru (An education portal for Sign Language)*” Submitted by “*Atharva Dumbre*”(18102009), “*Shrenik Jangada*”(19202003), “*Shreyas Gosavi*”(18102024) is approved for the partial fulfillment of the requirement for the award of the degree of *Bachelor of Engineering* in *Computer Engineering* from *University of Mumbai*.

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Place: A.P. Shah Institute of Technology, Thane  
Date:

## CERTIFICATE

This is to certify that the project entitled “*signGuru (An education portal for Sign Language)*” submitted by “*Atharva Dumbre*”(18102009), “*Shrenik Jangada*”(19202003), “*Shreyas Gosavi*”(18102024) for the partial fulfillment of the requirement for award of a degree *Bachelor of Engineering* in *Computer Engineering*, to the University of Mumbai, is a bonafide work carried out during academic year 2021-2022.

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## Acknowledgement

We have great pleasure in presenting the report on **signGuru (An education portal for Sign Language)** We take this opportunity to express our sincere thanks towards our guide **Prof. J.D Gupta** & Co-Guide **Co-Guide Name** Department of Computer Engineering, APSIT thane for providing the technical guidelines and suggestions regarding line of work. We would like to express our gratitude towards his constant encouragement, support and guidance through the development of project.

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## Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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(Signature)

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(Atharva Dumbre and 18102009)  
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Date:

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Project Concept</b>	<b>2</b>
2.1	Abstract . . . . .	2
2.2	Objectives . . . . .	2
2.3	Literature Review . . . . .	2
2.4	Problem Definition . . . . .	3
2.5	Scope . . . . .	3
2.6	Technology Stack . . . . .	4
2.7	Benefits For Environment And Society . . . . .	4
<b>3</b>	<b>Project Design</b>	<b>5</b>
3.1	Proposed System . . . . .	5
3.2	Design(Flow Of Modules) . . . . .	5
3.3	Class Diagram . . . . .	6
3.4	Modules . . . . .	7
3.4.1	Module 1-Data Acquisition . . . . .	7
3.4.2	Module 2- Image Pre-processing . . . . .	7
3.4.3	Module 3- Developing CNN model . . . . .	7
3.4.4	Module 4 - Optimization of Model . . . . .	7
3.4.5	Module 5 - Acquiring acceptable accuracy . . . . .	7
3.4.6	Module 6 - Saving the best model . . . . .	8
3.4.7	Module 7 - Model Deployment . . . . .	8
3.5	References . . . . .	8
<b>4</b>	<b>Planning for next semester</b>	<b>9</b>

# Chapter 1

## Introduction

Signed language is a natural, full-fledged language in visual-spatial modality. It has all linguistic features (from phonology to syntax) as found in spoken language. Sign language is a language that uses hands instead of words. It relies on different signs to express thoughts and ideas. The deaf community has used it as their primary form of communication for quite some time now. Moreover, it has been developed into a fully developed language with its own grammar, syntax, and vocabulary. There are many challenges that come with being deaf, including limited access to education. We are here to make learning sign language easy and accessible to everyone, everywhere.

Sign Language is developed as a language to meet the need of the Deaf to communicate with each other. According to WHO (2018) data, the prevalence of hearing impairment (HI) in India is around 6.3 percent (63 million people suffering from significant auditory loss). The estimated prevalence of adult-onset deafness in India is 7.6 percent and childhood-onset deafness is 2 percent. To address the needs of deaf and mute community our team is introducing “signGuru” , it is an education portal specially designed to arm normal people with the knowledge of sign language enabling them to converse with deaf and mute people with relative ease.

# Chapter 2

## Project Concept

### 2.1 Abstract

In this sign language recognition project, we create a sign detector, which detects numbers from 1 to 10 that can very easily be extended to cover a vast multitude of other signs and hand gestures including the alphabets. An end-to-end Deep learning project using convolution neural networks and a website hosted on cloud servers with user authentication services, lesson history tracking, learning modules and paths will be included in front end along with quizzes and a final exam to validate the skills acquired during the learning process will be designed as part of our project.

Our project proposes the recognition of Indian sign language gestures using a powerful artificial intelligence tool, convolutional neural networks (CNN). Different CNN architectures have to be designed and tested with our sign language data to obtain better accuracy in recognition. Three different pooling techniques namely mean pooling, max pooling and stochastic pooling will be implemented and best pooling will be determined for our case. Dataset that will be used to train our CNN models is taken from Kaggle as well as our own dataset will be added to make our models more robust.

### 2.2 Objectives

Education portal with tutorials and lessons on Indian sign language with the support for evaluation of the learned skills and addition of fun learning activities for more engaged user experience. UI should be plain and simple so as to be friendly to non-traditional users. Increasing the model accuracy for efficient sign language recognition.

### 2.3 Literature Review

- An introduction to the Flask Python web app framework.  
<https://opensource.com/article/18/4/flask>
- Building Full stack WebApp using Flask + Firebase + Heroku.  
<https://medium.com/analytics-vidhya/building-full-stack-webapp-using-js-flask-postgres-firebase-heroku-7b3ec622a345>



- Sign Language Recognition Application Systems for Deaf-Mute People: A Review Based on Input-Process-Output  
<https://www.sciencedirect.com/science/article/pii/S1877050917320720>

## 2.4 Problem Definition

Designing an education portal offering knowledge and training about sign language and how to use it in real life to communicate with people who cannot speak or listen in order to make this world a familiar place for the deaf and mute. The portal will have tutorials and quizzes on sign language basics, which include English alphabets and numbers. The learner's evaluation will be done through a real-time online examination which will test the learner's ability to follow the on-screen instructions and perform the various sign language basics. Upon passing, the learner will be granted a certificate of completion on his/her email id.

## 2.5 Scope

- This project aims to cover basic english alphabets in Indian Sign Language.
- It will also include 0-9 numbers.
- This project will not include words or sentences directly although, they can be created using the basic alphabets and numbers.

## 2.6 Technology Stack

- Database - Firebase
- Hosting Platform - Heroku/Netlify
- Programming language - Python
  - Flask - Web Development Framework
  - opencv - Python Library for image Processing.
  - numpy - Python Library For mathematical operations
- Keras Framework, Tensorflow 2.0
  - Used for building our deep learning model

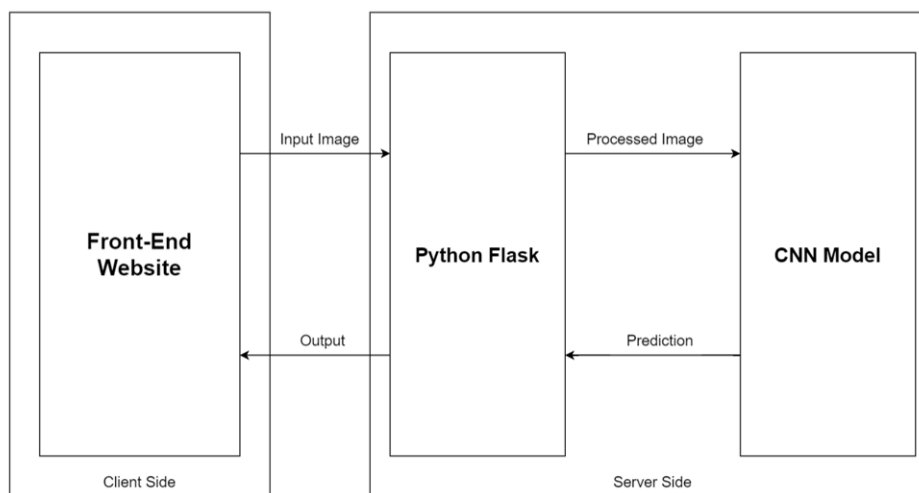
## 2.7 Benefits For Environment And Society

- The problems faced by deaf and mute people at present time and the difficulties they have communicating with normal people sparked our interest and led us to try to find a solution to their problems and to minimize them as much as possible.
- So, our project aims to bridge this gap by enabling communication between deaf/mute people, on the one hand, and normal people, on the other hand, by introducing an education portal which will educate normal people in sign language and, in turn, make communication possible between a normal person and a deaf/mute person.

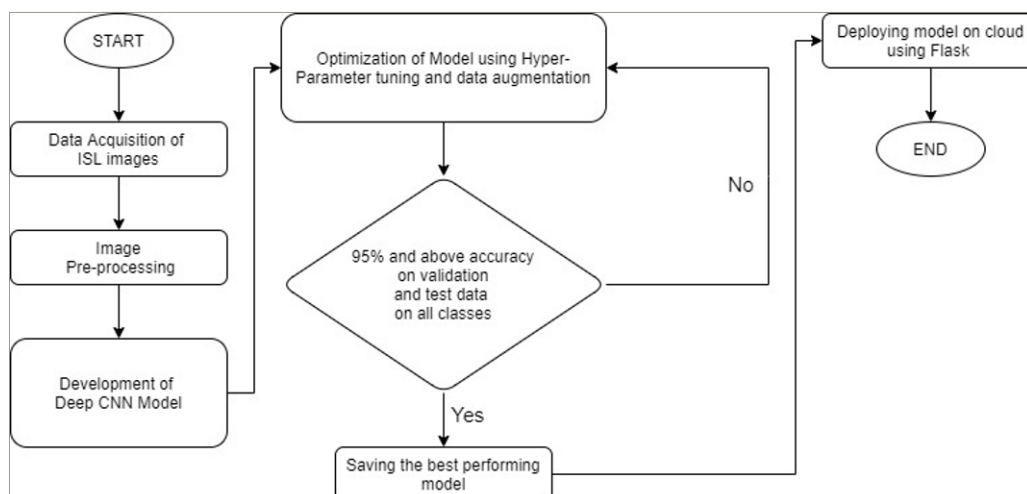
# Chapter 3

## Project Design

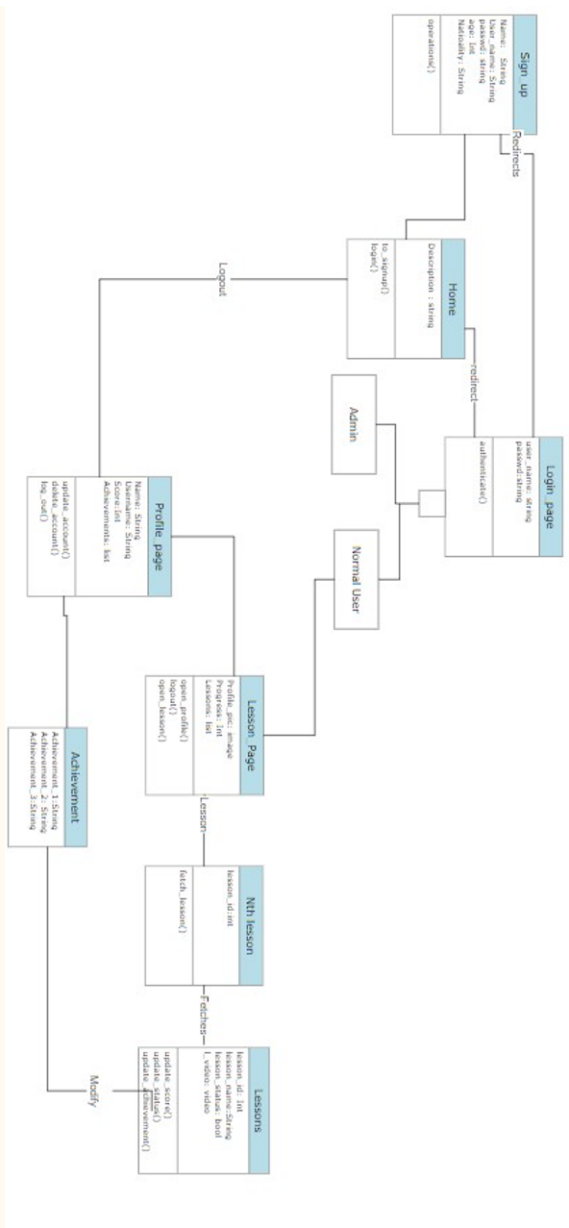
### 3.1 Proposed System



### 3.2 Design(Flow Of Modules)



### 3.3 Class Diagram



## **3.4 Modules**

### **3.4.1 Module 1-Data Acquisition**

- Collection of data using opencv to capture images.
- Datasets on Indian Sign Language (Downloaded from Kaggle) will be merged with custom data.

### **3.4.2 Module 2- Image Pre-processing**

- Using GuassianBlur/AverageBlur/MedianBlur to smooth out the image.
- Re-scaling the raw image to fixed size required for CNN.

### **3.4.3 Module 3- Developing CNN model**

- Creating a CNN architecture using Keras library in Tensorflow.
- Stacking multiple Convolution layers and MaxPooling layers.
- Adding Dense layers to get the final output for the images.

### **3.4.4 Module 4 - Optimization of Model**

- Trying different stacks of layer as well as training on multiple epochs.
- Comparing performance on various learning rates and other hyper-parameters.
- Implementing dynamic learning rate which decreases over time or on plateau.
- Attempting to increase accuracy with data augmentation.

### **3.4.5 Module 5 - Acquiring acceptable accuracy**

- If the required accuracy mark is achieved then proceed to next stage, else go back to optimization stage.

- All classes should have acceptable accuracy rates.
- Performance can be validated with confusion matrix.

### **3.4.6 Module 6 - Saving the best model**

- Model can be saved in '.h5' or '.pkl' format after we have trained and got the required performance.
- Pickle is used to save models in '.pkl' format and models are saved by default in tensorflow as '.h5' format.

### **3.4.7 Module 7 - Model Deployment**

- The final application can be deployed on AWS EC2 instance.
- AWS provides a free tier which can be used for our educational purpose.
- Application can also be deployed with heroku or netlify.

## **3.5 References**

- Flask implementation: <https://flask-doc.readthedocs.io/en/latest/>
- CodewithHarry , Krish Naik youtube channels
- AWS : <https://docs.aws.amazon.com/general/latest/gr/Welcome.html>
- Firebase : <https://firebase.google.com/docs/guides>.
- Heroku : <https://devcenter.heroku.com/categories/reference>
- Keras : <https://keras.io/guides/>
- OpenCV : <https://pypi.org/project/opencv-python/>

# Chapter 4

## Planning for next semester

- From the proposed work flow the individual modules will be developed and their working would be tested to ensure proper functionality.
- Integration of client-side web application with server-side.
- Deploying model on cloud services.
- Testing of complete web portal as a whole.
- Taking feedback from real users.
- Making optimizations according to the feedback.