

PROJECT CHARTER					
Project Title	Charcha - Strengthening Communication			Project Manager	Dr Jafar Hamra
Project Start Date	12-03-2021	Project End Date	21-05-2021	Project Sponsor	CM Kamal & SB Mahesh
Description					
Charcha is a service that has support for everyone to communicate smoothly. It is a service enabling effective communication of hearing and speech impaired among themselves and also with other people. It achieves this by live sign language to text transcription powered by robust Convolutional Neural Networks and Computer Vision techniques.					
Project Scope			Deliverables		
The ASL sign language is a mixture of hand gestures, lip movement, expressions and sequential hand movements. The coherent use of all 4 components enables a deaf, mute or blind person to communicate with others. Considering the complexity of the problem, our project will be limited to interpretation of signs in the forms of text. This will help a gifted person to communicate with other gifted people and with masses that do not understand the dynamics of ASL..			> Service to convert hand signs & gestures to text > Desktop App > Self curated Dataset		
Risks & Issues			Assumption/Dependencies		
> Creation of a robust GUI can be difficult due to lack of experience in web/software development			> Conversion of only one single language - ASL. > Although the dataset would be extremely comprehensive and inclusive of some of the most difficult image interpretation instances, we have to be assuming that there could be edge cases where the model could look forward to improvements in judgement		
Financials					
Time = [8 hrs (Discussion & Planning) + 4 hrs (Execution)] /per week      Money = \$ 0					
Milestones Schedule					
Milestone		Target Completion Date		Actual Date	
Dataset Creation		31-03-2021		31-03-2021	
Data Conformation & Model Creation		25-04-2021		25-04-2021	
Coding & Implementation of app with GUI		07-05-2021		05-05-2021	
Documentation & Final Report Making		20-05-2021		20-05-2021	
Final Presentation		21-05-2021		21-05-2021	
Project Team			Approval/Review Committee		
Team Member	Gautam Sadarangani		Sponsor	CM Kamal & SB Mahesh	
Team Member	Pratiksha Sharma		Stakeholder	Dr Jafar Hamra, CM Kamal & SB Mahesh	
Team Member	Rithwik Chhugani		Financial Head	Pratiksha Sharma	







# Charcha

## ▼ Initialization



### ▼ Finalize a project

- Look for trends in AI
- Form a subset of interesting topics
- Talk to the community to identify potential caveats in the selected topics
- Understand the product demand
- Identify target population
- Define scope of the project
- Form a concise description of the idea and possible approaches to solve the problem

### ▼ Venture for Sponsors

- Search for potential sponsors in our LinkedIn network
- Shortlist some professionals
- Initiate communication via inmails and calls (if possible)
- Book time slots for project debriefing
- Gather feedback
- Lock the sponsor

## ▼ Business Understanding



### ▼ Determine Business Objectives

#### ▼ Background

- Define motivation
- Our interest in the project

#### ▼ Business Objectives

- Identify what the product will do
- Determine the usage and end goal

#### ▼ Business Success Criteria

- If correct amount of data is collected
- if required variation is fed the the algorithm
- if the model is able to predict correctly 80% of the time

#### ▼ Assess the Situation

##### ▼ Inventory of Resources

- Check for available computational resources
- Asses health on GPUs on system
- Check for compatibility with latest CUDA libraries

##### ▼ Requirements

- Check for base configuration needed
- Understanding the sign language
- Knowledge of fingerspelling using ASL
- Ask what is desired form of product: desktop app or web app

##### ▼ Assumptions

- The app won't be used in crowded environment

##### ▼ Constraints

- Computational resources
- Dataset size
- Lack of model training time

##### ▼ Terminology

- Browsing and Brainstorming for product names
- Finalizing the selection
- Conveying with the sponsors

##### ▼ Costs and Benefits

- Rendered as free service to the NGO

#### ▼ Determine Goal

##### ▼ Prediction Goal

- 89% accuracy in real world setting
- Near real time predictions

##### ▼ UI/UX Goal

- Build a functional MVP adhering to sponsor guidelines

#### ▼ Produce Project Plan

- Project Plan

- Initial Assessment of Tools and Techniques

## ▼ Data Understanding



### ▼ Collect Initial Data

- Gather train, test and validation images for 36 class
- Collect 3000 images per class from varied sources

### ▪ Explore Data

### ▼ Verify Data Quality

- Run through sponsors
- Get green flag to proceed

## ▼ Data Preparation



### ▼ Select Data

- Collect all good images from the dataset
- Also check for any imbalance created while sampling

### ▼ Clean Data

- Add Gaussian Blur on top of all images
- Data Labelling
- Define ROI (Region of Interest)

### ▼ Format Data

- Arrange images in folders
- Write code to automate the procedure
- Write code for dividing images in train, test and validation splits

## ▼ Modeling



### ▼ Select Modeling Techniques

- ▼ Try transfer learning with VGG-19,16, Resnet and ImageNet
  - Freeze all layers

- Freeze different amount of layers
- Train for varied number of epochs
- Make models in conjunction with state of the art models

#### ▼ Build Model

- Try different loss functions, optimizers and activation functions
- Model pruning
- Enable gpus for training

#### ▼ Assess Model

- Hyperparameter tuning

#### ▼ Evaluation



- Evaluate Results
- Review Process
- Determine Next Steps

#### ▼ Deployment



#### ▼ Plan Deployment

- Explore different technologies to build desktop app
- Write code to render UI/UX interface
- Produce Final Report
- Review Project





# Network Diagram

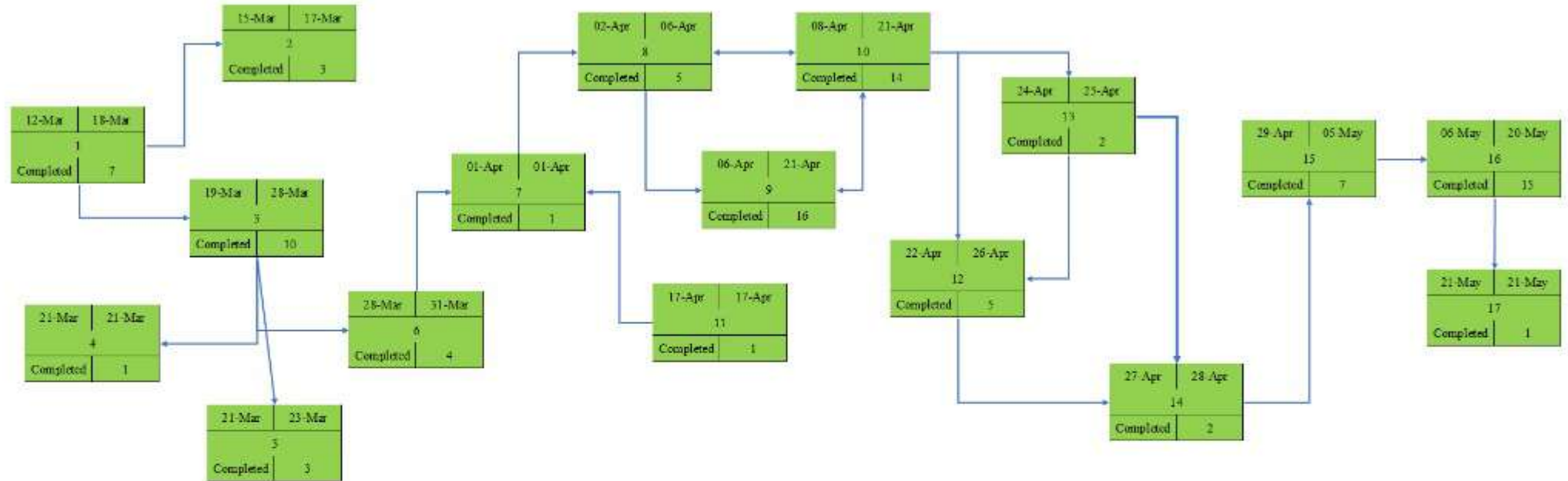
Activity	Index Number	Start Date	End Date	Duration	Status
Research and understanding of existing solutions	1	12-Mar	18-Mar	7	Completed
Discussion of Proprietorship, Copyright and T&C	2	15-Mar	17-Mar	3	Completed
Dataset Creation: Collection	3	19-Mar	28-Mar	10	Completed
Dataset Creation: Creation of Charcha talks Google Drive	4	21-Mar	21-Mar	1	Completed
Dataset Creation: Enabling Charcha Talks Google Drive access to all team members and sponsors	5	21-Mar	23-Mar	3	Completed
Dataset Creation: Data Transfer to Shared Drive	6	28-Mar	31-Mar	4	Completed
Data Conformation	7	01-Apr	01-Apr	1	Completed
Model Architecture Option Creations	8	02-Apr	06-Apr	5	Completed
Training multiple models	9	06-Apr	21-Apr	16	Completed
Testing and Tweaking models	10	08-Apr	21-Apr	14	Completed
Applying filters on Data: Gaussian Blur	11	17-Apr	17-Apr	1	Completed
Researching and Trying application formats and tools	12	22-Apr	26-Apr	5	Completed
Finalising a model with sponsors	13	24-Apr	25-Apr	2	Completed
Finalising Format (Desktop App) & GUI	14	27-Apr	28-Apr	2	Completed
Coding for the application with the GUI	15	29-Apr	05-May	7	Completed
Documentation & Final Report Making	16	06-May	20-May	15	Completed
Final Presentation	17	21-May	21-May	1	Completed



## Nodes

Start Date	End Date	12-Mar	18-Mar
Index		1	
Status	Duration	Completed	7
13-Mar	17-Mar	19-Mar	28-Mar
2		3	
Completed	3	Completed	10
21-Mar	21-Mar	21-Mar	23-Mar
4		5	
Completed	1	Completed	5
28-Mar	31-Mar	01-Apr	01-Apr
6		7	
Completed	4	Completed	1
05-Apr	06-Apr	06-Apr	21-Apr
8		9	
Completed	5	Completed	16
08-Apr	21-Apr	17-Apr	17-Apr
10		11	
Completed	14	Completed	1
22-Apr	26-Apr	24-Apr	25-Apr
12		13	
Completed	5	Completed	2
27-Apr	28-Apr	29-Apr	05-May
14		15	
Completed	2	Completed	7
06-May	20-May	21-May	21-May
16		17	
Completed	15	Completed	1

## Network Diagram



# Risk Register

Project name: Charcha - Strengthening Communication

Project Manager: Jafar Hamra

Team Members: Gautam Sadarangani, Rithwik Chhugani, Pratiksha Sharma

Project Sponsors: Mr. SB Mahesh, Mr. CM Kamal

ID	Date raised	Risk description	Likelihood of the risk occurring	Impact if the risk occurs	Severity <i>Rating based on impact &amp; likelihood.</i>	Owner <i>Person who will manage the risk.</i>	Mitigating action <i>Actions to mitigate the risk e.g. reduce the likelihood.</i>	Contingent action <i>Action to be taken if the risk happens.</i>	Progress on actions	Status
1	26 February 2021	Project purpose and need is not well-defined.	Low	High	High	Team Members	Complete a business case if not already provided and ensure purpose is well defined on Project Charter.	Escalate to the Project Board with an assessment of the risk of runaway costs/never-ending project.	Business case re-written with clear deliverables and submitted to the project sponsors for approval.	Closed
2	05 March 2021	Project design and deliverable definition is incomplete.	Low	High	Medium	Project Sponsors	Define the scope in detail via design workshops with input from subject matter experts.	Document assumptions made and associated risks. Request high risk items that are ill-defined are removed from scope.	Adjustments made on the project charter as per the Sponsor requirements.	Closed
3	20 March 2021	Dataset collection is not completed in proposed time	Medium	High	High	Team Members	Put the entire focus on dataset creation task.	Have a meeting with the Project Sponsors to push the target date and if required look at other resources for dataset creation.	Completed the Dataset Creation in proposed time.	Closed
4	10 April 2021	Model Creation is incomplete	Medium	High	High	Team Members	Focusing on the model creation by utilising each member's high performance computers constantly on the task non-stop for 1 week.	Escalate to the Project Sponsor and ask for more computational resources.	Model Creation successfully completed.	Closed
5	27 April 2021	Implementation of GUI fails	Low	Medium	Medium	Team Members	Look for alternate means to build a GUI in case the current software fails.	Escalate to Project Sponsor and Project Manager. Inform about delay in implementation.	GUI implementation is complete.	Closed
6	03 May 2021	Unable to meet additional requirements by Sponsors	Medium	Low	Low	Team Members	Examine the scope of new requirements by Sponsors and determine a quick POA to incorporate the requirements into the product with in the stipulated time.	Escalate to project sponsor and inform them that new requirements cannot be fulfilled in the given time frame.	New requirements were incorporated into the product within the proposed time frame.	Closed



Stakeholder Register							
Project Manager	Jafar Hamra			Project Phase	Completed		
Name of Stakeholder	Role	Contact	Category	Interest	Influence	Expectations	Comms Requirements
C M Kamal	Project Sponsor	Phone: +919879372322	External	High	High	User friendly application that works seamlessly and is able to succesfully fulfill the requirements.	Video Conference and Phone
S B Mahesh	Project Sponsor	Phone: +919820214142	External	High	High	An application that is able to help the people with hearing and vocal impairment.	Video Conference and Phone
Rithwik Chhugani	Team Member	Email: rithwik.bs18bds008@spjain.org	Internal	High	High	Fulfilling the expectations of project managers and sponsors by building a robust and seamless app.	Video Conference and Email
Pratiksha Sharma	Team Member	Email: pratiksha.bs18bds010@spjain.org	Internal	High	High	Learning more about applying CNN in real life scenario. Delivering a product that benefits the society.	Video Conference and Email
Gautam Sadarangani	Team Member	Email: gautam.bs18bds015@spjain.org	Internal	High	High	Building a product that can help people as well as enhance my learning. Gaining experience from a real-life project and understanding the work process behind it.	Video Conference and Email
Jafar Hamra	Project Manager	Email: jafar.hamra@yahoo.com	Internal	High	High	Understanding the software development process from beginning to end. Successful delivery of a working product.	Email
Customers	Users	-	External	High	-	A working product which would help reduce the communication barriers between people with hearing and speaking impairment.	-

# Software Requirements Specification

**CHARCHA – STRENGTHENING COMMUNICATION**

**“Sign language to text conversion”**

Gautam Sadarangani – BS18BDS015

Pratiksha Sharma – BS18BDS010

Rithwik Chhugani – BS18BDS008



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## 1 Introduction

### 1.1 Purpose

The main purpose of this document is to build a desktop application that uses Artificial Intelligence to convert American Sign Language (ASL) to text, facilitating communication for people that have impaired hearing and/or speech.

### 1.2 Scope

This document specifies requirements for a simple application for detecting hand signs in real-time and converting it to text.

The package provides users:

- Programs:
  - To click pictures that can be used for Training Custom Model
  - To store pictures on your local machine
  - To convert input pictures to filtered formats using gaussian blur
  - To train and store a Model
- Application:
  - To access webcam and feed input in real-time
  - To detect hand signs and convert them to alphabets
  - To make words using the detected alphabets
  - To build a sentence using the formed words

The package stores pictures in .jpg format that can be accessed and modified.

### 1.3 Product perspective

#### 1.3.1 System interfaces

The product runs as a Desktop application on both Linux and Windows distribution.

#### 1.3.2 User interfaces

The application's graphical user interface provides a window with a focus area for gaussian blur filtered input, onscreen prediction of the sign, confirmed alphabets during word formation and history of all formed words in the sentence.

#### 1.3.3 Software interfaces

The application uses Python to write code, OpenCV for image detection and collection, JSON to store the trained model, H5 for storing and loading of model weights, and Command line for executing the application.



## 1.4 Functional Requirements

- Good quality webcam
- Site packages
- Supported OS Environment
- Python Environment
- Minimum 4 GB RAM

## 1.5 Non-functional Requirements

- Plain white backgrounds
- Steady hand signs
- Clear view of hands (avoiding heavy or bulky jewellery or accessories)
- Proximity to webcam
- Recommended 8 GB+ RAM
- Sturdy System

## 1.6 User characteristics (Various Actors)

- Non-Government & Government Organisations
- People with impaired hearing and/or speech
- And practically anyone that would have a need to communicate using ASL!

## 1.7 Limitations

- Processing and detection time is slow
- Not accessible remotely
- Model needs to be recalibrated using new data for other people

## 1.8 Assumptions and dependencies

- User has full knowledge of ASL
- User is comfortable with technological interaction
- User has a physical computer system

## 1.9 Acronyms and abbreviations

**Charcha:** (English - Discussion) A Marathi word that means the action or process of talking about something in order to reach a decision or to exchange ideas.

## 2 Detailed Information

- Application recognizes 27 symbols that include all the English alphabets and a blank space.
- Fifty frames of similar detection confirm the prediction obtained for a hand sign
- A blank frame confirms the formation of a word and its addition to a sentence

### 3 Security

Since, the application does not require internet connection, there is a very less probability of cyber-attacks. The application also does not store any real-time information for protection of user privacy rights.

### 4 Copyright

The dataset collected and curated for this application is proprietary and cannot be shared with any external parties or clients. Sole ownership belongs to the sponsors and the developers.

### 5 Supporting information

Usage of this application is subject to the following terms and conditions:

- This application should not be used in a commercial fashion under all circumstances.
- This application should not be used for communication of foul or offensive language
- This application should not be used for communication of information that endangers the privacy, safety, and security of the society.
- The use of this application is not intended to offend or call out the sentiments of any group, person, community, or religion.

### 6 References

**Adewale, V. A., & Olamiti, A. O.**

(2018, December). *Conversion of Sign Language To Text And Speech Using Machine Learning Techniques*. [http://dx.doi.org/10.36108/jrrslasu/8102/50\(0170\)](http://dx.doi.org/10.36108/jrrslasu/8102/50(0170)).

**N B, M. K.**

(2018). *Conversion of Sign Language into Text*.  
[https://www.ripublication.com/ijaer18/ijaerv13n9\\_90.pdf](https://www.ripublication.com/ijaer18/ijaerv13n9_90.pdf).

**Anon**

(2021). Retrieved 21 May 2021, from <https://www.ripublication.com/ijaer18/ija>

**Ojha, A., Pandey, A., Maurya, S., Thakur, A. and P, D.**

Ojha, A., Pandey, A., Maurya, S., Thakur, A., & P, D. (2020). Sign Language to Text and Speech Translation in Real Time Using Convolutional Neural Network. *International Journal Of Engineering Research & Technology*, 8(15). Retrieved from <https://www.ijert.org/sign-language-to-text-and-speech-translation-in-real-time-using-convolutional-neural-network>

**Real-time Conversion of Sign Language to Text and Speech**

Real-time Conversion of Sign Language to Text and Speech. (2021). Retrieved 21 May 2021, from <https://ieeexplore.ieee.org/document/9182877>



### **luvk1412 - Overview**

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### **Project Idea | Sign Language Translator for Speech-Impaired - GeeksforGeeks**

Project Idea | Sign Language Translator for Speech-Impaired - GeeksforGeeks. (2017).

Retrieved 21 May 2021, from <https://www.geeksforgeeks.org/project-idea-sign-language-translator-speech-impaired/>

### **Sign language recognition using deep learning**

Sign language recognition using deep learning. (2020). Retrieved 21 May 2021, from <https://towardsdatascience.com/sign-language-recognition-using-deep-learning-6549268c60bd>

### **Using AI To Translate Sign Language in Real Time**

Using AI To Translate Sign Language in Real Time. (2020). Retrieved 21 May 2021, from <https://towardsdatascience.com/using-ai-to-translate-sign-language-in-real-time-96fe8c8223ed>

### **Real-Time Indian Sign Language Recognition System to Aid Specially Abled**

Real-Time Indian Sign Language Recognition System to Aid Specially Abled. (2020).

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### **Papers with Code - Sign Language Recognition**

Papers with Code - Sign Language Recognition. (2021). Retrieved 21 May 2021, from <https://paperswithcode.com/task/sign-language-recognition>

### **Datasets Resource Center**

Datasets Resource Center. (2021). Retrieved 21 May 2021, from <https://appen.com/open-source-datasets/>

# Software Design Document

**CHARCHA – STRENGTHENING COMMUNICATION**  
**“Sign language to text conversion”**

Gautam Sadarangani – BS18BDS015  
Pratiksha Sharma – BS18BDS010  
Rithwik Chhugani – BS18BDS008



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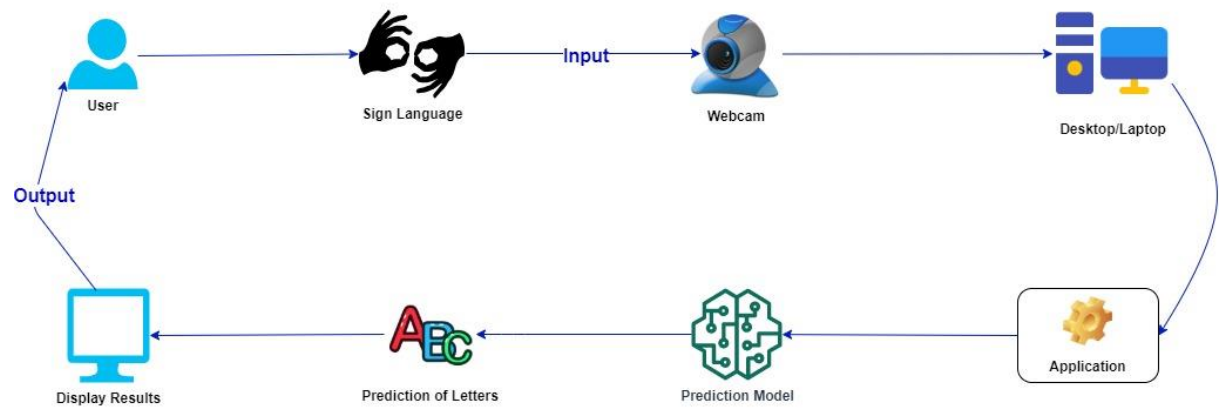
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## 1. Technologies Used:

The following technologies have been used in our entire project:

- Python,
- OpenCV,
- TensorFlow,
- Keras,
- TKinter,
- Pandas,
- Numpy,
- Matplotlib,
- Cuda,
- Splitfolders,
- PIL,
- Operator,
- Trello Boards,
- Microsoft Teams,
- Google drive,
- XMind,
- LucidCharts,
- App.diagrams.net,
- Blender,
- Sequencediagram.org, and
- Microsoft Excel

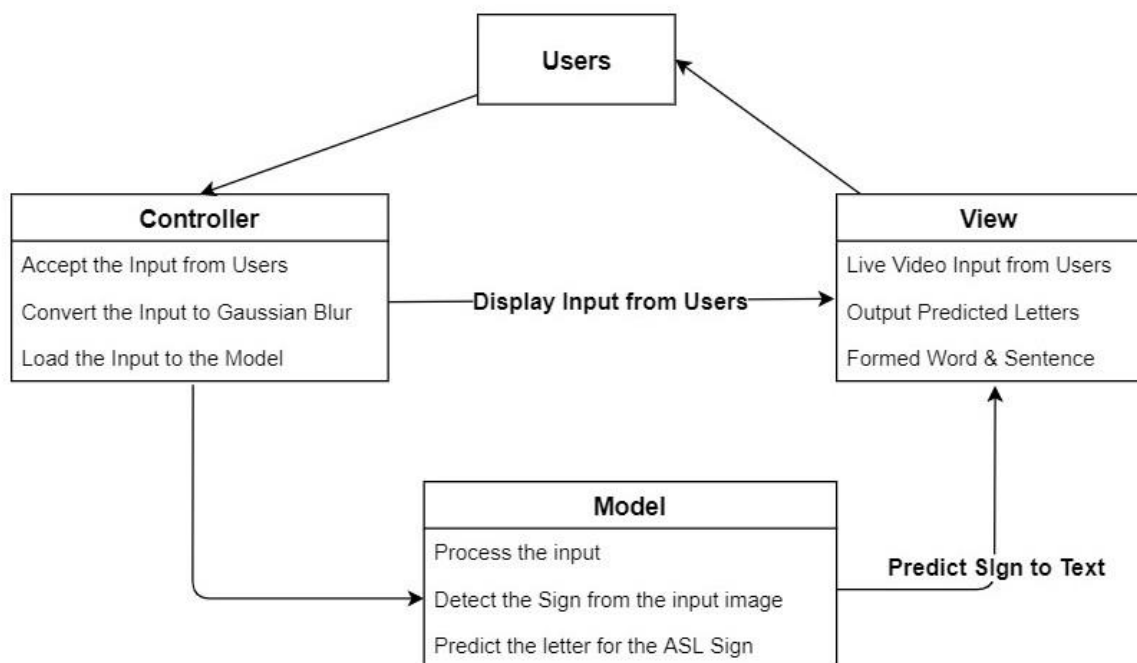
## 2. System Overview Diagram:



Charcha Talks System Overview

## 3. Architectural Design Pattern:

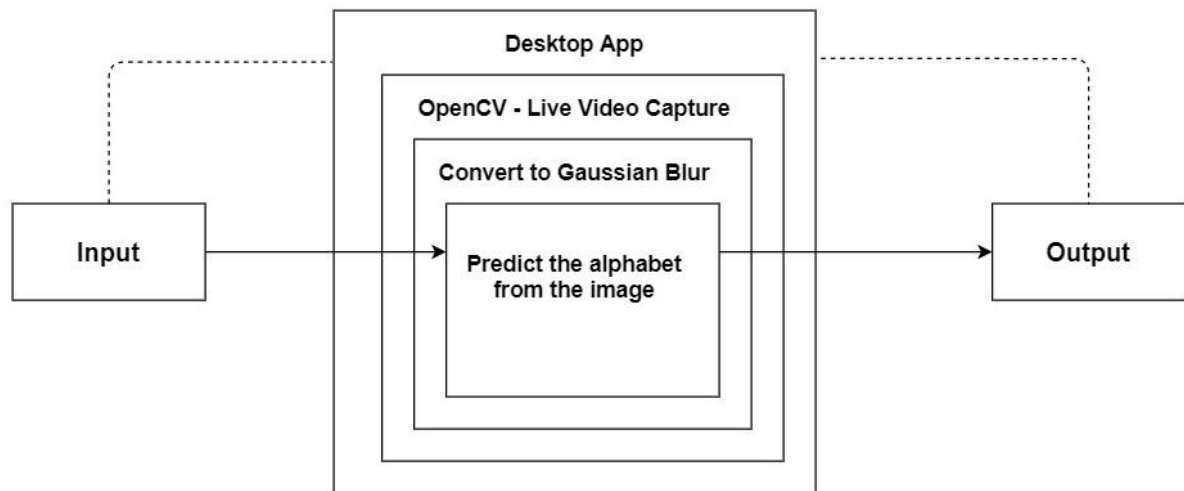
Our project fits the MVC architectural design pattern. The diagram is shown below;



Architectural Design - MVC Pattern

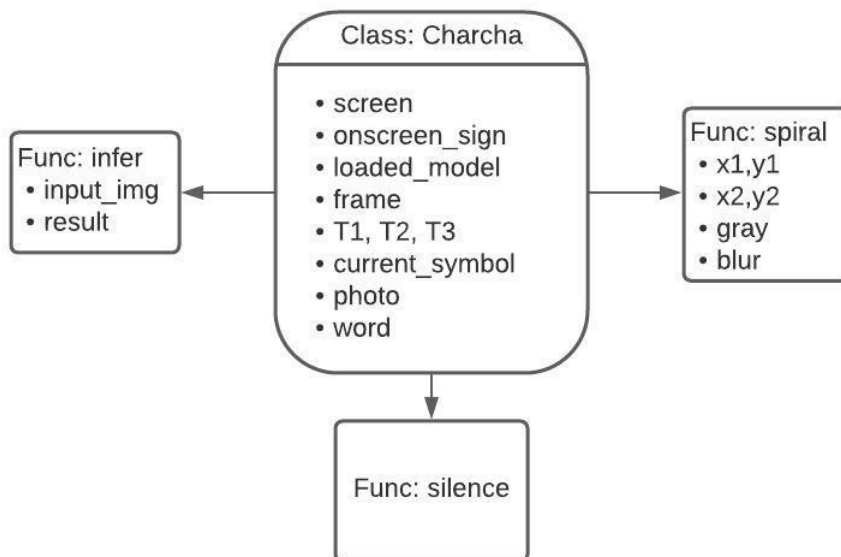


#### 4. Block Diagram:



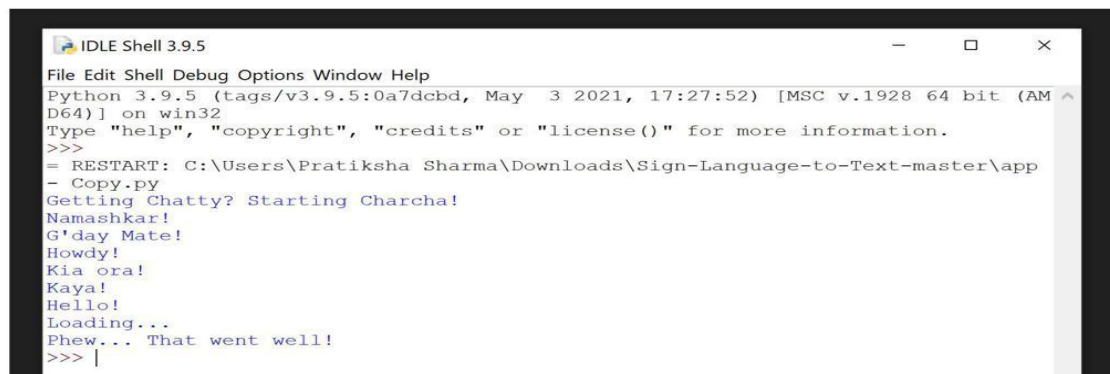
**Block Diagram**

#### 5. Design Viewpoints including Logical Viewpoints (Class Diagram):

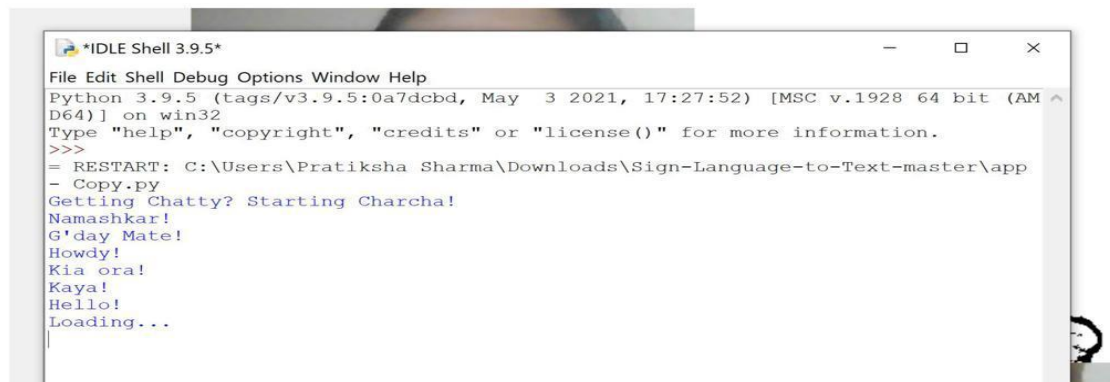


## 6. Interface Viewpoints (Frontend Screenshots):

This is how the console log looks like;

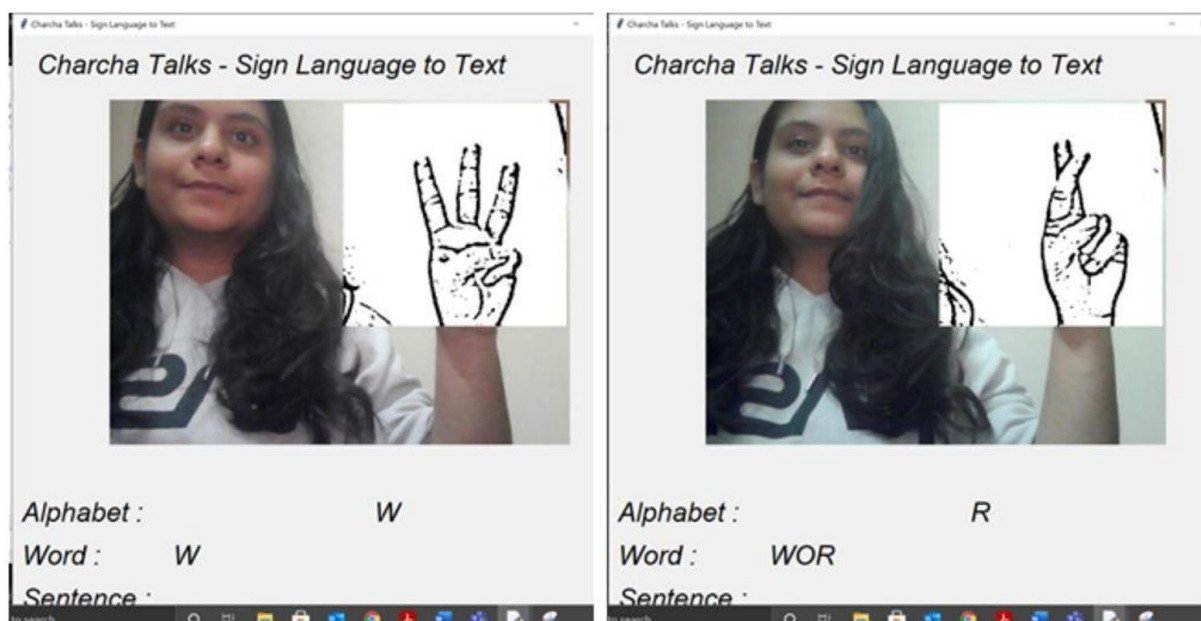


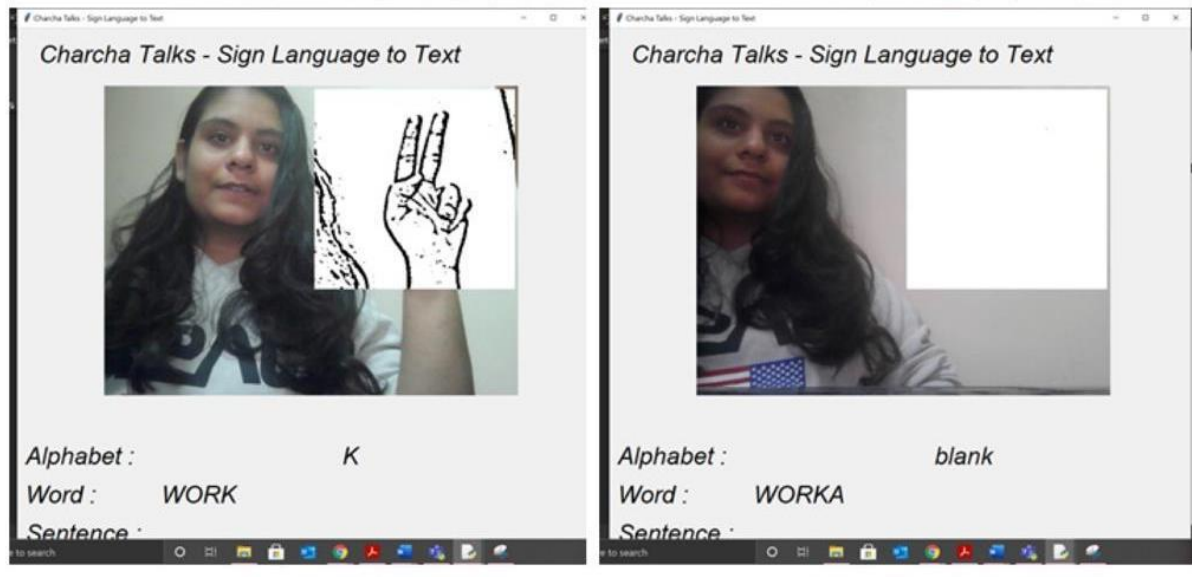
```
IDLE Shell 3.9.5
File Edit Shell Debug Options Window Help
Python 3.9.5 (tags/v3.9.5:0a7dcdb, May 3 2021, 17:27:52) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: C:\Users\Pratiksha Sharma\Downloads\Sign-Language-to-Text-master\app
- Copy.py
Getting Chatty? Starting Charcha!
Namashkar!
G'day Mate!
Howdy!
Kia ora!
Kaya!
Hello!
Loading...
Phew... That went well!
>>> |
```



```
*IDLE Shell 3.9.5*
File Edit Shell Debug Options Window Help
Python 3.9.5 (tags/v3.9.5:0a7dcdb, May 3 2021, 17:27:52) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: C:\Users\Pratiksha Sharma\Downloads\Sign-Language-to-Text-master\app
- Copy.py
Getting Chatty? Starting Charcha!
Namashkar!
G'day Mate!
Howdy!
Kia ora!
Kaya!
Hello!
Loading...
|
```

These are how the letters and blanks look like;





## 7. Interaction Viewpoints (Sequence Diagram):

