HAND SIGN RECOGNITION USING IMAGE PROCESSING

EPICS Project report submitted in partial fulfillment of the Requirements for the Award of the Degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING

Submitted by

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CERTIFICATE

This is to certify that the EPICS project course report entitled **" HAND SIGN RECOGNITION USING IMAGE PROCESSING "** being submitted by

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in partial fulfilment for the award of the Degree of Bachelor of Technology in Computer Science and Engineering to the Jawaharlal Nehru Technological University, Kakinada, is a record of bonafide work carried out during the period from 2021 - 2022.

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DECLARATION

We hereby declare that the EPICS project entitled **"HAND SIGN RECOGNITION USING IMAGE PROCESSING"** submitted for the B.Tech Degree is our original work and the dissertation has not formed the basis for the award of any degree, associateship, fellowship or any other similar titles.

Place: Vijayawada

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Abstract

As a medium of communication Sign Language is used by the dumb people and the people who have difficulty to speak and hear to communicate within their community or with others people. Hand Sign Recognition involves translation of the sign language to English. There are many sign languages, but here we deal with American Sign Language. There are existing methods to detect sign language by using IOT sensors, colours, glove etc., These will be expensive, time consuming, involves complex work, and are not flexible. Image processing can solve the problem and makes sign language detection flexible, faster, simple and more accurate. Carrying the equipment by the dumb people or arranging the equipment by the normal person , both will be difficult. So using a software can easily solve this problem. Here the sign shown by the user in front of the camera in the prescribed area will be captured, predicted and displayed. Hence, The message that the user wants to convey will be displayed in English. In this way, the intended intention of the user will be conveyed. It can be used to solve the minimal communicational problems faced by the dumb people in the society. It removes the communicational barriers between the dumb people and the outside world. In this way the Image Processing can be used to solve the problems faced by the disabled in the society with less cost.

KEYWORDS

Image Processing, OpenCV, Machine Learning, Tensor flow, Gesture Recognition, Flask, Keras

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1 INTRODUCTION

Human Computer Interaction in short HCI is a study which involves a field of computer technology, in particular, the interaction between the humans and the computers. In HCI mouse, keyboard, joystick, track pad etc. plays a crucial role. Hand Sign Recognition is a sub class of gesture recognition. Gestures are some signs or points which are known to computer, so that when user performs these gestures, intent or an action by the computer will be taking place. The main goal of our project is to make a computer application or a web application which involves translation of the sign language to English. The scope of this project includes the dumb people around the country and people who have difficulty to hear. The main application of this project is that it can be used at places where there is minimal requirement of communication is needed from the dumb people . The main objective of our

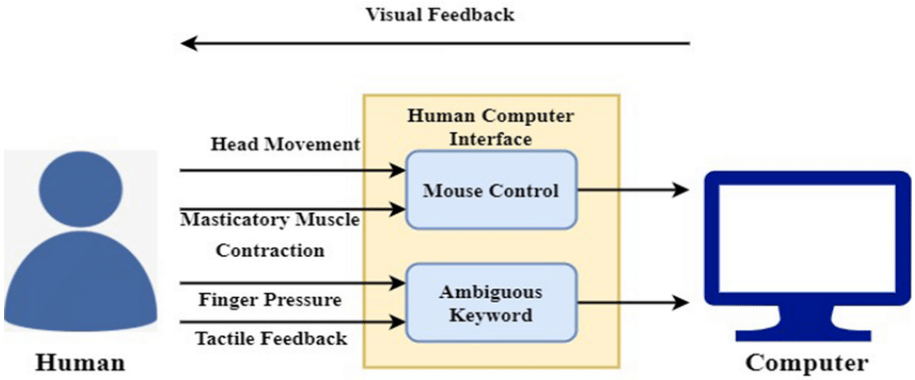


Figure 1: Human Computer Interaction

Hand Sign Recognition project is to remove the communicational barriers between the persons who are facing difficulties in speaking and the outside world. This involves real time translation of gestures shown by user to English. Figure 1 represents the interaction between the humans and the computer [1].

1.1 Basic Concepts

Image Processing

Image processing is a method to perform some operations on an image , in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image.Figure 2 represents the steps of image processing that can be done.

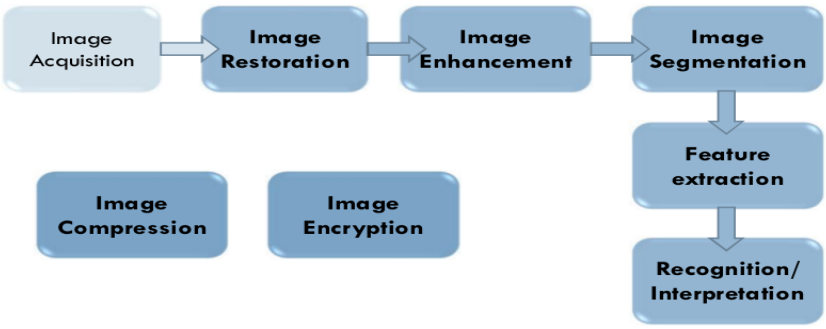


Figure 2: Image Processing

Convolutional Neural Network

A convolutional neural network (CNN) is a type of artificial neural network used primarily for image recognition and processing, due to its ability to recognize patterns in images. A CNN is a powerful tool but requires millions of labelled data points for training. CNNs must be trained with high-power processors, such as a GPU or an NPU, if they are to produce results quickly enough to be useful.While CNNs are designed to solve problems with visual imagery, they also have many applications outside of image recognition and analysis, including image classification, natural language processing, drug discovery, and health risk assessments. CNNs also help provide depth estimation for self-driving cars Figure 3 represents the block diageram of CNN.[2].

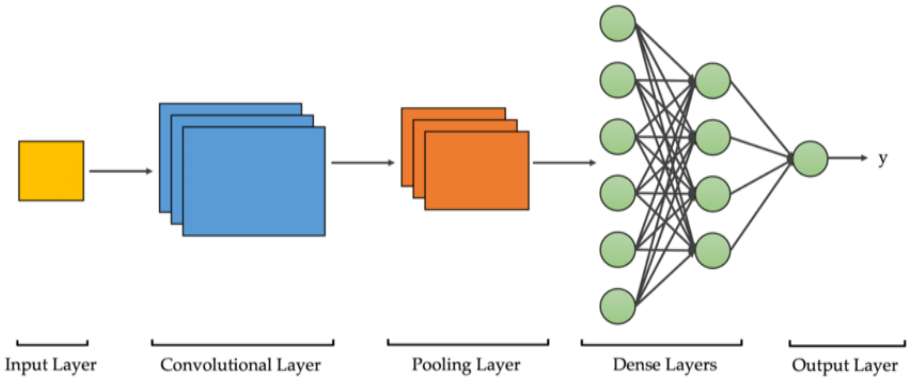


Figure 3: convolutional neural network

Machine learning

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values. For example, an algorithm would be trained with pictures of dogs and other things, all labelled by humans, and the machine would learn ways to identify pictures of dogs on its own. Supervised machine learning is the most common type used today. Artificial intelligence is a technology that enables a machine to simulate human behaviour. Machine learning is a subset of AI which allows a machine to automatically learn from past data without programming explicitly. The goal of AI is to make a smart computer system like humans to solve complex problems. Figure 4 represents the process of machine learning [3]

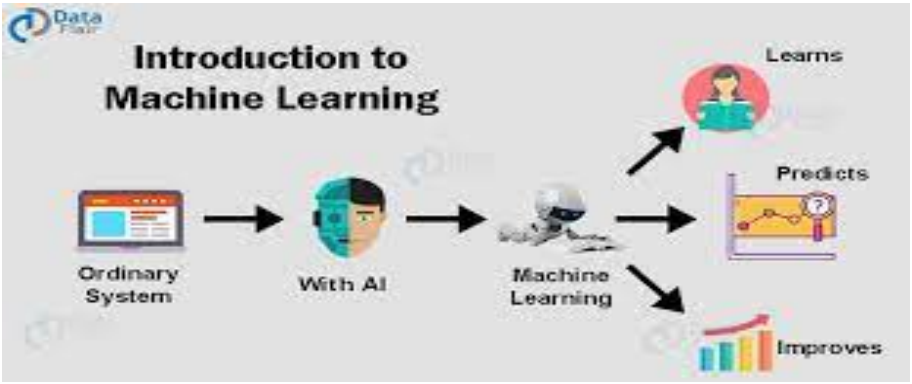


Figure 4: Machine Learning

1.2 Motivation

- The motivation is to develop a system which can detect the gestures which are widely used for conveying the information or to control the devices.
- In many places we can find the dumb people or deaf people or the people who have little hearing problems, find it difficult to convey their message to the others. So this project will be useful for those kind of people.
- This plays a role of communication medium between the normal people and people with dumb and deaf problems
- It aims in removing the communicational barriers and solving the communicational problems faced by the disabled in the society.

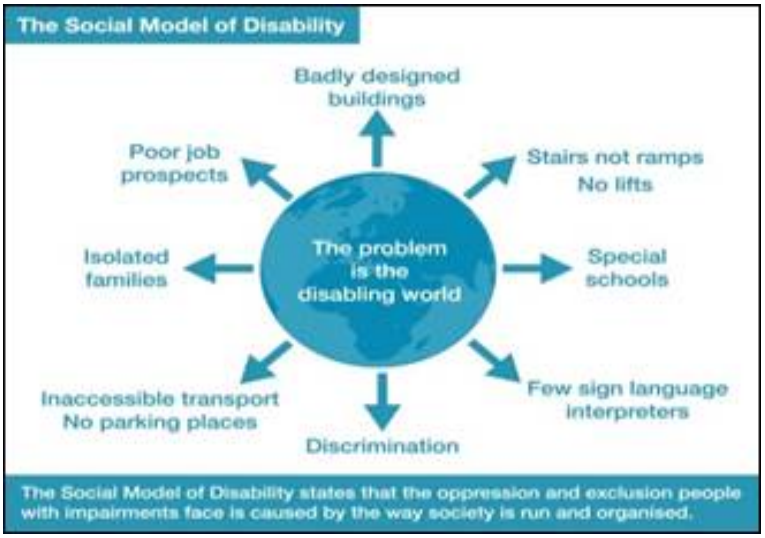


Figure 5: Problems faced by disabled in society

Figure 5 represents the problems faced by the disabled persons in the society.

1.3 Client Visited

We visited "Madonna High School for the Deaf and Dumb" located in Carmil nagar, Gunadala, Vijayawada, Andhra Pradesh
Figure 6 represents the photo of the school visited

Figure 6: Madonna High School

(a) Photo with client

(b) Handing over project to client

Figure 7: Photo with Client

1.4 Photo with Client

Figure 7 represents Photos taken with the client by visiting the Madonna High school.
Figure 7(a) represents the photo with the students and the staff at the school.
Figure 7(b) represents the process of explaining the code to the client and handing over the project to the client.

1.5 Problem Statement

- Our project aims to create a computer application to detect the signs.
- When user shows a sign in real time in this application , the corresponding text will be displayed
- It shows the intended meaning that the user wants to convey.
- It also involves translation of sign language to english.
- it is done mainly to solve the communicational problems faced by the dumb

1.6 Scope

- Dumb people around the country and people who have difficulties to hear.
- People who are having the disability to speak.
- Children who are dumb.
- Educated persons, to convey message to others
- Any dumb who wants to convey message to the normal people in public places

1.7 Objective

- The main objective is to impart sound education leading to the harmonious and holistic development of the hearing-impaired students so that they can stand on their own feet on this highly competitive society and build a community based on love, freedom and creativity .
- To build a real time gesture classification system that can automatically detect gestures in natural lighting condition.
- It also includes the removal of communicational barriers between the dumb and the normal people in the society.
- Solve the communicational problems faced by the dumb people.

1.8 Advantage

- Translates sign language to English text.
- Establishes effective communication between the dumb and others and also remove communication barriers between them.
- Helps the dumb to get connected with the world.
- Can be used in places where minimal communication is required.
- Helps the dumb or any disabled person to convey their message to the outside world.

1.9 Applications

- To place the order in restaurants by dumb.
- Answer queries in government offices by dumb.
- To purchase things in small shops
- Answer small queries in peer-to-peer communication.
- Details verification in airports.
- To translate sign language to English.
- Helps Educated persons in offices to convey message to the customers
- Helps to learn English from the sign language

2 LITERATURE SURVEY

This section contains the list of research papers that we have studied under literature survey. We focused on the approaches for maintaining accuracy in these papers. Our study included the techniques used for developing and training the model.

2.1 Sign Language Recognition : Learning: A Case Study of Pakistan Sign Language

Farman Shah Muhammad et al. discussed about the detection of the Pakistan sign language. Few dumb communities may use PSL (Pakistan Sign Language) as the main medium of communication. Majority of their work is focused on colour-based hands and the kinect based approaches [4]. This involves translation of PSL into their native language.

Advantages

- This technique is proposed for the recognition of thirty-six static alphabets of PSL using bare hands.
- It has Good accuracy.

Disadvantages

- It is Costly.
- It is Restricted to PSL only.

2.2 Deep Learning for Sign Language Recognition: Current Techniques, Benchmarks,and Open Issues

Muhammad Al-Qurish et al. discussed about detection of the sign language. This project aims to recognize the signs and detect the sign language and also converts the speech to their corresponding signs [5]. This project takes the frames from the video under with minimum disturbances using skin color segmentation. This also differentiates the static and dynamic gestures and also extracts the necessary features.

Advantages

- It has the capacity to translate continuous sign language communication with minimum delay.

Disadvantages

- The rate of incorrectly recognized items increases as the size of the vocabulary and complexity of task increases.
- It does not include recognition of dynamic gestures.

2.3 Arabic Sign Language Recognition System Using 2D Hands and Body Skeleton Data

Mohammed A.Bencherif et al. discussed about detection of Arabic sign language [6]. Few dumb communities may use Novel Arabic Sign Language as a medium of communication. This uses a video consisting of the gestures in the successive frames and translating them into the corresponding text. This is implemented using three-dimensional Convolutional Neural Network skeleton and two-dimensional convolutional network.

Advantages

- It has good accuracy for the results
- It can detect both static and dynamic signs.

Disadvantages

- Field of view of each camera was too large and was unable to detect the key points in the image efficiently.
- Need an improvement in delay removal in the whole pipeline.

2.4 DeepArSLR: A Novel Signer-Independent Deep: Learning Framework for Isolated Arabic Sign Language Gestures Recognition

Saleh Aly et al. discussed about detection of the dynamic gestures. Majority of the gestures used in sign languages will be dynamic in nature which involves movement in them. This project aims in translation of dynamic gestures which are isolated [7]. The two major problems faced and solved during this project are hand shape and hand segmentation issue. This uses Hidden Markov Model for translation. This is the next version of the projects which uses traditional methodology for classification which is efficient.

Advantages

- High signer-independent recognition accuracy.
- Avoids skin colour variations by converting images into grayscale.

Disadvantages

- It is time consuming and less accurate.

2.5 Hand Gesture Recognition for Sign Language Using 3-D CNN

Muneer Al-Hammadi et al. discussed about detection of sign language using CNN and transfer learning. This undertakes goals in the use of the environment friendly CNN which means Convolutional Neural Network which will help in classification of any gestures with appropriate metrics [8]. Here transfer learning is deployed to overcome the scarcity of the large labelled hang gestures. This project is implemented based on three gesture datasets from coloured videos.

Advantages

- The approach obtained recognition rates of 98.12, 100, and 76.67 percent on the collected datasets,respectively for the signer-dependent mode.

Disadvantages

- For the signer-independent mode,recognition rates are less

2.6 Continuous Sign Language Recognition Through Cross-Modal Alignment of Video and Text Embeddings in a Joint-Latent Space

Ilias Papastraits et al. discussed about detection of continuous sign language. This project aims in overcoming the challenges in Sign Language Recognition in short SLR. The challenges include identifying the signs and their corresponding video's temporal boundaries where the video can also be weakly annotated[9]. This project aims in visual feature extraction along with the text information identification. Here a cross-model learning approach is used.

Advantages

- Integrating other modalities such as cropped hands, optical flow and skeletal key points can also be explored.
- Highly accurate CSLR results.

Disadvantages

- It is expensive

2.7 The Progress of Human Pose Estimation: A Survey and Taxonomy of Models Applied in 2D Human Pose Estimation

Tewodros Legesse Munea et al. discussed about detection of human pose. Human Pose detection is the next version of the sign language recognition. This involves identification of the key points in human posture and predicting the action [10]. Identification of key points in the body postures plays a crucial role in process classification. It involves the usage of latest and efficient methodologies to implement in real time. This is widely used is gaming, video surveillance, human tracking etc. So this human pose recognition may build path for many major projects.

Advantages

- It can work well for single person as well as with multiple persons.

Disadvantages

- If the detection of individuals fails , there is no possibility of recovering.
- The more the people the more the computational cost.

2.8 The Traffic Scene Understanding and Prediction Based on Image

Wei Li et al. discussed about detection of traffic scenes. With the advancements in the technology Traffic scene understanding has become a major requirement. A traffic scene understanding involves Pedestrian detection, Traffic sign recognition, Vehicle detection and lots many. Intelligent transportation system along with the advanced driver assistance system will make the Traffic scene understanding easier. The aim of it is to clearly identify the traffic situation and all kinds of traffic scene objects. [11]This also involves providing suggestions for optimal driving strategies. Suggestions will be given according to the traffic scene using natural language processing tools like LSTM(Long Short Term Memory) can be used alternatively for key phrases description.

Advantages

- Solves the problems of feature fusion , general object regonition and low level semantic understanding
- Identify more objects and produce higher-level semantic information than the state-of-the- arts.

Disadvantages

- Most work focus on only recognizing certain targets involved in driving rather than providing driving suggestions.
- Directly applying the existing model of image captioning to ITS(Intellectual Traffic System) is not an optimal solution.

3 ANALYSIS AND DESIGN

This section includes the analysis of requirements for the proposed project. This chapter contains functional and non functional requirements.

3.1 Functional-Requirements

Functional requirement analysis entails a thorough examination, analysis, and description of software requirements and hardware requirements in order to meet actual and also necessary criteria in order to solve an issue. Analyzing functional Requirements includes a number of processes. The Functional Requirements include:

Software Requirements

Open-CV:
OpenCV-Python is a library of Python bindings designed to solve computer vision problems. Python is a general purpose programming language started by Guido van Rossum that became very popular very quickly, mainly because of its simplicity and code readability.OpenCV is an open-source library for the computer vision. It provides the facility to the machine to recognize the faces or objects.[12]

Keras:
Keras is a powerful and easy-to-use free open source Python library for developing deep learning models. It wraps the efficient numerical computation libraries Theano and TensorFlow and allows you to define and train neural network models in just a few lines of code.[13]

Tensorflow-lite:
TensorFlow Lite uses TensorFlow models converted into a smaller, more efficient machine learning (ML) model format. You can train the models and then convert them to TensorFlow Lite format. TensorFlow Lite models can perform almost any task a regular TensorFlow model can do: object detection, natural language processing, pattern recognition, and more using a wide range of input data including images, video, audio, and text.[14]

Flask:
Why Flask in Python is used? Flask is a small and lightweight Python web framework that provides useful tools and features that make creating web applications in Python easier. It gives developers flexibility and is a more accessible framework for new developers since you can build a web application quickly using only a single Python file.[15]

Hardware Requirements

- Modern Operating System with x86 64-bit CPU
- Disk Space - 4GB SSD and RAM/Main Memory - 4GB DDR4 3200Mhz

3.2 Non-Functional Requirements

Non functional requirements are the constraints imposed on the functional requirements.

- Having a plain background
- Having a stable background environment
- Having sufficient lighting conditions
- Having a stable platform for the system to reside

3.3 Design Diagram

Design diagram is a diagram which is a visual representations of various parts to the whole project.

Figure 8 represents different modules in the project. The first module is about dataset creation

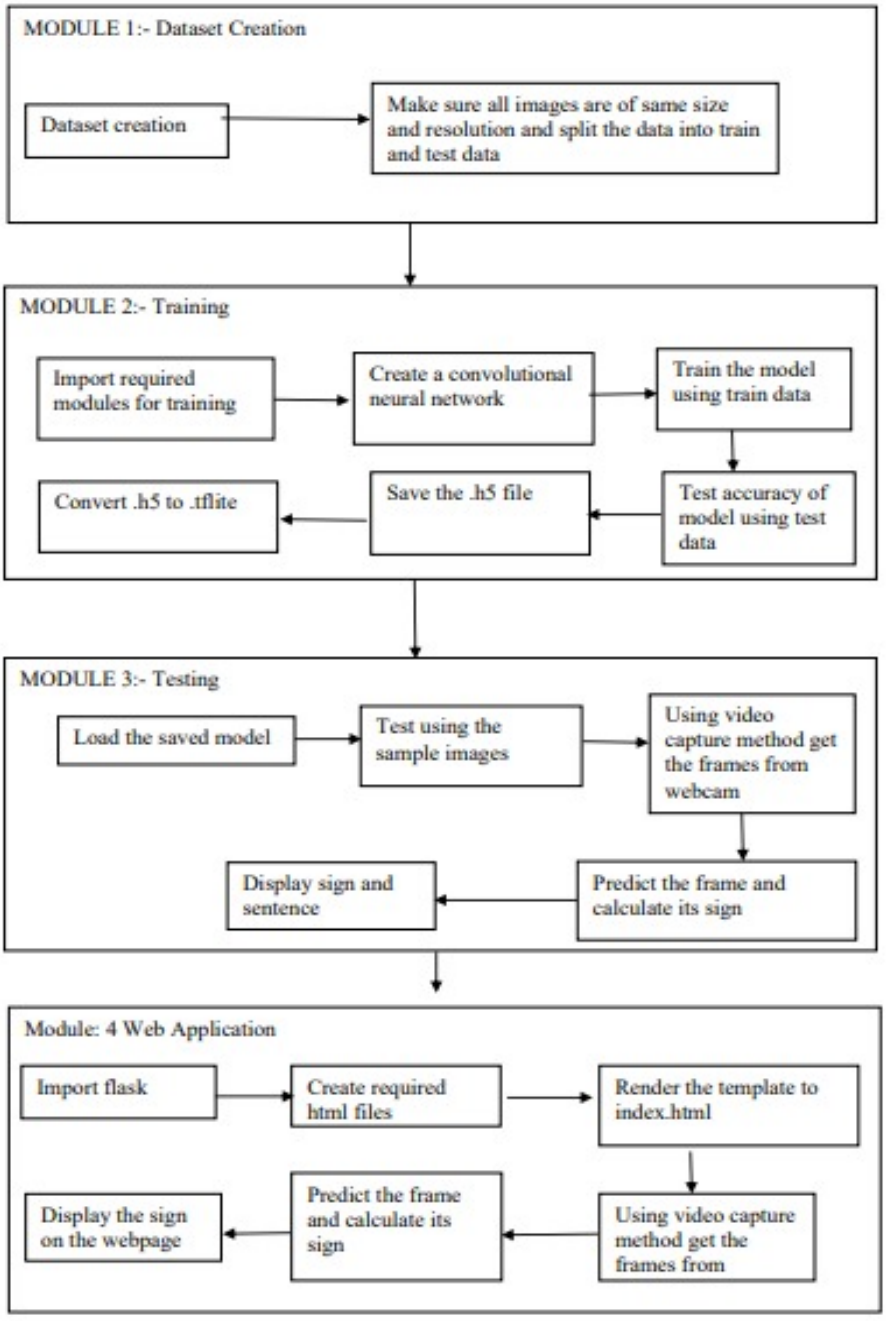


Figure 8: Design Diagram

and splitting the data. The second module is about training using sequential model in keras library. The third module is about testing the model using sample images and also wih open-cv module in real time and the fourth module is about developing a web application

4 PROPOSED SYSTEM

This section includes the process flow diagram and methodology along with the algorithms of modules.

4.1 Process Flow Diagram

A flow diagram displays graphically the project's objective and seeks to more logically order the activities therein.

Figure 9 represents flow chart of the project. this flow chart includes the modules used in the

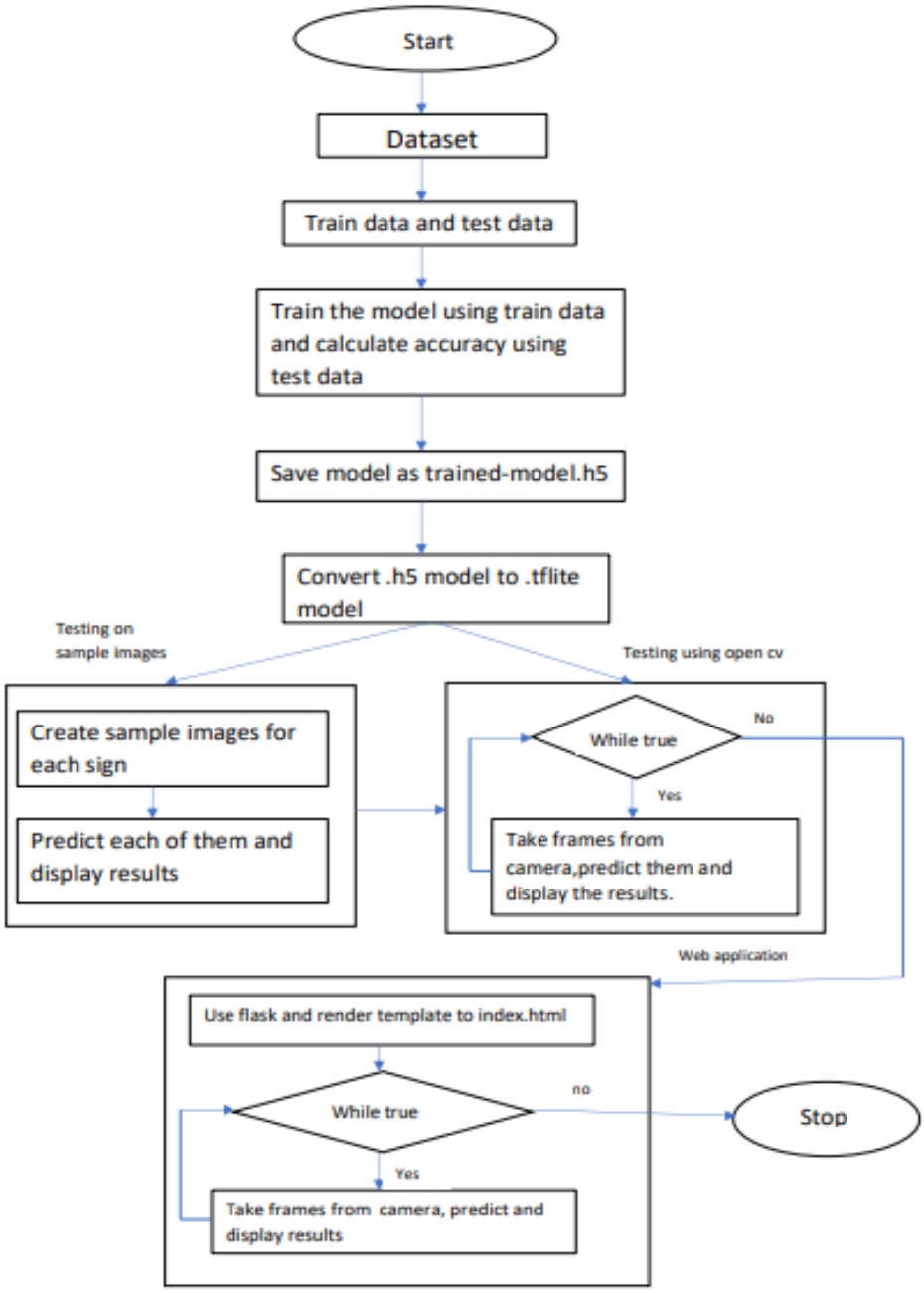


Figure 9: Process flow diagram

project in sequential order. The first two blocks will be first module and the next three block will be second module and the next step represents the training part and the comes the web application module.

4.2 Methodology

The methodology of this project involves four modules. The sign displayed by the user in the prescribed area on the screen will be predicted using the model trained by taking the help of created dataset and the predicted sign is appended to the string sequence. This string sequence will be shown to the user on screen, reflecting the user's intension to convey. The following steps describe the sequence of steps that are followed in project.

- Create the dataset according to the requirement
- Split the dataset into train and test data, containing 80 percent of data in train and rest in test data
- train the model using keras module in convolutional neural network
- Testing the trained model
  - Test the trained model using sample images.
  - Test the model using open-cv module by capturing frames dynamically from the web-cam.
- Developing the web application
  - Capture the image from the camera and do the pre-processing
  - Predict and display the sign
- Exit when completed

4.3 Algorithm

Module-1
Creating the Dataset and splitting them
input:Dataset containing images for each sign
output:Splitting into train and test data

1. Traverse through the directory specified and do
2. if the "train" folder exists
   2.1 delete the folder and contents in it
3. if the "test" folder exits
   3.1 delete the folder and contents in it
4. Create "train" and "test" folder if they don't exist
5. Traverse through the specified dataset folder where all the images created for each sign reside
   5.1 Traverse through every sub-directory in the dataset directory(there are 29 sub-directories, each containing the images for their corresponding signs)
      5.1.1 initialize num to 0.8 percent of the number of images in the current sub-directory and initialize i to 0
      5.1.2 if i <num do:move the image dataset directory to the "train" directory
      5.1.3 else do: move the image dataset directory to the "test" directory
      5.1.4 increment i
6. Display the details of number of images in test and train folders

Module-2
Training on the split data
input:The split dataset in the module 1
output:Obtaining the trained model

1. import required libraries
2. create an reference for “Sequential” model in keras Library
3. Add the “Conv2D” layers to the convolutional neural network with increasing number of units in each layer
4. Add a final “Dense” layer with 29 units
5. Compile the model with appropriate metics.
6. Use ImageDataGenerator in keras.preprocessing library to prepare train data by including real time data
7. Use ImageDataGenerator in keras.preprocessing library to compile the testing images
8. Evaluate the model using the train calculate accuracy using test data
9. save the model

Module-3
Testing on the trained model
input:sample images for each sign to test
output:Observing the behaviour of model

1. Load the saved model
2. Convert the keras .h5 model to .tflite model
3. Traverse through the images in the sample images folder
   3.1 Load the image
   3.2 resize the image according to model
   3.3 predict the image and display the predicted alphabet
4. import cv2
5. use video capture for capturing the frames
6. while True do
   6.1 Capture the frame
   6.2 resize the image
   6.3 predict the image and append the alphabet to a “sequence” string display the sequence predicted alphabet
7. Close the application

Module-4
Developing the web application
input:trained model, the labels and index.html
output:web application

1. import the flask library
2. assign the reference the flask to a variable
3. render the template to index.html images folder
4. While True do
   4.1 get the frame and the predicted sign from camera.py (Camera.py will capture the frame, predict it and Return the predicted sign and the frame to be displayed on the webpage)
5. append the sign returned to sequence string
6. pass the frame and the sequence to the webpage and display them on the screen
7. Exit when closed the application

5 IMPLEMENTATION

This section represents the implementation part for all the modules involved in our project.

5.1 Output Screen Shots

Module-1

Module-1 involves the creation of dataset consisting of images for all the signs corresponding to English alphabets.It also involves making sure that all images are of same resolution and involves splitting the dataset into train and test data.It also involves splitting the data into train and test data. Figure 10 represents splitting done on the created dataset and represents the successful working of the module 1

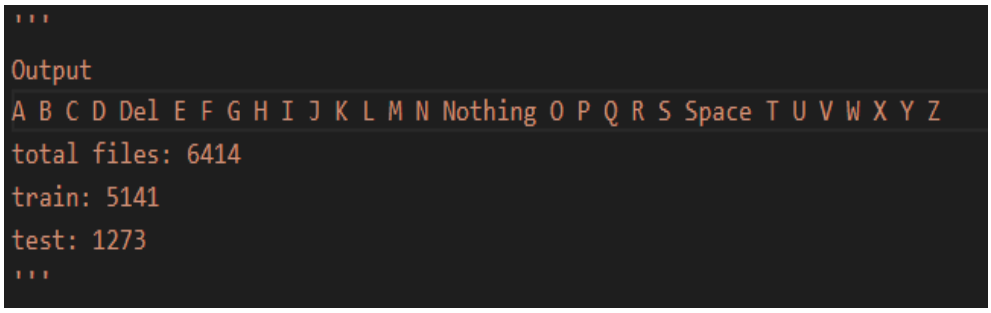


Figure 10: Module-1 output

Module-2 output

Module-2 involves training the model using Convolutional neural networks on the collected dataset.Accuracy matters a lot in prediction.It also involves training using sequential model in keras library. Figure 11 represents the training done on dataset and it also represents the successful working of the module 2

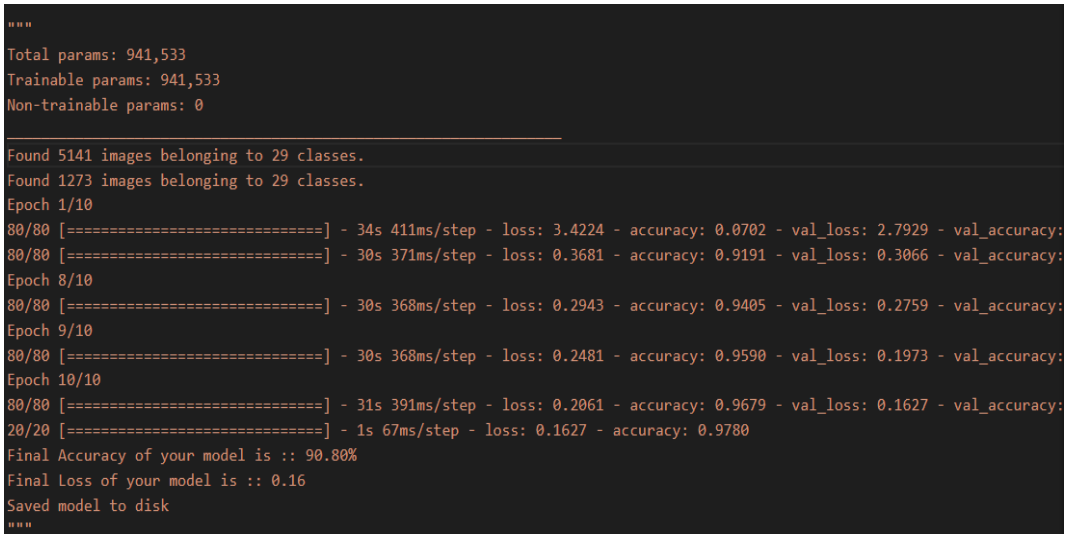
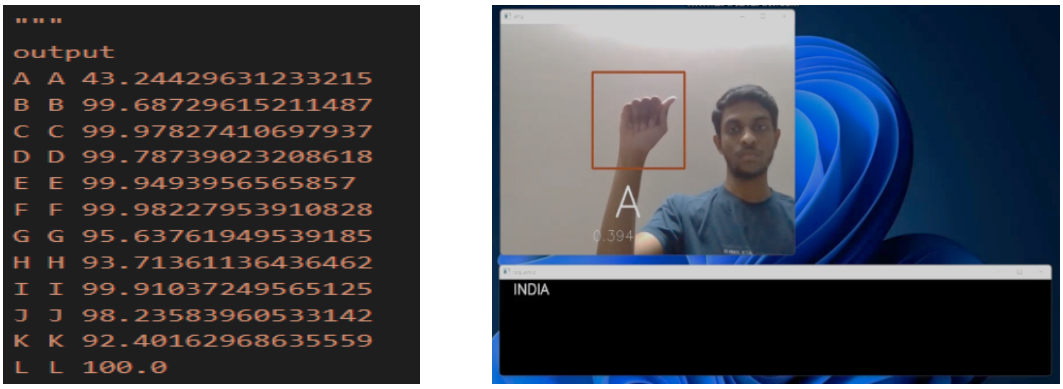


Figure 11: Module-2 output

Module-3 output

Module-3 involves collecting a random single image for every sign in the dataset and giving it as input to the model and testing the accuracy of the model.It also involves testing using opencv module in real time. It take frames from the web-cam, captures them , predicts them and displays the sign to the user. Figure 12 represents testing done on the trained model using



(a) Testing with sample images (b) Testing with open-cv

Figure 12: Module-3 output

sample images and also with open-cv module.It also represents the successful working of the module 3

Module-4 output

On opening the application, the camera will be switched on and the sign shown by the user in the prescribed area will be captured and will be sent for prediction. The corresponding English alphabet predicted will be displayed on the screen. The sentence displayed on the web page reflects the actual meaning of the message that the user wants to convey. Figure 13 represents the prototype of the project.It also represents the successful working of the module 4

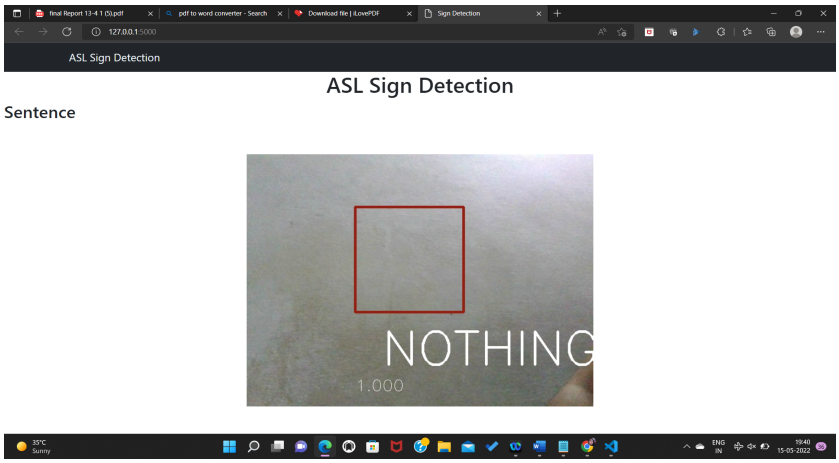


Figure 13: Module-4 output

5.2 Test Cases

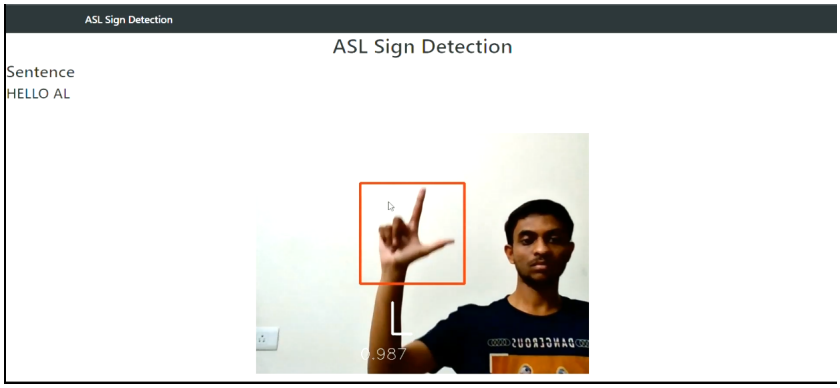
Test cases for this project involves

- Testing to random images taken for each sign corresponding to each alphabet
- Taking image from the web-cam in run time and predicting it.

5.3 Results and Analysis

In the web application the sign displayed in the prescribed area will be captured and will be resized according to the target size and will be given for prediction. The corresponding sign is calculated from the prediction results. Each sign will be appended to the sequence and will

(a) Displaying 'H'



(b) Displaying 'L'

Figure 14: Working-1

convey the user's intension. The following figures depict the working of the web application developed using flask framework. Figure 14 denotes, displaying of letter 'H' and 'L' on screen corresponding to its sign shown
Figure 14 denotes displaying of sign corresponding to the letter 'H' and 'L'. The signs shown by the user are being appended to the sequence and the sequence is displayed on the screen reflecting the message that the user wants to convey. In the next step the 'L' will be appended to sequence and the sentence 'HELLO ALL' will be displayed on the screen. This indicates the successful process of communication. Considering another example:

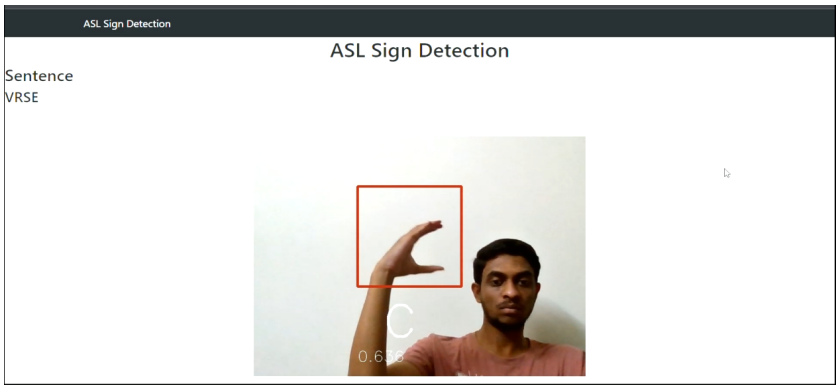
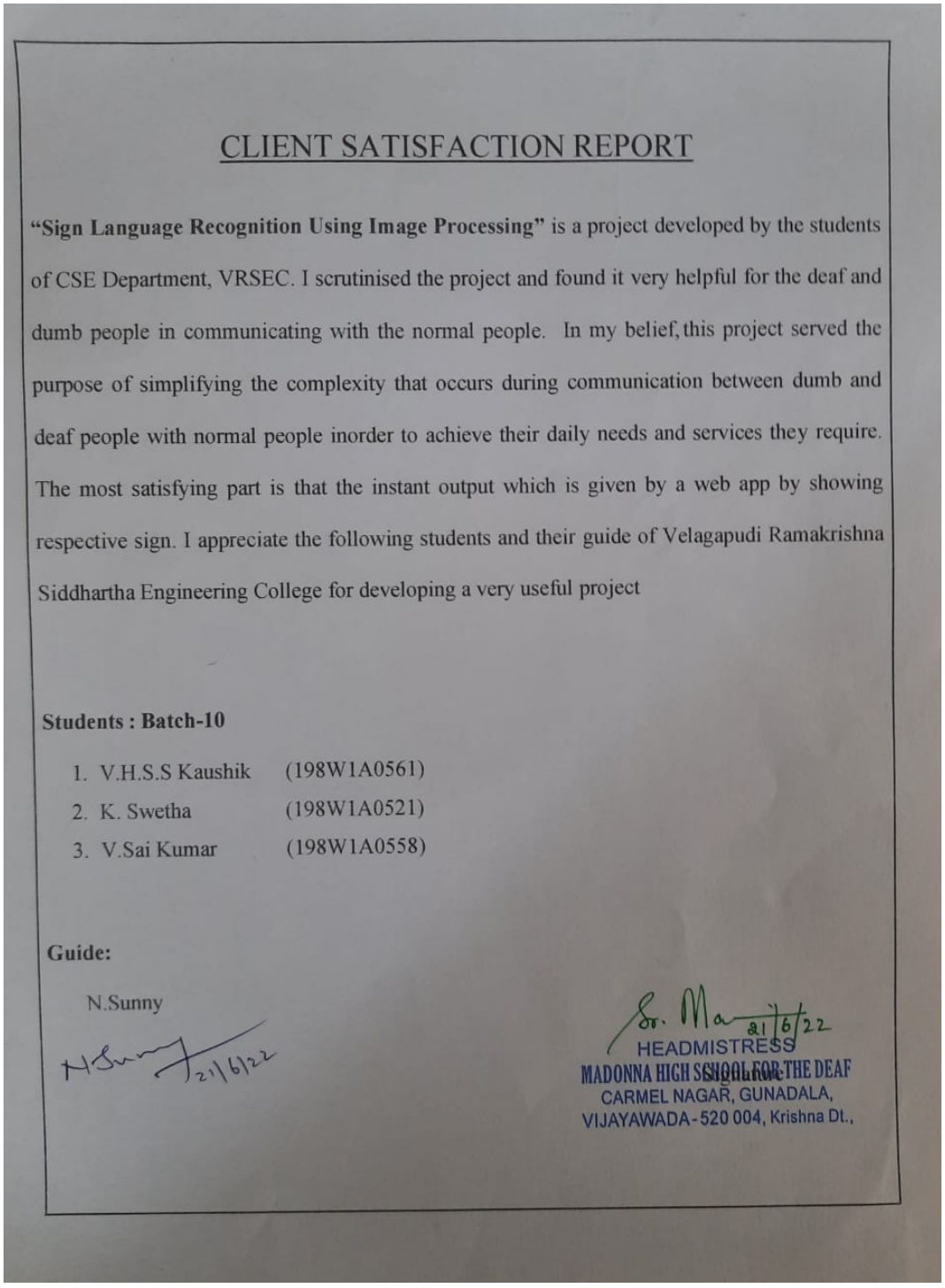


Figure 15: Working-2

In Figure 15, the message that is to be conveyed is "VRSEC". All the signs displayed are appended and make a sequence "VRSE". In the next step the "C" will also be appended and makes the word "VRSEC" which means our college Velagapudi Ramakrishna Siddhartha Engineering College.

5.4 Client Satisfaction Report

Client Satisfaction report says that the client has been satisfied with the project done. Figure 16 represents the satisfaction of the client with this project



CLIENT SATISFACTION REPORT

"Sign Language Recognition Using Image Processing" is a project developed by the students of CSE Department, VRSEC. I scrutinised the project and found it very helpful for the deaf and dumb people in communicating with the normal people. In my belief, this project served the purpose of simplifying the complexity that occurs during communication between dumb and deaf people with normal people inorder to achieve their daily needs and services they require. The most satisfying part is that the instant output which is given by a web app by showing respective sign. I appreciate the following students and their guide of Velagapudi Ramakrishna Siddhartha Engineering College for developing a very useful project

Students : Batch-10

1. V.H.S.S Kaushik (198W1A0561)
2. K. Swetha (198W1A0521)
3. V.Sai Kumar (198W1A0558)

Guide:

N.Sunny

21/6/22

Sr. Ma 21/6/22
HEADMISTRESS
Signature
MADONNA HIGH SCHOOL FOR THE DEAF
CARMEL NAGAR, GUNADALA,
VIJAYAWADA-520 004, Krishna Dt.,

Figure 16: Client Satisfaction Report

Figure 16 represents the satisfaction of client with the project that was shown to them.

6 CONCLUSION AND FUTURE WORK

This section includes the conclusion of the project and future work

The proposed project aims in translation of the sign language to the English language.The sign displayed by the user in the prescribed area on the screen will be predicted using the model trained by taking the help of created dataset and the sign will be calculated from the labels available. The predicted sign will be appended to the string sequence. This string sequence will be shown to the user on screen, reflecting the user's intension to convey.In this way, the message that the user wants to convey will be displayed on the screen.

The future developments include developing it in such a way that it will work in any environmental conditions and the background of the user will not matter in the process of prediction. It could be extended in such a away that it can predict in all the available languages. Having more accuracy does not mean that all the predictions done will be correct. This project can be developed in such a way that is can perform predictions accurately. It can be improved in such that the predictions will be accurate and will be provided without latency. Each letter will be given equal importance and each of it will be equally trained and can be made sure that all of them will be predicted spontaneously when the gesture is shown without any delay. It can be developed to predict most frequently used words also.

References

[1] Yubin Liu, and Sivaparthipan, C B and Shankar, Achyut.*Human–computer interaction based visual feedback system for augmentative and alternative communication*,[Last Accessed on 21-05-2022]

[2] Sit, Muhammed and Demiray, Bekir and Xiang, Zhongrun and Ewing, Gregory and Sermet, Yusuf and Demir, Ibrahim.*A comprehensive review of deep learning applications in hydrology and water resources*,[Last Accessed on 21-05-2022]

[3] Machine Learning.*https://data-flair.training/blogs/machine-learning-tutorial/*,[Last Accessed on 21-05-2022]

[4] Farman Shah Muhammad Saqlain Shah; Waseem Akram; Awais Manzoor; Rasha Orban, *Sign Language Recognition Using Multiple Kernel Learning" , IEEE , 2021, Volume 9 , 67548-67558.*

[5] Muhammad Al-Qurish; Thariq Khalid; Riad Souissi, *Deep Learning for Sign Language Recognition" , IEEE , 2021 , Volume 9 ,126917-126951*

[6] Mohammed A.Bencherif; Mohammed Algabri;Mohammed A,Mekhtiche;Mohammed Faisal;Mansouri Alsulaiman, *Arabic Sign Language Regonition System using 2D Hands and Body Skeleton Data", IEEE, March 2021, Volume 9 , 59612-59627*

[7] Saleh Aly; And Walaa Aly, *DeepArSLR: A Novel Signer-Independent Deep Learning Framework for Isolated Arabic Sign Language Gesture Recognition", IEEE , April 2020, Volume 8 , 83199-83212*

[8] Muneer Al-Hammadi;Ghulam Muhammad; Wadood Abdul; Mansour Alsulaiman , *Hand Gesture Recognition for Sign Language using 3DCNN" , IEEE , April 2020, Volume 8 , 79491-79509.*

[9] Ilias Papastraits; Kosmas Dimitropolous; Dimitro Konstantinidis; And Petros Daras ,*Continous Sign Language Recognition Through Cross-Modal Alignment of Video and Text Embedding in a Joint-Latent Space", IEEE, April 2020, Volume 8 , 91170-91180.*

[10] Tewodros Legesse Munea ; Yalew Zelalem Jembre, Halefom Tekle Weldegerbriel , Longbiao Chen *The Progress of Human Pose Estimation: A Survey and Taxonomy of Models Applied in 2D Human Pose Estimation" , IEEE, June 2020, Volume 8 , 133330-133348.*

[11] Wei Li ; Zhaowei Qu ; Haiyu Song ; Pengjie Wang ; Bo Xue , *The Traffic Scene Understanding and Prediction Based on Image Captioning" ,IEEE , 24 Dec 2020 , Volume 9 , 1420-1427.*

[12] Open-CV is a tool used for image processing.*https://pypi.org/project/opencv-python/*,[Last Accessed on 21-05-2022]

[13] keras is a module used for training the model.*https://keras.io/*,[Last Accessed on 21-05-2022]

[14] Tesnsorflow lite will generate a light-weight model used in almost all web and mobile applications.*https://www.tensorflow.org/lite/models*,[Last Accessed on 21-05-2022]

[15] Flask is a framework in python used to develop web applications.*https://flask.palletsprojects.com/en/2.1.x/*,[Last Accessed on 21-05-2022]