# DAYANANDA SAGAR UNIVERSITY
## KUDLU GATE, BANGALORE – 560068


**Bachelor of Technology**
**in**
**COMPUTER SCIENCE AND ENGINEERING**

# Major Project Phase-II Report

***"HAND GESTURE RECOGNITION"***

By
**ARVIN PRADHAN – ENG17CS0038**
**ABDULLAH ALAWI AHMED ALHAMED- ENG17CS0002**
**ABDULRAHMAN SALEH SALEM HADI SAQRAN - ENG17CS0004**

Under the supervision of
*Dr. Debanjali Bhattacharya,*
Assistant Professor, Department of Computer science and Engineering.

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING,**
**SCHOOL OF ENGINEERING**
**DAYANANDA SAGAR UNIVERSITY,**
**BANGALORE**
**(2021-2022)**

**DAYANANDA SAGAR UNIVERSITY**

**School of Engineering**
**Department of Computer Science & Engineering**
Kudlu Gate, Bangalore – 560068
Karnataka, India

# CERTIFICATE

This is to certify that the Phase-II project work titled "HAND GESTURE RECOGNITION" is carried out by **Arvin Pradhan (ENG17CS0038), Abdullah Alawi Ahmed Alhamed (ENG17CS0002), Abdulrahman Saleh Salem Hadi Saqran (ENG17CS0004),**bona fide students of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering, during the year 2021-2022.

| **Dr. Debanjali Bhattacharya** | **Dr Girisha G S** | **Dr. A Srinivas** |
|---|---|---|
| Assistant Professor<br>Dept. of CS&E,<br>School of Engineering<br>Dayananda Sagar<br>University | Chairman CSE<br>School of Engineering<br>Dayananda Sagar<br>University | Dean<br>School of<br>Engineering<br>Dayananda Sagar<br>University |
| Date: | Date: | Date: |

| **Name of the Examiner** | **Signature of Examiner** |
|---|---|
| 1. | |
| 2. | |

# DECLARATION

We, **Arvin Pradhan (ENG17CS0038), Abdullah Alawi Ahmed Alhamed (ENG17CS0002), Abdulrahman Saleh Salem Hadi Saqran (ENG17CS0004**), are students of the seventh semester B. Tech in Computer Science and Engineering, at School of Engineering, Dayananda Sagar University, hereby declare that the phase-II project titled "Title" has been carried out by us and submitted in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering during the academic year 2021-2022.

**Student** **Signature**

**Name1:**
**USN:**
**Name2**
**USN:**
**Name3:**
**USN:**

**Place: Bangalore**
**Date:**

# ACKNOWLEDGEMENT

It is a great pleasure for us to acknowledge the assistance and support of many individuals who have been responsible for the successful completion of this project work.

First, we take this opportunity to express our sincere gratitude to School of Engineering & Technology, Dayananda Sagar University for providing us with a great opportunity to pursue our Bachelor's degree in this institution.

We would like to thank **Dr. A Srinivas. Dean**, **School of Engineering & Technology**, **Dayananda Sagar University** for his constant encouragement and expert advice. It is a matter of immense pleasure to express our sincere thanks to **Dr. Girisha G S, Department Chairman**, **Computer Science, and Engineering**, **Dayananda Sagar University,** for providing the right academic guidance that made our task possible.

We would like to thank our guide **Dr. Debanjali Bhattacharya, Assistant Professor**, **Dept. of Computer Science and Engineering**, **Dayananda Sagar University**, for sparing her valuable time to extend help in every step of our project work, which paved the way for smooth progress and the fruitful culmination of the project.

We would like to thank our Project Coordinator Dr. Meenakshi Malhotra and all the staff members of Computer Science and Engineering for their support.

We are also grateful to our family and friends who provided us with every requirement throughout the course. We would like to thank one and all who directly or indirectly helped us in the Project work.

# ABSTRACT

Hand gesture recognition is very significant for human-computer interaction. In this work, we present a novel real-time method for hand gesture recognition. In our framework, the hand region is extracted from the background with the background subtraction method. Then, the palm and fingers are segmented so as to detect and recognize the fingers. Finally, a rule classifier is applied to predict the labels of hand gestures. The experiments on the data set of 1300 images show that our method performs well and is highly efficient. Moreover, our method shows better performance than a state-of-art method on another data set of hand gestures In our country, there is a lack of contact with deaf people. The invention of Sign Language (SL) was made to solve this hurdle. Sign language uses symbols that are visually transmitted sign signals to relay information to common people. Autism Spectrum Disorder sufferers may benefit from sign language as well (ASD). Deaf people use signs that normal people don't get so they don't know what they say. This dilemma is addressed by the scheme presented here. A camera is used in this method to record different hand movements. After that, the image is processed using different algorithms. Pre-processing of the image is the first step. The edges are then calculated using an edge detection algorithm. Finally, the symbol is identified and the text is shown using a template-matching algorithm. Since the display is text, it is simple to decipher the context of a given symbol. It also makes it possible to communicate with deaf people. The implementation of the system is by using OpenCV-Python, CNN. The system uses various libraries.

# TABLE OF CONTENTS

# LIST OF FIGURES

# CHAPTER 1

# INTRODUCTION

The People who are deaf or deaf-blind use sign language as a way of communicating. A sign language is made up of a variety of signs made up of different hand forms, motions, and orientations. In today ‘s world, the computers have become an important aspect of life and are used in various fields however, the systems and methods that we use to interact with computers are outdated and have various issues, which we will discuss a little later in our project. Hence, a very new field trying to overcome these issues has emerged namely HUMAN COMPUTER INTERACTIONS (HCI). Although, computers have made numerous advancements in both fields of Software and Hardware, Still the basic way in which Humans interact with computers remains the same, using basic pointing device (mouse) and Keyboard or advanced Voice Recognition System, or maybe Natural Language processing in really advanced cases to make this communication more human and easier for us. Our proposed project is the Hand gestures recognition system to replace the basic pointing devices used in computer systems to reduce the limitations that stay due to the legacy systems such as mouse and Touchpad. The proposed system uses hand gesture, mostly no of fingers raised within the region of Interest to perform various operations such as Play, Pause, seek forward, seek back word in video player (for instance VLC media player). A static control board restrains the versatility of client and limits the capacity of the client like a remote can be lost, dropped or broken while, the physical nearness of client is required at sight of activity and that is a limitation of the user. Not just as a means of communication for the impaired ones but Hand gestures is one of the prime communication methods. Not just as a means of communication for the impaired ones but in many of the environments where language communications cannot be made, hand gestures can deliver the messages to achieve the purpose of communication.

## 1.1 Background

Hand gestures are one of best way for people with disabilities to speak and communicate with the normal people. A gesture in a sign language is a particular moment of hand with which specific shapes are made out of them. A design for recognizing the sign formats and interpreting them is done. This acts as a means between the impaired ones and the normal person being successful in conveying the information rendered by the impaired ones to the normal person. Gesture recognition has been a very interesting problem in Computer Vision community for a long time. In our project we are introducing Hand Gesture Recognition, which will display messages based on the input gestures. We have also used Unicode to print the text messages in different languages on the python shell. Gesture recognition can be used to communicate merely through gestures without any physical link with the actual machine. Using gesture recognition, a person can point at the computer screen and use gesture to select and use different applications in the device. Image processing is usually used for gesture recognition as it provides features like pattern recognition, texture understanding, content-based retrieval, compression and many more. Convert that segmented image into binary, apply feature extraction on the binary image, for extraction of the features the techniques used are distance transformation. All input images are captured by web camera. The output text is displayed on the screen based on the gesture showed to the camera.

## 1.2 Motivation

Hand gestures are one of best way for people with disabilities to speak and communicate with the normal people. A gesture in a sign language is a particular moment of hand with which specific shapes are made out of them. A design for recognizing the sign formats and interpreting them is done. This acts as a means between the impaired ones and the normal person being successful in conveying the information rendered by the impaired ones to the normal person.

## 1.3 Problem Statement

Sign Language is most accepted and meaningful way of communication for deaf and dumb people of the society. If a random person pays a visit to a deaf person who is having a problem and attempts to describe it, it is incredibly difficult to grasp what he is trying to say. For the deaf person, a delay in detecting his Sign Language may become a major issue. These people are unable to live a regular life. Any step of the way, they run into contact difficulties. They still have constraints and limits set on their aspirations and career ambitions. As a consequence, they feel demotivated and develop an inferiority complex.
Essentially, we have identified a lack of communication with people with disabilities. Mainly due to not knowing the language, even social awkwardness and so on.

## 1.4 Aim and Objective

Hand Gesture recognition system provides us an innovative, natural, user friendly way of interaction with the computer which is more familiar to human beings. Gesture Recognition has a wide area of application including human machine interaction, sign language, immersive game technology etc. By keeping in mind, the similarities of human hand shape with four fingers and one thumb, our project aims to present a real time system for hand gesture recognition on the basis of detection of some meaningful shape-based features like orientation, centre of mass (centroid), status of fingers, thumb in terms of raised or folded fingers of hand and their respective location in image i.e.;

- Using technologies to benefit humanity
- This would make education more accessible to a greater number of people.
- The system will catch hand gestures and navigate words in text format, which it would use to allow muted people to see and understand the sentences.
- It can also be used by blind people who need to communicate with non-blind people (via speech recognition).

## 1.5 Scope

Sign languages pose the challenge that they're multi-channel; conveying meaning through many modes at once. While the studies of signing linguistics are still in their early stages, it's already apparent that this makes many of the techniques used by speech recognition unsuitable for SLR. In addition, publicly available data sets are limited, affecting many traditional deep learning algorithms improper for the task of building classifiers. However, even given the shortage of translation tools, most public services aren't translated into sign. There is no commonly-used, written sort of sign language, so all written communication is within the local speech. The system are often useful for static ASL numeral signs only. The ASL recognizer system can't be considered as an entire system, as for complete recognition of sign language, we've to incorporate ASL alphabets, words and sentences. These signs can be included in future. Also, other feature extraction algorithms can be used for this purpose. Shape and other features using other existing methods can be included in conducting experiments for improvement in the results. Other classifiers like multi class Support Vector Machine (SVM) and Linear Discriminant Analysis (LDA) or a combination of these classifiers can be included to improve the recognition rate.

# CHAPTER 2

# Literature survey

## 2.1 Literature Survey

### Study of Sign Language Translation using Gesture Recognition [2015]

Communication is an integral part of human life. But for people who are mute & hearing impaired, communication is a challenge. To understand them, one has to either learn their language i.e. sign language or finger language. The system proposed in this project aims at tackling this problem to some extent. In this paper, the motivation was to create an object tracking application to interact with the computer, and develop a virtual human computer interaction device. The motivation behind this system is two-fold. It has two modes of operation: Teach and Learn. The project uses a webcam to recognize the hand positions and sign made using contour recognition and outputs the Sign Language in PC onto the gesture made. This will convert the gesture captured via webcam into audio output which will make normal people understand what exactly is being conveyed. Thus, our project Sign Language to Speech Converter aims to convert the Sign Language into text and audio.

### Intelligent Sign Language Recognition Using Image Processing [2013]

Computer recognition of sign language is an important research problem for enabling communication with hearing impaired people. This project introduces an efficient and fast algorithm for identification of the number of fingers opened in a gesture representing an alphabet of the Binary Sign Language. The system does not require the hand to be perfectly aligned to the camera. The project uses image processing system to identify, especially English alphabetic sign language used by the deaf people to communicate. The basic objective of this project is to develop a computer based intelligent system that will enable dumb people significantly to communicate with all other people using their natural hand gestures. The idea consisted of designing and building up an intelligent system using image processing, machine learning and artificial intelligence concepts to take visual inputs of sign language's hand gestures and generate easily recognizable form of outputs. Hence the objective of this project is to develop an intelligent system which can act as a translator between the sign language and the spoken language dynamically and can make the

communication between people with hearing impairment and normal people both effective and efficient. The system is we are implementing for Binary sign language but it can detect any sign language with prior image processing.

## Segment, Track, Extract, Recognize and Convert Sign Language Videos to Voice/Text [2012]

This paper summarizes various algorithms used to design a sign language recognition system. Sign language is the language used by deaf people to communicate among themselves and with normal people. We designed a real time sign language recognition system that can recognize gestures of sign language from videos under complex backgrounds. Segmenting and tracking of non-rigid hands and head of the signer in sign language videos is achieved by using active contour models. Active contour energy minimization is done using signers' hand and head skin colour, texture, boundary and shape information. Classification of signs is done by an artificial neural network using error back propagation algorithm. Each sign in the video is converted into a voice and text command. The system has been implemented successfully for 351 signs of Indian Sign Language under different possible video environments. The recognition rates are calculated for different video environments.

## Sign Language Recognition Using Image Processing [2017]

One of the major drawbacks of our society is the barrier that is created between disabled or handicapped persons and the normal person. Communication is the only medium by which we can share our thoughts or convey the message but for a person with disability (deaf and dumb) faces difficulty in communication with normal person. For many deaf and dumb people, sign language is the basic means of communication. Sign language recognition (SLR) aims to interpret sign languages automatically by a computer in order to help the deaf communicate with hearing society conveniently. Our aim is to design a system to help the person who trained the hearing impaired to communicate with the rest of the world using sign language or hand gesture recognition techniques. In this system, feature detection and feature extraction of hand gesture is done with the help of SURF algorithm using image processing. All this work is done using MATLAB software. With the help of this algorithm, a person can easily have trained a deaf and dumb.

## Real-Time Hand Gesture Recognition Using Finger Segmentation [2014]

Hand gesture recognition is very significant for human-computer interaction. In this work, we present a novel real-time method for hand gesture recognition. In our framework, the hand region is extracted from the background with the background subtraction method. Then, the palm and fingers are segmented so as to detect and recognize the fingers. Finally, a rule classifier is applied to predict the labels of hand gestures. The experiments on the data set of 1300 images show that our method performs well and is highly efficient. Moreover, our method shows better performance than a state-of-art method on another data set of hand gestures.

## An Efficient Approach for the Recognition of Hand Gestures from Very Low-Resolution Images

In this paper, a simple and effective move toward for the recognition of hand gestures from very low-resolution images was projected. Improvement of the low-resolution images has always been the focus in the dispensation of the digital images. Images with declaration as low as [50×50 pixels] are also taken for recognition. The gestures under thought here were the number of fingers (one, two, three, four or five) increased by the person. The less resolution gesture picture capture from mobile phone, web camera, or low-cost cameras was processed methodically to amount produced the number of fingers raised. Simple logic of the geometry of the hand has been used for the identification of hand gesture from the input low declaration images. The projected method extracts the hand gesture directly from the low-resolution image without the need of renovation to a high-resolution image or use of any classifier. The proposed method is based on the creation of a mask for the image which was vital in the recognition of the hand gesture recognition.

## To Analyze Hand Gesture Recognition for Electronic Device Control

Almost all purchaser electric apparatus equipment today utilizes isolated controls for user interfaces. Although, the type of individual types and focused directions that each isolated order distinctiveness furthermore raises many Problems: the adversity in locating the needed inaccessible command, the disorder with the button design, the substitution topic and so on. The buyer electronics domination design utilizes hand signs was a new inventive client interface that resolves the problems of using many inaccessible controls for household machines. We advise such a method for automatically identify a restricted set of signs from hand resemblance for electronics equipment command purpose by means of straddling consecutive facts and figures outcome from PC to wireless device manager circuits. Hand gesture recognition was a challenging difficulty in its universal form. We address a fixed set of physical commands and a logically organised natural situation, and go forward an easy, yet productive, method for sign recognition.

## Analysis of Hand Gesture Recognition

Human gesture recognition was a stimulating research area. Hand gesture recognition could have marvelous applications in Human Computer interface. The mouse and keyboard were presently the main interface between man and computer. There was a need of mechanized hand that could perform events like human hand in real time application, as it was not probable for human to reach up to every object due to not easy environment. In other areas where 3D series was required, such as computer games, robotics and design, other mechanical strategy such as roller-balls, joysticks and data-gloves were used. User would perform gesture according to the act as he wanted to be done by robotic hand. The capability to recognize human gestures open up a broad range of probable applications such as automatic identification of sign language to make possible communication with the hearing impair, using gestures as input to explain the sentiment of a gesturing person. A variety of researchers was proposed unlike approach for real time gesture recognition.

# CHAPTER 3

# PROJECT DESCRIPTION

## 3.1 Overall Structure

The model used in this classification task is a fairly basic implementation of a Convolutional Neural Network (CNN). As the project requires classification of images, a CNN is the go-to architecture. The basis for our model design came from Using Deep Convolutional Networks for Gesture Recognition in American Sign Language paper that accomplished a similar ASL Gesture Classification task [4]. This model consisted of convolutional blocks containing two 2D Convolutional Layers with ReLU activation, followed by Max Pooling and Dropout layers. These convolutional blocks are repeated 3 times and followed by Fully Connected layers that eventually classify into the required categories. The kernel sizes are maintained at 3 X 3 throughout the model. Our originally proposed model is identical to the one from the aforementioned paper, this model is shown in Figure 5. We omitted the dropout layers on the fully connected layers at first to allow for faster training and to establish a baseline without dropout.

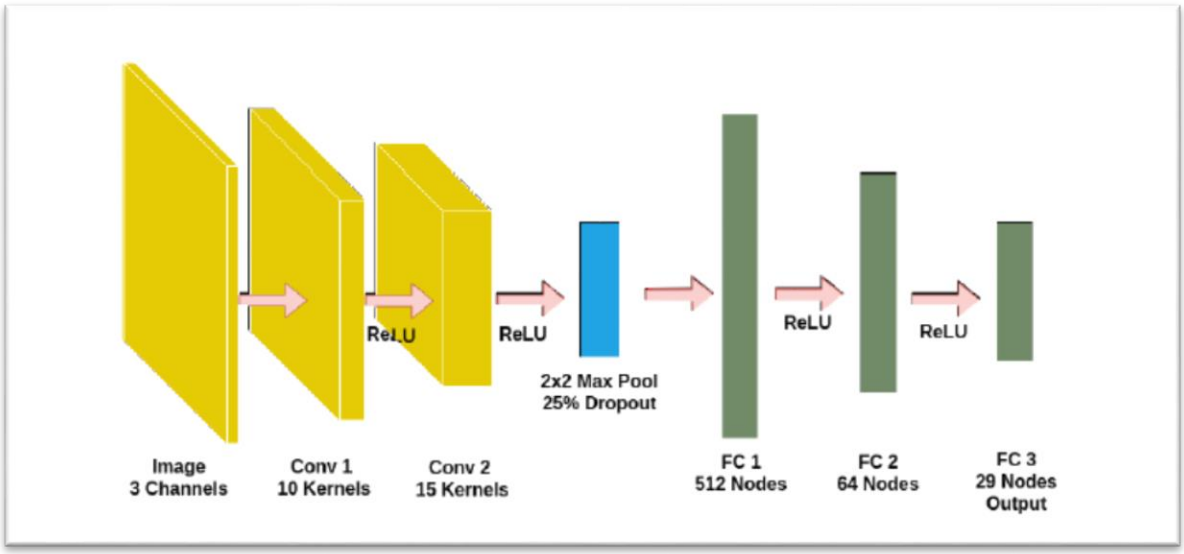


Fig 1: Model Architecture as implemented in Using Deep Convolutional Networks for Gesture Recognition

## 3.2 Convolutional Neural Networks (CNN)

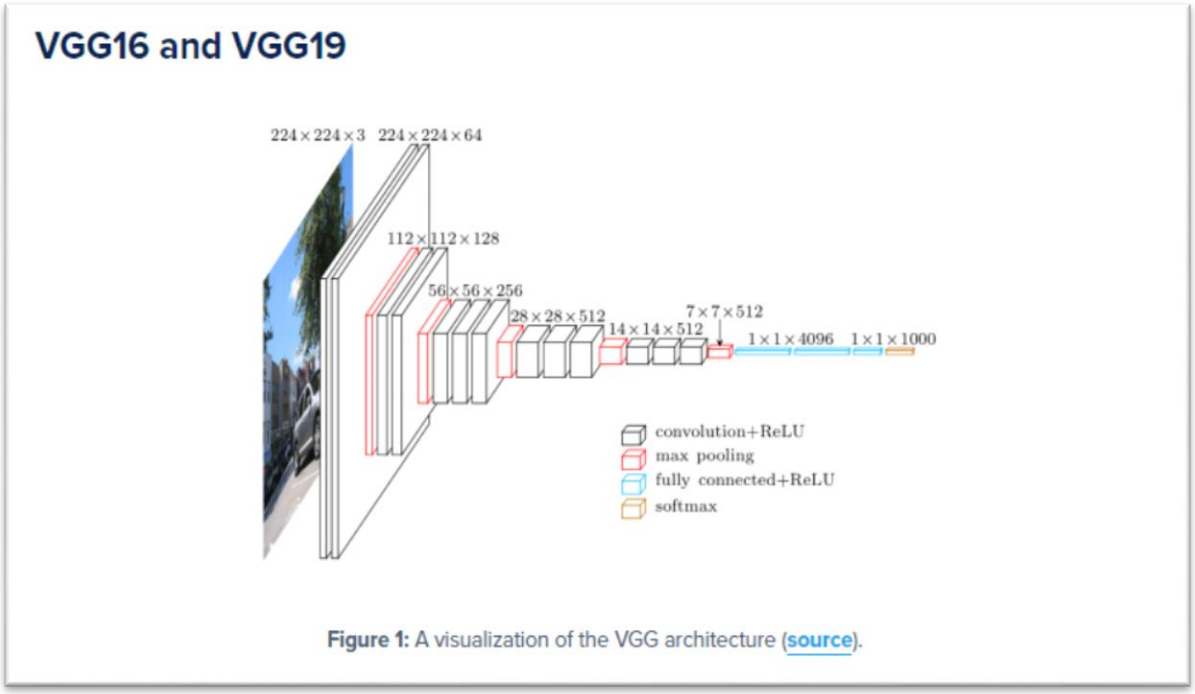


Fig 2: A visualization of the VGG architecture

Each layer in a CNN applies a different set of filters, typically hundreds or thousands of them, and combines the results, feeding the output into the next layer in the network. During training, a

CNN automatically learns the values for these filters.

In the context of image classification, our CNN may learn to:

Detect edges from raw pixel data in the first layer.

Use these edges to detect shapes (i.e., “blobs”) in the second layer.

Use these shapes to detect higher-level features such as facial structures, parts of a car, etc.in the highest layers of the network.

The last layer in a CNN uses these higher-level features to make predictions regarding the Contents of the image.

In terms of deep learning, an (image) convolution is an element-wise multiplication of two matrices followed by a sum.

1. Take two matrices (which both have the same dimensions).
2. Multiply them, element-by-element (i.e., not the dot product, just a simple multiplication).
3. Sum the elements together.

VGG-16 is a transfer learning model that also helps in classification of different types of images and also due to its uniform architecture and having 138 Million parameters it is considered to be one of the best models used for image processing. By importing the vgg-16 model from python libraries we can train our training data and validate the testing data.

## 3.4 SYSTEM ARCHITECTURE

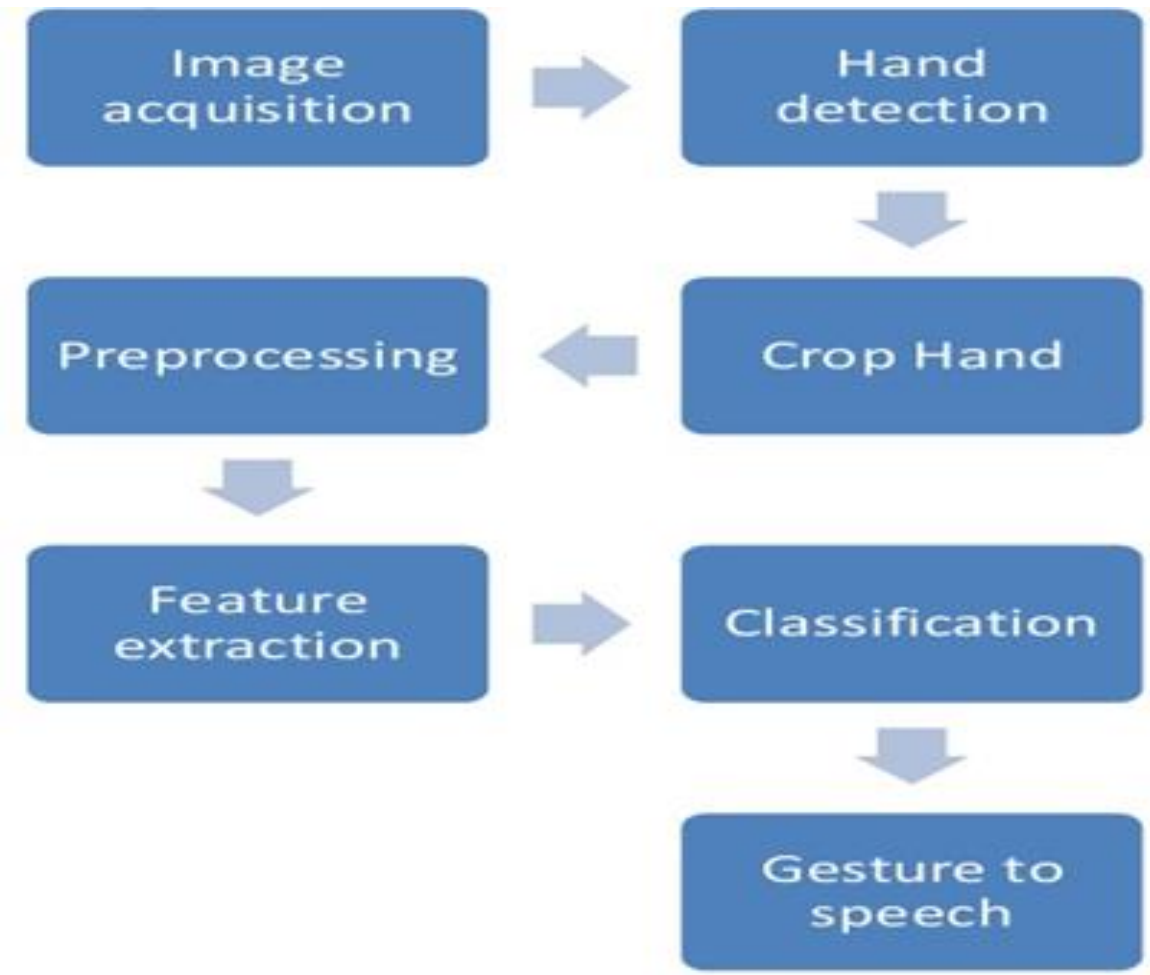


Fig 3: Flow chart of the system

The first step is image acquisition where GUI will allow the user to capture the scene.
Next step is to detect the hand and separate it from the scene from the obtained image because only hand is needed to make the classification. If hand is not separated from the scene, then it might affect the precision of the prediction. This step is followed by pre-processing where firstly the image is converted into greyscale image and then to edged format so that the classification in made based on shape. After this process factors like

background and colors won't affect the classification. Now the image is passed through VGG model to make the classification. After the classification is made, the text will be visible in the screen. In the end we can add additional features such as text to speech so that the output will be.

Since the pre-processing before going to the convolutional neural networks was simplified to just rescaling, the background will always get passed to the model. In this case, the model needs to be able to recognize a sign despite the different backgrounds it can have. To improve the generalization capability of the model it was artificially added more images with different backgrounds replacing the green backgrounds. During the training, it was also added another data augmentation process consisting of performing some transformations, such as some rotations, changes in light intensity, and rescaling. The models were evaluated in a test set with data corresponding to a normal use of the system in indoors, in other words, in the background it appears a person acting as the observer, similar to the input image in the figure above (*Convolutional neural networks architecture*).

## 3.4 Component Design

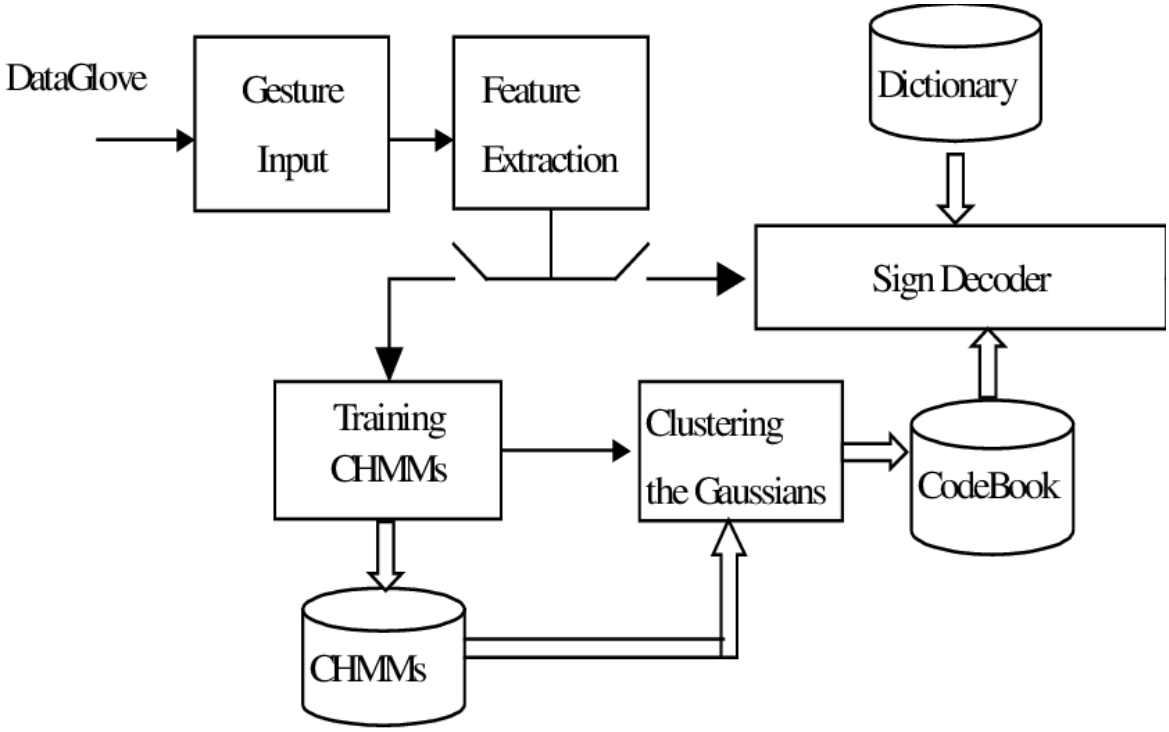

Fig 4: Diagram of component design

To calculate all gesture data from the left hand, right hand and body parts in a well-defined space, we need to consider the modelling of the relative 3D motion of three receivers working with a transmitter. The timely motion of the transmitter will be also considered. 3D motion of receivers can be viewed as the rigid motion. It is well known that 3D displacement of a rigid object in the Cartesian coordinates can be modelled by an affine transformation as the following,

$$X' = R(X - S) \tag{1}$$

where $R$ is a 3×3 rotation matrix,

$$R = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\alpha & -\sin\alpha \\ 0 & \sin\alpha & \cos\alpha \end{pmatrix} \begin{pmatrix} \cos\beta & 0 & \sin\beta \\ 0 & 1 & 0 \\ -\sin\beta & 0 & \cos\beta \end{pmatrix} \begin{pmatrix} \cos\gamma & -\sin\gamma & 0 \\ \sin\gamma & \cos\gamma & 0 \\ 0 & 0 & 1 \end{pmatrix} \tag{2}$$

$$= \begin{pmatrix} \cos\beta\cos\gamma & \cos\beta\sin\gamma & -\sin\beta \\ \sin\alpha\sin\beta\cos\gamma - \cos\alpha\sin\gamma & \sin\alpha\sin\beta\sin\gamma + \cos\alpha\cos\gamma & \sin\alpha\cos\beta \\ \cos\alpha\sin\beta\cos\gamma + \sin\alpha\sin\gamma & \cos\alpha\sin\beta\sin\gamma - \sin\alpha\cos\gamma & \cos\alpha\cos\beta \end{pmatrix}$$

denote the coordinates of the transmitter and receiver respectively, S is the position vector of the receiver with respect to Cartesian coordinate systems of the transmitter. The receiver outputs the data of Eulerian angles, namely, α, β, γ, the angles of rotation about X1 , X2 and X3 axes. Normally these data cannot be used directly as the features because inconsistent

reference might exist since the position of the transmitter might be changed between the processing of training and that of testing. Therefore, it is necessary to define a reference point so that the features are invariant wherever the positions of transmitter and receivers are changed. The idea we propose to fix this problem is as follows. There is a receiver on each hand, and the third receiver is mounted at a fixed position on the body, such as the waist or the back. Suppose that r S, l S , and S are the position vectors of the receivers at right hand, left hand and on the body. It is clear that the product t RRr, t RRl, R( ) S S r − and R( ) Sl − S are invariant to the positions of the transmitter and the signer, where Rl , Rr , and R are the rotation matrix of the receivers at right hand, left hand and on the body. t Rr is the transpose matrix of Rr that is the rotation matrix of the receiver at the right-hand respect to Cartesian coordinate systems of the transmitter. The raw gesture data, which in our system are obtained from 36 sensors on two data gloves, and three receivers mounted on the data gloves and the waist, are formed as 48-dimensional vector. A dynamic range concept is employed in our system for satisfying the requirement of using a tiny scale of data. The dynamic range of each element is different, and each element value is normalized to ensure its dynamic range 0-1.

## 3.5 Behavioral Design

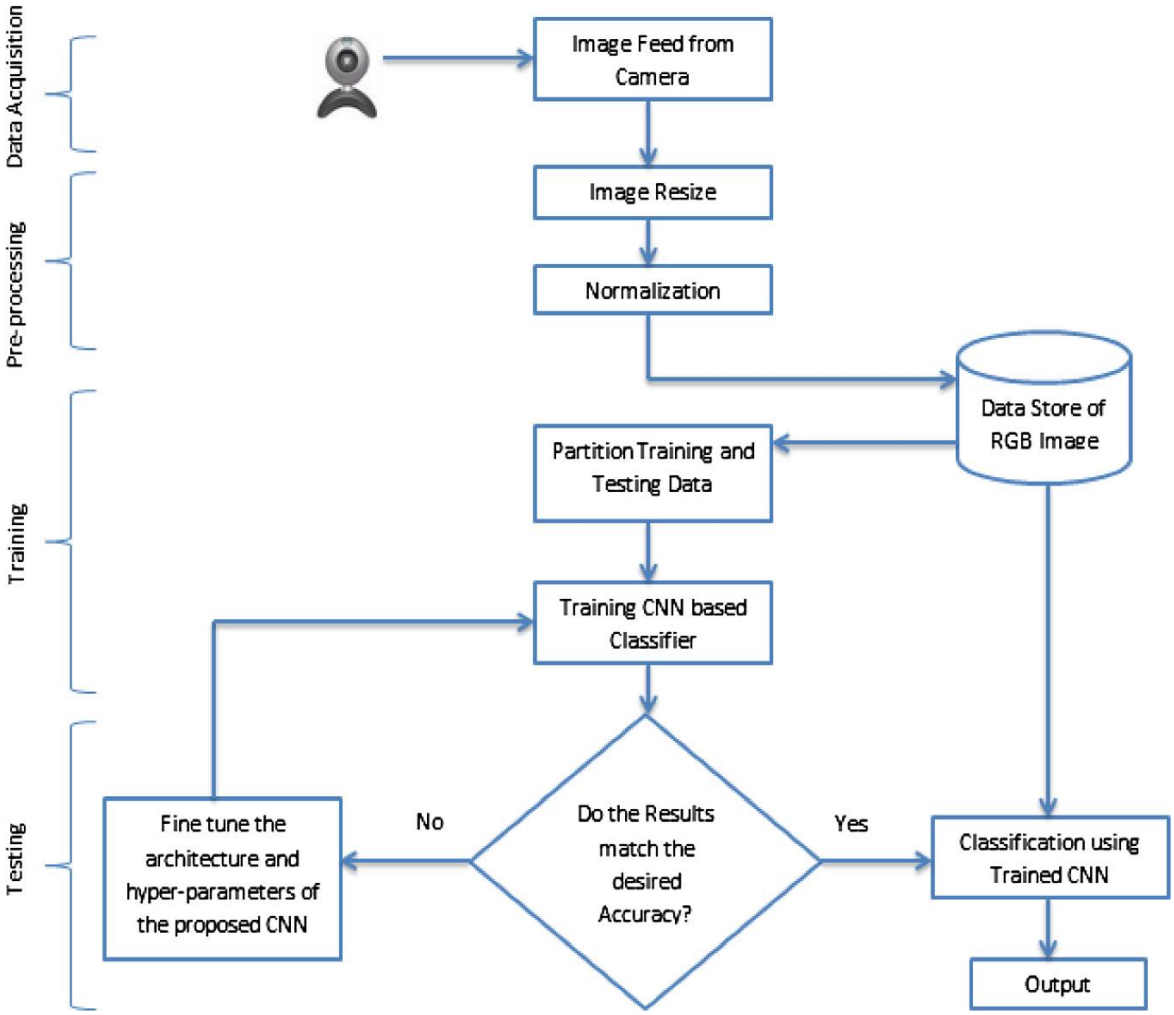


Fig 5: Flow chart of behavioral design

The proposed sign language recognition system includes four major phases that are data acquisition, image pre-processing, training and testing of the CNN classifier. Figure 3 describes the data flow diagram depicting the working model of the system. The first phase is the data acquisition phase, in which the RGB data of static signs get collected using a camera. The collected sign images are then pre-processed using image resizing and normalization. These normalized images are stored in the data store for future use. In the next phase, the proposed system gets trained using CNN classifier and then the trained model is used to perform testing. The last phase is the testing phase in which the CNN architecture parameters are fine-tuned until the results match the desired accuracy. The three-channel image frames (RGB) are retrieved from the camera, and then these images are passed to the image pre-processing module. The dataset consists of the collection of the RGB images for different static signs. The dataset comprises 35,000 images which include

350 images for each of the static signs. There are 100 distinct sign classes that include 23 alphabets of English, 0–10 digits and 67 commonly used words (e.g., bowl, water, stand, hand, fever, etc.). The dataset consists of static sign images with various sizes, colours and taken under different environmental conditions to assist in the better generalization of the classifier. The data pre-processing is the application of different morphological operations that are used to remove noise from the data. In this phase, the sign images are pre-processed using two methods that are image resizing and normalization. In image resizing, the image is resized to $128 \times 128$. These images are then normalized to change the range of pixel intensity values which results in mean 0 and variance 1. The model training is based upon convolutional neural networks. The proposed model is trained using the Tesla K80 Graphical Processing Unit (GPU), 12 GB memory, 64 GB Random Access Memory (RAM) and 100 GB Solid State Drive (SSD). The classifier takes the pre-processed sign images and classifies it into the corresponding category. The classifier is trained on the dataset of different ISL signs. The dataset is shuffled and divided into training and validation set with the size of training set being 80% of the whole dataset. Shuffling the dataset is very significant in terms of adding randomness to the process of neural network training which prevents the network from being biased toward certain parameters.

# CHAPTER 4

# REQUIERMENT SPECIFICATION

## 4.1 Libraries

**OpenCV**:

This is called as open-source computer vision library. As the name suggests it isa library which is used for processing images. OpenCV is available for free. OpenCV library is programmed using C or C++ because of these programming languages it is fast. This particular library uses less memory space and also portable. To make use of the functions that are available in this library we need a compiler. First the OpenCV mut be installed and compiler must be installed and then link must be created between them

**NumPy:**

NumPy is main library function in python. A great-performance, numerous dimensional array object, and for working with those arrays tools are provided by NumPy. For the computation of python scientifically NumPy is the main package. Using NumPy random datatypes can also be declared this would allow to get integrated with numerous databases. NumPy provide good performance related to speed. They require less space. They have some algebra functions built in.

**Imutils**:

A function that is benefit for basic processing of images functions like translating,rotating, reshaping, images of matplotlib getting displayed, skeletonization, sorting, edgesgetting detected and many more.

## 4.2 About The Dataset

As mentioned earlier the dataset consists of 200x200 colored images. The training files are arranged by folder according to the what they denote. Each folder consists of 3000 images. In addition to the 26 letters in the English alphabet, three additional folders were included. One folder labeled ‘nothing’ is just an image of the background where the hand symbols were captured. No hand is visible in these images. Another folder labeled ‘space’ consists of images of a hand denoting the “␣” symbol. The other folder is the ‘delete’ folder. For the letters “J” and “Z”, the images in these folders are varied to try to capture the action needed to gesture the letters. On the other hand, the testing files are in a folder with one testing image for each letter. This may be not enough to test the accuracy of the model and other external data may be needed. As such, I used an external dataset consisting of 200x200 colored images. The files are arranged similarly where images are placed in a folder corresponding to their label. Each folder contains 30 files resulting to 870 images in total.

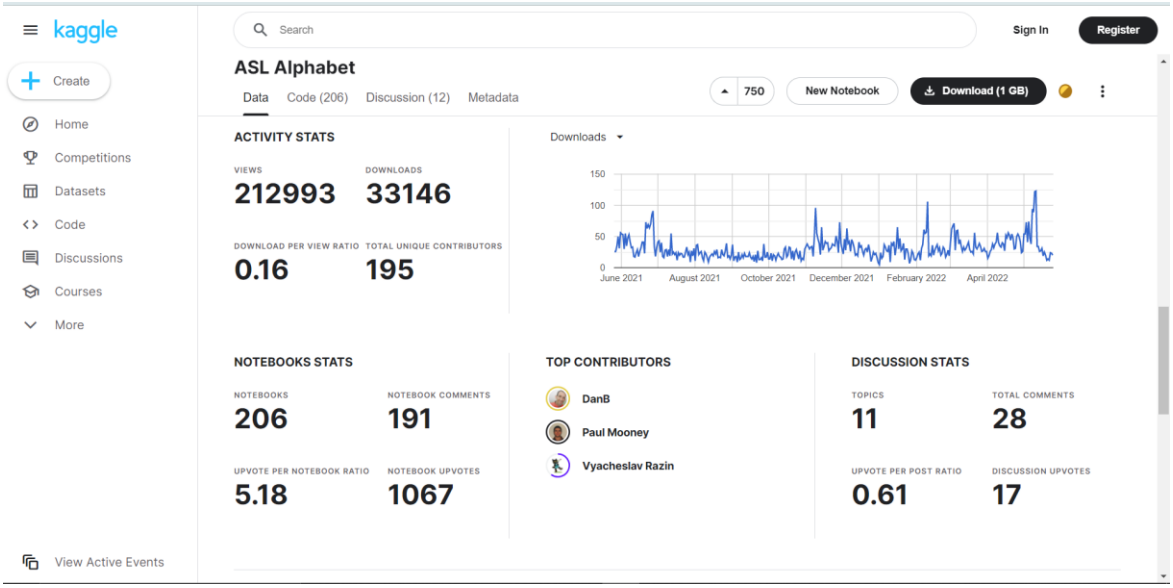


Fig 6: ASL dataset stats

# CHAPTER 5

# TESTING AND RESULTS

## 5.1 Passed Test Case

The system is able to identify hand gestures and give accurate outputs.


Fig 7: The System output for the letter A and hand sign for letter a for the letter A

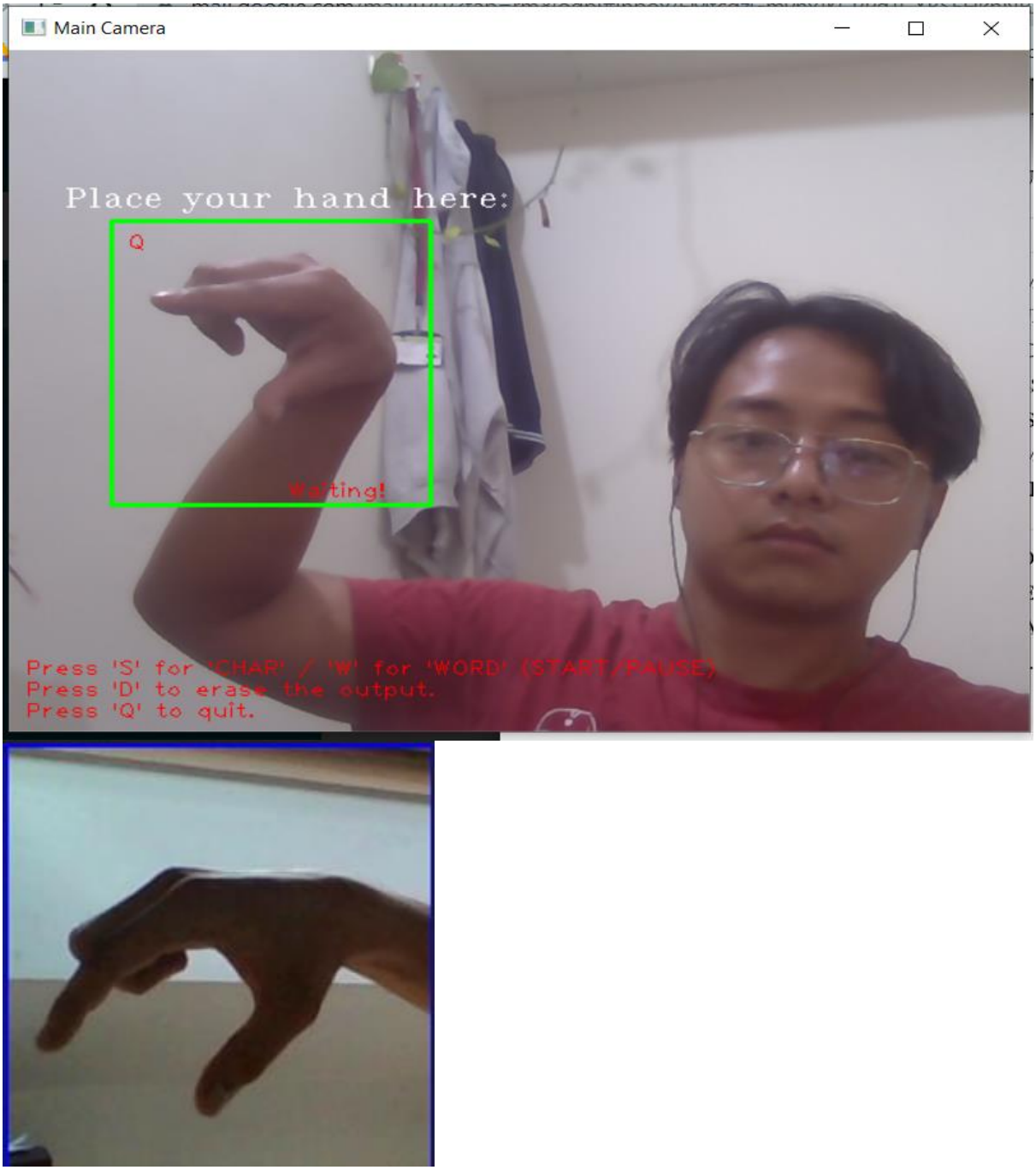


Fig 8: System output for the letter Q and the hand sign for the letter Q

## 5.2 Failed Test case

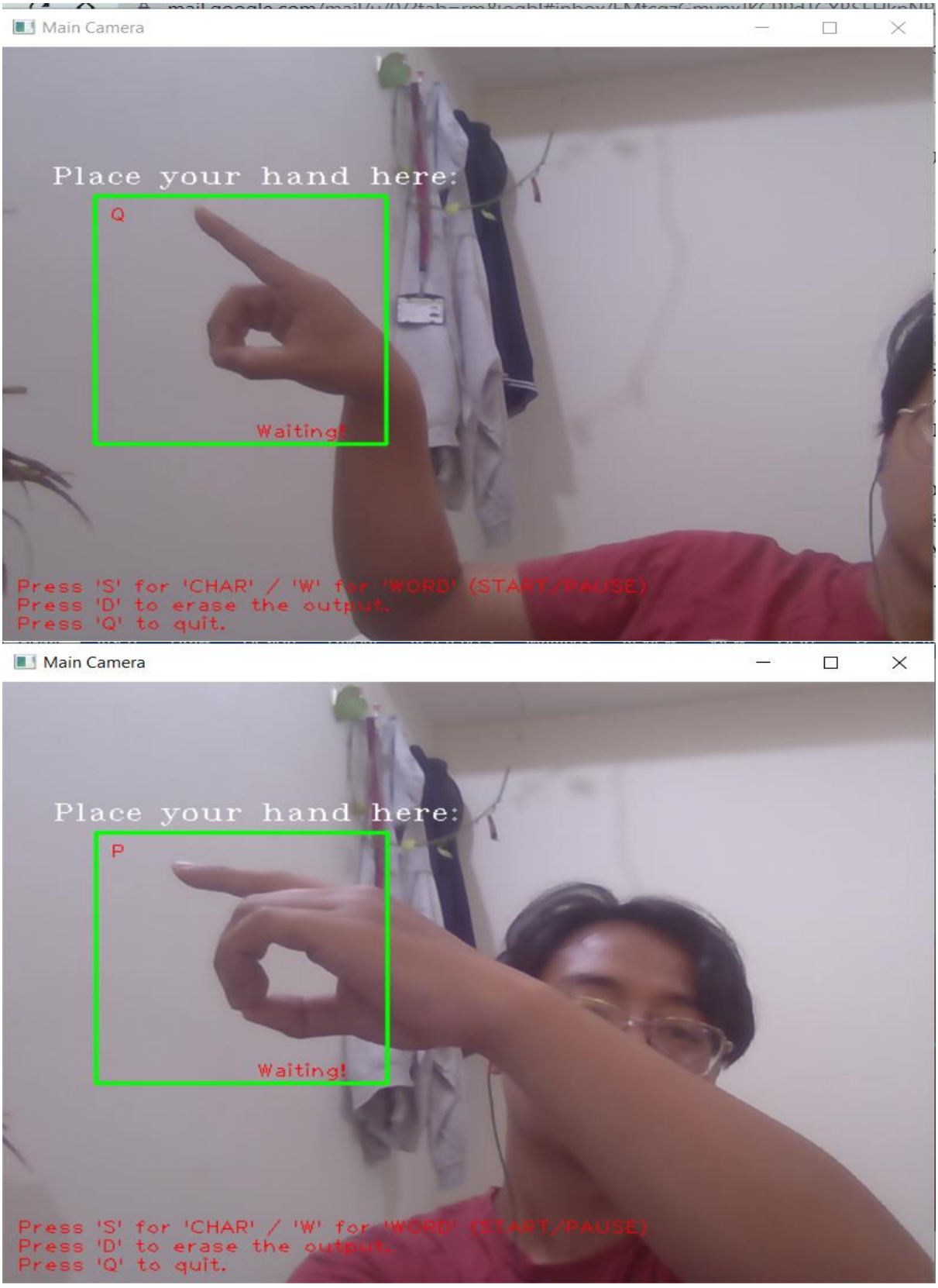

Fig 9: Two system outputs for testcases and the hand sign for the letter P

Inference: From the two images we can see that the system identifies only in one side of the hand and finds difficulty in identifying or makes a wrong identification.

## 5.3 Edge Output

The Captured images from the camera is converted into a greyscale and is thus easier for the system to identify the hand gesture


Fig 10: Edge output for the letter A


Fig 11: edge output for the letter Q


Fig 12: Edge output for the letter P

# CHAPTER 6

# Conclusion

We have demonstrated the output and have shown the results. The output is partial and therefore cannot be claimed as completed. The program still has issues identifying similar gestures, this problem will be towards the algorithm we used and not in the isolation of the grey scale images.

## Future works

The model has problems identifying similar hand signs. The reason behind this, we believe is the algorithm used, we plan to use a more updated algorithm and thereby have more accurate results.

# REFERENCES


[1] Neha Poddar, Shrushti Rao, Shruti Sawant, Vrushali Somavanshi, Prof. Sumita Chandak "Study of Sign Language Translation using Gesture Recognition", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 4, Issue 2, 2015

[2] Pramada, Deshpande Saylee, Nale Pranita, Nerkar Samiksha, Mrs.Archana S, Vaidya "Intelligent Sign Language Recognition Using Image Processing", IOSR Journal of Engineering, Vol. 3, Issue 2, 2013.

[3] P.V.V.Kishore, "Segment, Track, Extract, Recognize and Convert Sign Language Videos to Voice/Text", International Journal of Advanced Computer Science and Applications, Vol. 3, Issue 6, 2012.

[4] Kamal Preet Kour, Dr. Lini Mathew" Sign Language Recognition Using Image Processing", International Journals of Advanced Research in Computer Science and Software Engineering, Vol. 7, Issue 8, 2017.

[5] Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang and Yu-Bo Yuan "Real-Time Hand Gesture Recognition Using Finger Segmentation", The Scientific World Journal, Volume 2014, Article ID 267872, 9

[6] D.K. Vishwakarma,Rajiv Kapoor and Rockey Maheshwari ,"An Efficient Approach for the Recognition of Hand Gestures from Very Low Resolution Images ",2015 Fifth International Conference on Communication Systems and Network Technologies, IEEE 2015

[7] Dhanashee Pannasa,"To Analyse Hand Gesture Recognition for Electronic Device Control", International Journal of Advance Research in Computer Science and Management Studies, Jan 2015

[8] Sakshi Gupta and Sushil Kumar,"Analysis of Hand Gesture Recognition", International Journal of Advanced Research in Computer Science and Software Engineering, May 2013