SIGN LANGUAGE RECOGNITION

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FINAL YEAR PROJECT REPORT SUBMITTED TO THE FACULTY OF COMPUTING, MOHAMMAD ALI JINNAH UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE/SOFTWARE ENGINEERING

SPRING 2022

SIGN LANGUAGE RECOGNITION

Batch – 2018

DEPARTMENT OF COMPUTER SCIENCE
Mohammad Ali Jinnah University. Karachi
June 2022

PREFACE

The deaf and the deaf use sign language to communicate, but ordinary people can understand their own language. The PSL uses two hands to communicate (24 of 26) while the ASL uses one hand to communicate. The use of both hands often causes the features to blur because of the folded hands. In addition, the lack of data, as well as changes in sign language in the vernacular, led to efforts to prevent the acquisition of PSL signals. This application is to take important steps to close the communication gap between ordinary people and the deaf and the deaf who use Pakistani Sign Language. Successfully extending this project to common words and ideas will not only enable deaf and dumb people to communicate quickly and easily with the outside world but will also help them to understand and build an independent system that will help them.

ACKNOWLEDGMENT

All praise to Almighty Allah the most Gracious, The most Merciful. He gave us His blessings and conferred us with the power of mind and capability to complete this project successfully on time. Foremost, we would like to express our deep sense of gratitude with much appreciation to our project supervisor Mr. Awais Ahmed who has provided his immense knowledge, stimulation suggestions and invaluable guidance throughout the project. He deals with us with patience and supports us, listens to us on every step of the project development.

Beside our Advisor, we would like to Thank our EYP Committee, Teachers for their encouragement and their support that helped us in this journey and guided us directly or indirectly. We finally managed to finish this project due to their immense efforts

Acknowledgement is due to Muhammad Ali Jinnah for support of this Project, a highly appreciated achievement for us at the undergraduate level.

INTRODUCTION TO GROUP MEMBERS

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CERTIFICATE OF COMPLETION

This is to certify that the following students of BS (CS) of Batch 2018

Ahsan	FA18-BSCS-0033
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have successfully completed their final year project titled

SIGN LANGUAGE RECOGNITION

in the partial fulfillment for the Degree of Bachelor of Science in Computer Science.

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MR.AWAIS AHMED

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ABSTRACT

The application in this document is called live detection of Pakistani Sign Language Recognition via camera and webcam. This application is designed and used for normal people and for those who cannot speak or listen to make their lives easier, as well as government offices that should serve all their citizens equally, private companies that want to reach and serve deaf and dumb people, to co-ordinate, partnerships, that aim to help the people with speech and listening problems. Our application will act as a visual signal (later called "user") standing in front of the camera and webcam. To specify specific hand touch points with a media pipe, the user's hand area is located in a rectangular box on the web camera and camera. After tracking the user's hand gestures, the camera is ready for use. It will provide the output of hand gestures detection into text in front of camera. Our project will use the output from the camera or webcam and will match the pre-defined gestures in database which we load in the system. Our project aims to educate the Pakistani Sign Language and live detection of gestures that translate it into English text. Initially, the system will detect 26 previously defined gestures. However, it will be possible to explain the additional touch once the system has been proven to be efficient enough. The program will work on PC, laptop, and cell phone environments in particular. By connecting the camera to a PC, laptop, and mobile phone user able to use.

Table of Contents

1. Introduction

Our application specifies the communication gap between deaf and dumb and normal people for Pakistani Sign Language Recognition through Camera and Webcam. With this document, we will provide all the details and implementation of our project. This document will talk about the functionality of our application how our application recognizes the hand gestures and gives output in the form of text, external interaction with users, functionality, attributes, i.e., if the app is portable, maintained, and the design limitations imposed on the application such as usage. language, input details and output expectations.

1.1 Purpose

The purpose of this application is to clarify the features, requirements for the final product and the visual communication of PSL recognition using a camera and webcam. It will explain the type of project you want and the steps you need to take to succeed. To do this throughout the text, a full description of the project, a description of the problem that the project provides the solution and appropriate explanations and summaries of the project will be provided. The adjustment of this report will help to consider all the requirements before the project begins, and minimize recent redesign, recording, and review. In the event of a change in operating requirements or part of a project obligation, these changes will be noted with reference to this SRS in the following documents.

1.2 Problem

The deaf and the deaf use sign language to communicate, but ordinary people can understand their own language. The PSL uses two hands to communicate (24 of 26) while the ASL uses one hand to communicate. The use of both hands often causes the features to blur because of the folded hands. In addition, the lack of data, as well as changes in sign language in the vernacular, led to efforts to prevent the acquisition of PSL signals. The aim of our project is to take important steps to close the communication gap between ordinary people and the deaf and the deaf who use Pakistani Sign Language. Successfully extending this project to common words and ideas will not only enable deaf and dumb people to communicate quickly and easily with the outside world but will also help them to understand and build an independent system that will help them.

1.3 Intended Audience and Reading Suggestions

The problem we are investigating is the perception of sign language by learning the unattended element. [1] Detailed research was presented based on statistical data on deaf or mute people in Pakistan. Approximately ***3.3 million Pakistanis suffer from any form of disability of which 0.24 million are deaf or hard of hearing at an estimated 7.4% of all disabled people [1].***
Its software development area is not yet fully developed. As we research this subject, we have never encountered any commercial PSL recognition product. However, there are several student projects regarding gesture recognition through OpenCV and media pipeline in ASL. Our project also works

on these frameworks as we described in our documentation. Our application is a live detection program that helps normal people to communicate easily with deaf and dumb people and also useful for educating the children and the people to develop working memory and improve their language skills by using our Sign language detection application. Our application is the fact that it creates a neural network and the “self-study” features of our application will make it more efficient for the users.
We are using the same technologies and methods, which are used in gesture detection like open CV, media-pipe and tensor flow frameworks, however the difference of our application is that we are working and presenting the first for Pakistan Sign Language hand gesture recognition.

1.4 Product Scope

The application in this document is called live detection of Pakistani Sign Language Recognition via camera and webcam. This application is designed and used for normal people and for those who cannot speak or listen to make their lives easier, as well as government offices that should serve all their citizens equally, private companies that want to reach and serve deaf and dumb people, to co-ordinate, partnerships, that aim to help the people with speech and listening problems. Our application will act as a visual signal (later called "user") standing in front of the camera and webcam. To specify specific hand touch points with a media pipe, the user's hand area is located in a rectangular box on the web camera and camera. After tracking the user's hand gestures, the camera is ready for use. It will provide the output of hand gestures detection into text in front of camera. Our project will use the output from the camera or webcam and will match the pre-defined gestures in database which we load in the system. Our project aims to educate the Pakistani Sign Language and live detection of gestures that translate it into English text. Initially, the system will detect 26 previously defined gestures. However, it will be possible to explain the additional touch once the system has been proven to be efficient enough. The program will work on PC, laptop, and cell phone environments in particular. By connecting the camera to a PC, laptop, and mobile phone user able to use.

2. Overall Description

2.1 Product Perspective

PSL uses OpenCV and media pipe will help non-speaking people to read the PSL easily and have no difficulty communicating by giving their signals to translate text to people who do not know the PSL. There will be two main features in our application one is communication and other is education. The communication module is detecting the hand gesture and converting into text. Hand gesture will be searched during gesture introduced in to our project. The education module is a menu bar type and has a feature that displays each module of alphabets, phrases and words that match the predefined gestures. The user will learn the gestures of PSL through images and which are load in our project.
In terms of hardware, only PC, Laptop, Mobile and camera and webcam are required. gestures will be detected by a webcam and camera with OpenCV.

Depending on the software, we will use:

- Application: Windows 10 or Windows 11 Developer Preview
- Programming Language: Python & Java
- OpenCV, media pipeline and Tensor flow.
- Developmental Area: Android SDK java

2.2 Product Functions

The PSL will have two key elements; that is, to speak live and learn the signs. Both modules have two standard categories:

• Hand-tracking by OpenCV and media-pipe framework provides real-time location and in-depth information about multiple points on human hand touch.

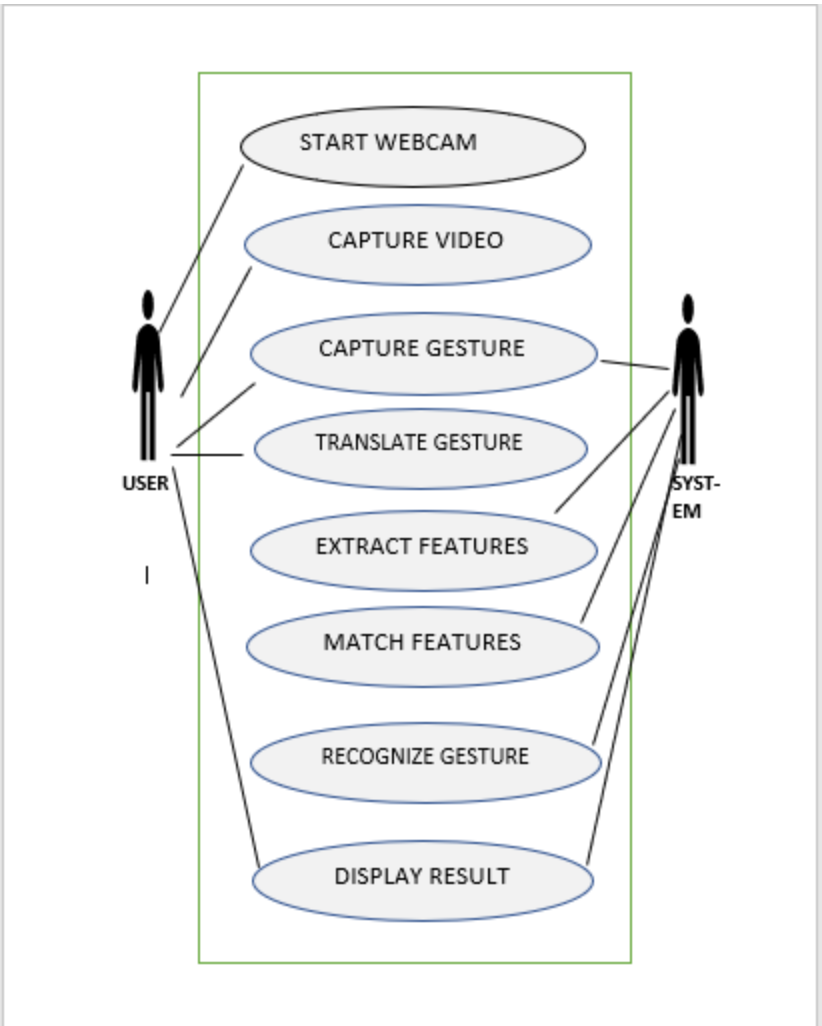
• Matching hand gestures to related words / sentences.

The system will compare user-generated movements with pre-defined movements on its website.
The educational module has divided into 3 different submodules;

1- Learn English Alphabet signs
2- Learn words signs
3- Learn phrases signs

In educational module we have live detection feature, which will detect the same live detection so the user can practice the PSL signs easily.

Our project other main module is live detection phase that can be accessible directly in home screen.



2.3 Assumptions and Dependencies

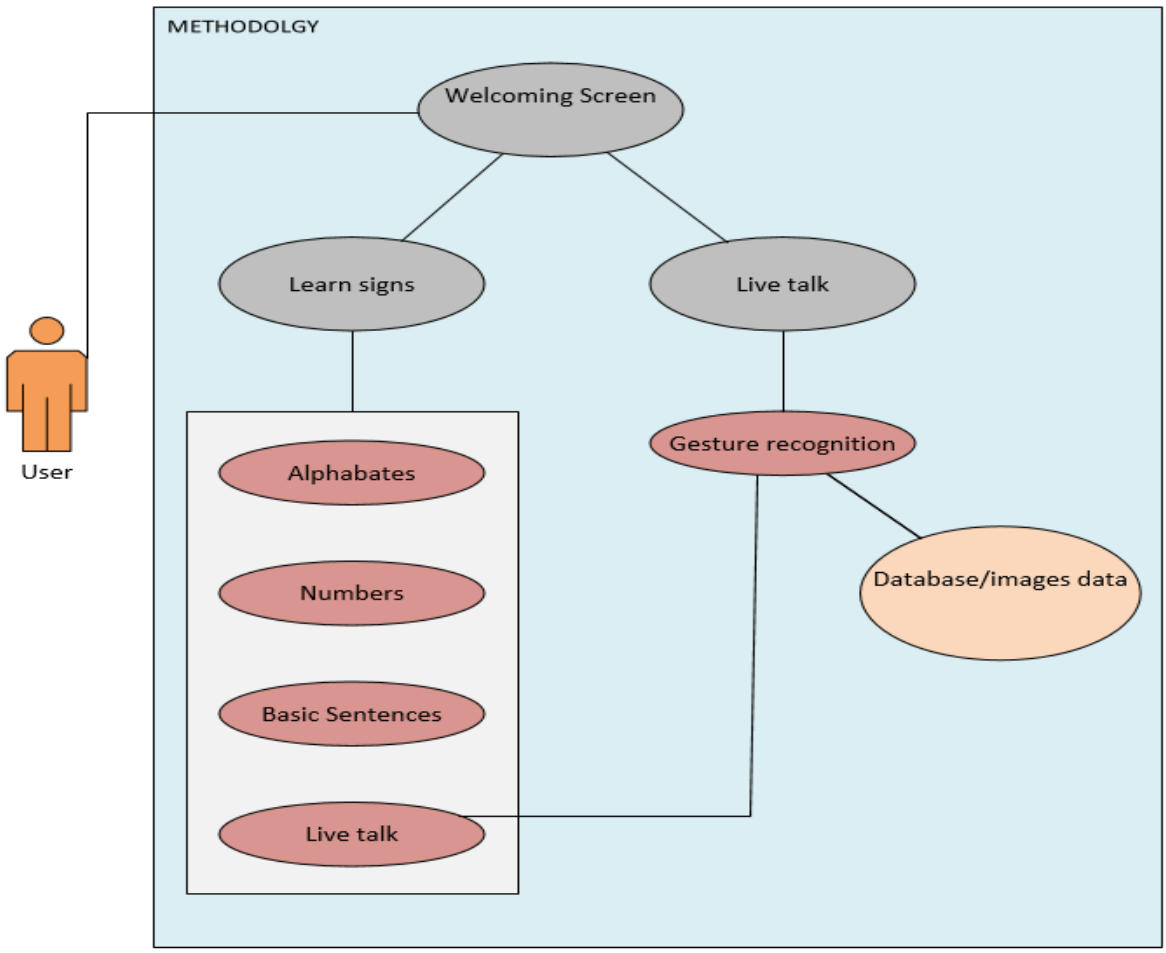
To achieve the best accuracy, the user should follow these which are made:

1. User must be at a distance of 0.5 within 1 meter from the camera sensor and web camera.
2. Hand gesture tracking by camera should be done by the user properly.
3. The program will work mainly on PCs, laptops, and mobile devices.
4. System response depends on the camera and web camera capabilities to detect. No worries about security and safety in the application.
5. The resilience of the system depends on the capability of the camera and webcam. The application has no worries and security.

3. External Interface Requirements

3.1 User Interfaces

The user interface will contain 8 to 10 screens, when the user enters into our application, first we provide our main design, our logo and welcoming screen which welcome the user, when the user click on the logo icon it will move forward and after we put the swiping starter menu that provide the uses of our product, our team members description etc. After that the user see the 2 main modules in main screen one is educational mode and other is live detection. In educational mode we put 4 to 5 screens, we put images of different signs of PSL which will shows in front of user so user can learn and practice on it in live detection. After that our other mode is live detection method, when the user goes in live detection, the camera is open and our program is ready to recognize the hand gestures signs, user will locate his hand towards camera and give any sign gesture it will detect it and gives output in text msg printed on the screen. The "Back" button is also available in the communication module and its function is the same as that in education mode.
The PSL is moving and will get a description of the action on the screen if anything is the same. These descriptions will be written in sequence in the text area. The "exit" button will exit the application.



Interface Diagram

3.2 Operational Requirements

3.2.1 Operational Requirements for live talk:

This feature will translate hand gesture recognition into a text description, it will match the hand gesture into our data where gestures are put and then will translate hand gestures into the text.

3.2.2 Normal flow:

- A person can live talk from menu.
- Person click on the live talk through sub menu.
- Person moves his hand gesture to recognize.
- Hand gesture should be clear to be recognize and match to our data.
- After recognizing hand gesture, it should give output in text and show to the person.

3.2.3 Alternative Event:

1. The signal could not be detected due to background noise or the camera and webcam standing outside the range.
2. User gets feedback that describes the correct location or presence of sound in the background.

3.2.4 Operational requirements:

1. The movement performed should be a pre-characterized action to get its accurate output.
2. User should be kept a few feet away from the sensor.

3.2.5 Operational requirements for learn sign:

For the live talk user have to give text first then system will show the hand gesture of those text which user is asking then it will teach user to recognize through same matter live talking mode.
After recognizing it will give the output in the to the user.

3.2.6 Normal flow:

- Person can learn from learn sign mode.
- A mean of sign will be showing on screen.
- Person makes requested token.
- Touches are visible then it should made to compare.
- Person will get to know hand gesture recognition movements.

3.2.7 Alternative Events:

1. Hand gesture recognition may be not detected because of noise and depends upon on camera and webcam or keeping your hand gesture far away from camera and webcam.
2. Visitor will get to know about problems like why hand gesture is not recognizing.

3.2.8 Operational Requirements:

The user should be kept a few feet away from the sensor.

3.2.9 Operational Requirements for User Guide:

This part is all about features that are given in this interface, like how to use this system from starting like menu and submenu. This system will provide how to learn signs and live talk, it will be great for user to know about required how to use this system while using the system.

3.2.10 Normal flow:

- Person taps the "How to utilize?" button on the screen.
- A person manual is shown.
- A person has the option of closing the icon and then back to the main screen.

3.2.11 Alternative Events:

There is no alternative event in this flow.

3.2.12 Operational Requirements:

There are not operational requirements for this flow.

3.3 Non-Operational Requirements

3.3.1 Operating Requirements:

Creating a PSL with a camera and webcam and it can be play at a one time with one specific person and This will run on 32 or 63 dual core processor.

3.3.2 Design Barriers:

In the meantime, we will use OpenCV and media pipeline to control input streaming from the camera or webcam and Python languages in the React native area will be utilized with framework like tracking. the design of the software is like you can recognize hand gestures for continuously and there are no determined barriers, and if any change required in this principle will be referenced in the accompanying records.

4. System Features

In this section, we provide information about project data models.

4.1 Data Definitions

We will provide insights about the objects associated with in project, the relationships between them, data object insights and a complete model with data object functions.

4.1.1 Data Objects

There are six data items: Input Holder, Visitor, Visual Connector, Websites, Live talk and learning feature.

1. **Input Holder Object:** This item will take shared links from the camera and web camera sensor and similar library functions. It will set up I/O strategy for streaming camera and web camera input, remove poor quality input, and organize continuous bone links and its time data into a format the visioner will work on.
2. **Visitor:** This item takes the information of the fixed bones in the Input Holder Object and tries to match them to the pre-defined touch on the Point Object.
3. **Interface connector:** This item contains the GUI information, i.e. main menu information for building compatible user interactions.
4. **Website item**: This item contains pre-defined touch data sets.
5. **Live talk:** This item will generate random touch queries for the user and provide working time for the user. If the user can make the correct touch with given time, it will provide information in the GUI item to show the results.
6. **Learning feature:** This item will take a fixed touch on the viewer rather than add the similar strings to the currently open file viewed on the screen. Also, this item can remove words from the viewed file, open a new file, save and extract the current one.

4.1.2 Relation

The input holder includes a list of the upper hand touch areas and the intermission of the movement present. List will transfer to the mirror item to look if there are any similarities with the explain input creator.
The alert would start automatically use the Neural Web and the launcher and then we will detect the changed broadcast location from the Input holder and detect the contact names found in the currently active module. The User Interface item will control the current menu/sub-menu menus and will display the meaning of the educational and communication items. Two things, Trend models will open the Input Holder to activate the Input Holder and apply the contact names from the touch set name of the display.

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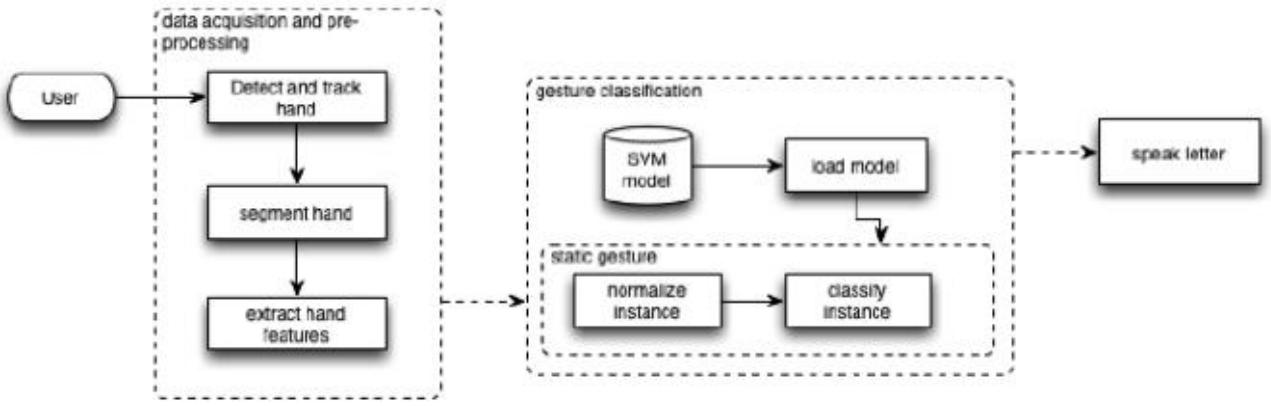
4.1.3 Complete the data model



Sign language recognition prototype

4.1.4 Data dictionary

1. **Skeleton Array:** A list of data that keeps all time values and associated locations associated.

2. **Current Activity Name:** Contains the last contact's name received.

3. **Getting Started**: It is a control variable to check whether the module is working or not.

4. **Advanced Touch:** It is a permanent program on a Web site created to start a neural network.

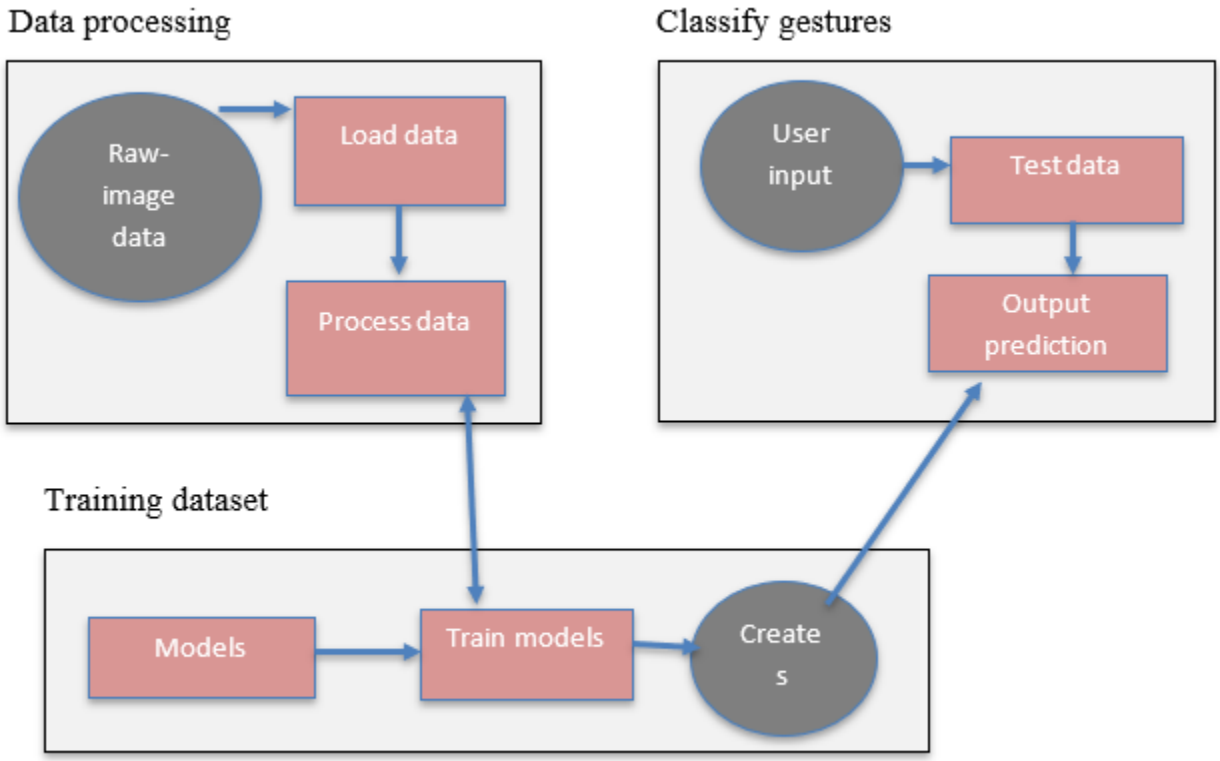
5. Behavior and Definition

5.1 Definition of Software Behavior

At the point when the program is begun just the Interface module is begun toward the start. One of these modules controls any remaining modules and buttons, after person has selected live speech or reading symbols, the relating module will be actuated once more, process doing initiate the info holder and the viewer to activate. The info holder start processing the local broadcast of the frame from the camera and webcam of the media pipe only if one of the live speeches and reading signal is active. Info holder is active, we will always change the location of the skeletal area and send the same times corresponding positions to the viewer. Also, it will remove bone reserves if sufficient time passes or the seer sends a signal in the same way. The viewer will take a modified stand-in information from the input holder and try to match it to the predefined touch, then it will recognize and match with save database and will convert into letter character unit to live speech and read signal as well as cautioning signal to the info holder stating that hand gesture is matched to the release function. An important

function of the live chat module is about to open a record, save words from the viewer, then provide the contents of the opening file to the visual name to be displayed. The learning features module will select random predefined touch words, then send you a query about interaction and will take process for a while, and then, at that point, the viewer will give it a similar name for the inquiry posed.
This process handle viewing functions of system, then sub-menu is open and module will active through this module. If assuming the dynamic mode makes a character unit for you to visualize, the visual object will pick it up and display it. All system behavior can understand or explained by changes in user interface.

5.2 Transition diagram



6. Organization

6.1 Organization structure

Ahsan: UI designer, Application Developer

Harikant: SRS, Application Developer

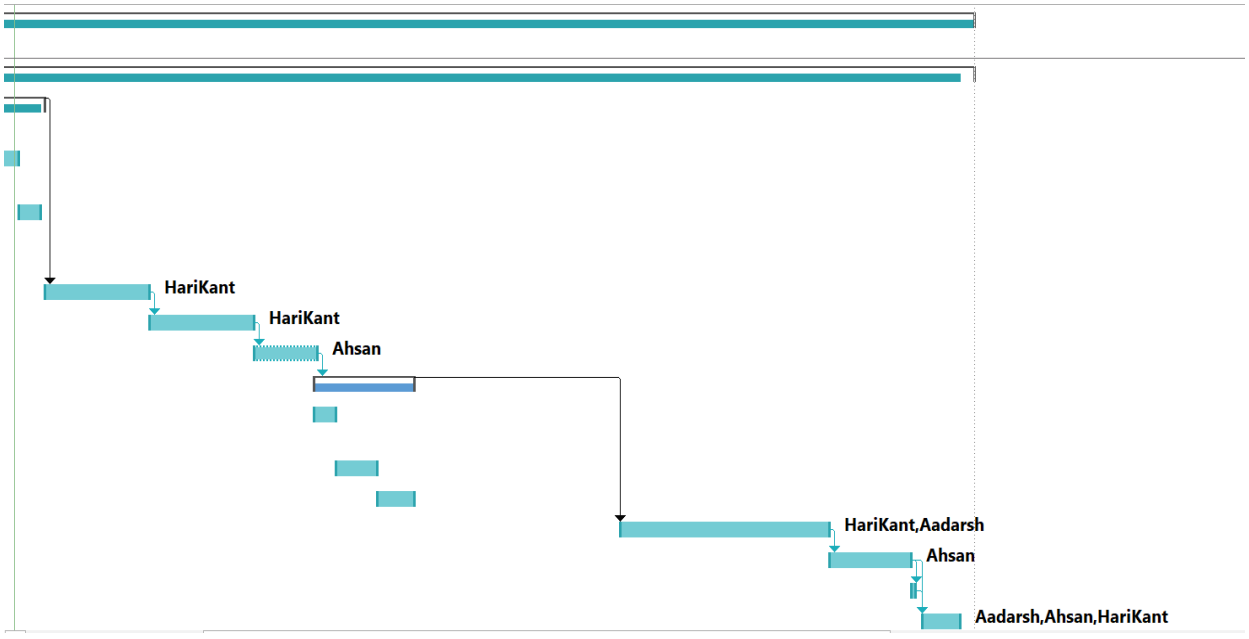
Aadarsh khatri: Report, Application Developer

As a group member, we would see every member's opinion has equivalent and critical importance. Therefore, we had an autonomous decentralized process. As the knowledge of all members and development tools' information is almost identical and all of us will have to put up to design and development of each block of the module. The development process will be broken down into different modules themselves and each one will play his or her own role.

6.2 Plan (Work Breakdown Structure)

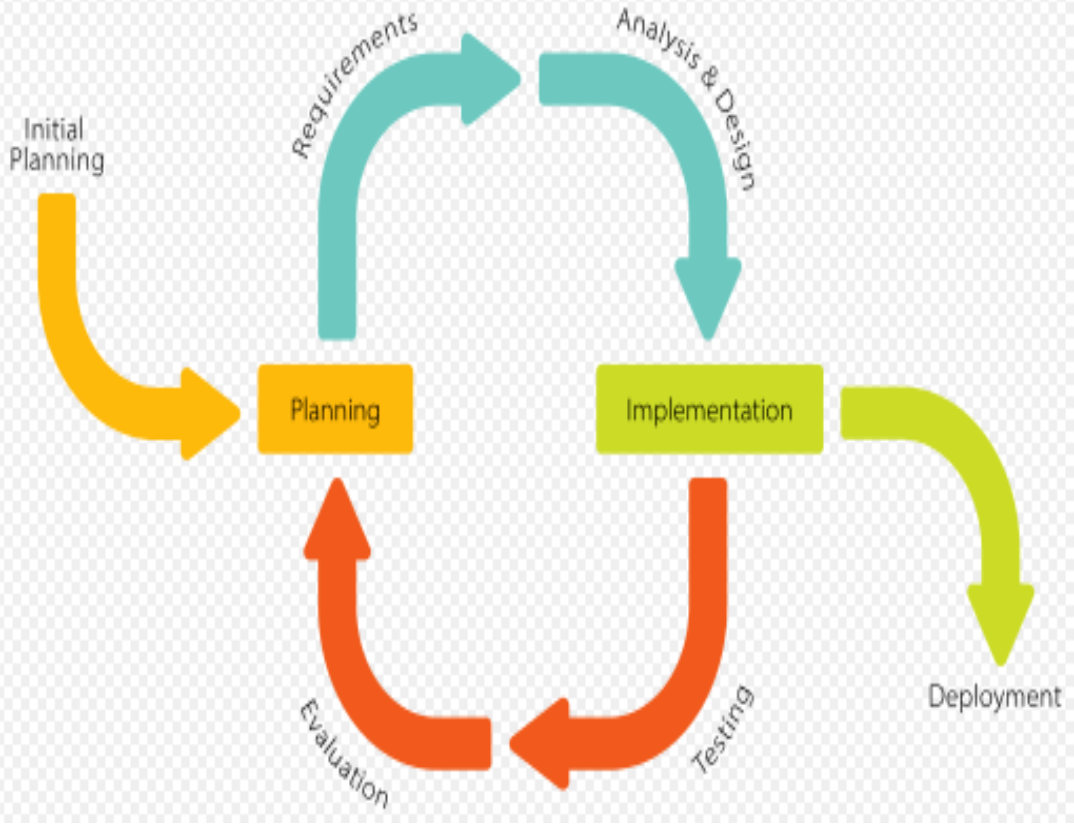
The Gantt chart showing the interim project schedule is as follows with the activities and dates included:

Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
	Sign language recog(FYP)	**187 days**	**Fri 10/22/21**	**Sun 7/10/22**		
	Milestone	**187 days**	**Fri 10/22/21**	**Sun 7/10/22**		
	Home(GUI interface)	**9 days**	**Fri 10/22/21**	**Wed 11/3/21**		**Aadarsh**
	Option 1(deaf and dumb)	4 days	Fri 10/22/21	Wed 10/27/21		
	Option 2(Normal person)	4 days	Thu 10/28/21	Tue 11/2/21		
	Data gathering	20 days	Thu 11/4/21	Wed 12/1/21	3	HariKant
	Data analysis	1 mon	Thu 12/2/21	Wed 12/29/21	6	HariKant
	Proposal document	13 days	Thu 12/30/21	Sat 1/15/22	7	Ahsan
	Design	**20 days**	**Sat 1/15/22**	**Thu 2/10/22**	**8**	**Ahsan**
	Design prototype	5 days	Sat 1/15/22	Thu 1/20/22		
	Frontend	7 days	Fri 1/21/22	Mon 1/31/22		
	Backend	8 days	Tue 2/1/22	Thu 2/10/22		
	Implementation	2 mons	Thu 4/7/22	Wed 6/1/22	9	HariKant,Aadarsh
	testing	16 days	Thu 6/2/22	Thu 6/23/22	13	Ahsan
	Bug fixes	1 day	Fri 6/24/22	Fri 6/24/22	14	
	Documentation	8 days	Mon 6/27/22	Wed 7/6/22	14,15	Aadarsh,Ahsan,Ha



6.3 Process model

As our institute decided to work on Waterfall model, which is also known as Waterfall method, this is used for a continuous programming mapping which levitate as waterfall along with this project parts (as an example, we can take testing, analysis, development, and design), for every part. wrap up completely before the start of the next phase. It begins with the initial planning and ends with the use of intermediate cycle interactions. The same process follows in the plan-do-check-act cycle.

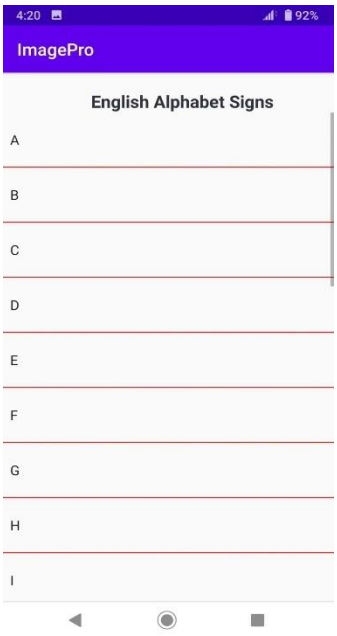


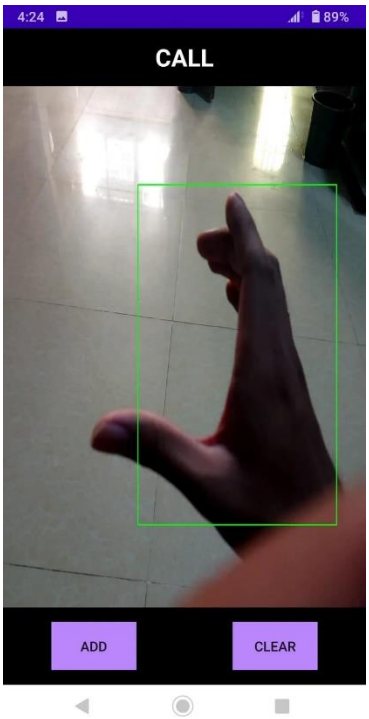
Process model

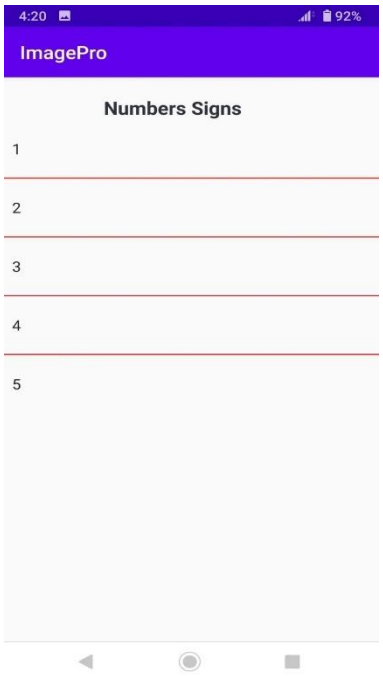
7. System Implementation

7.1 First Screen

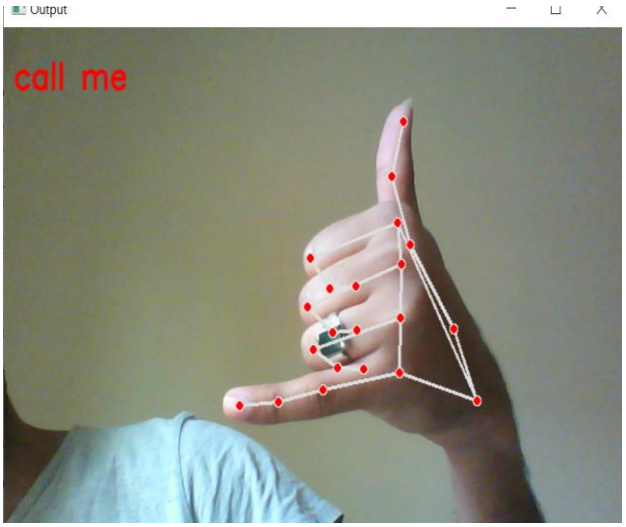
7.2 The Learning Sign Language Screen

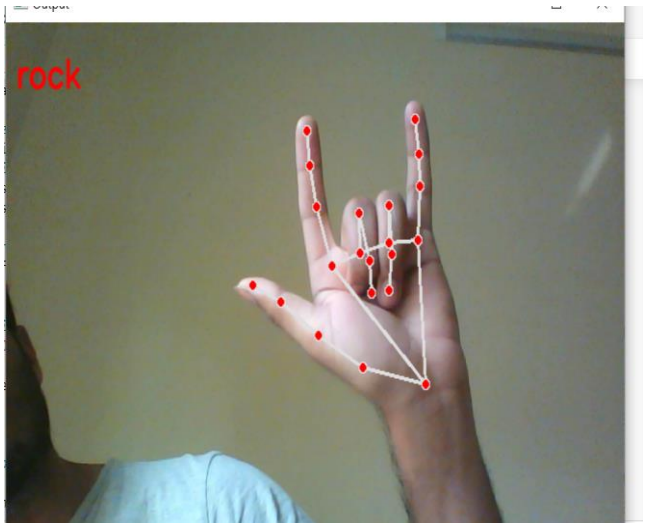


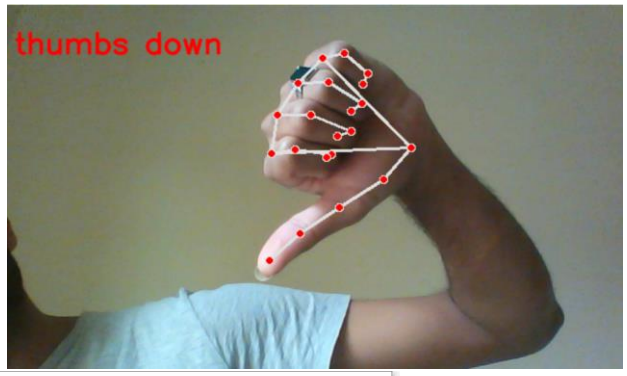


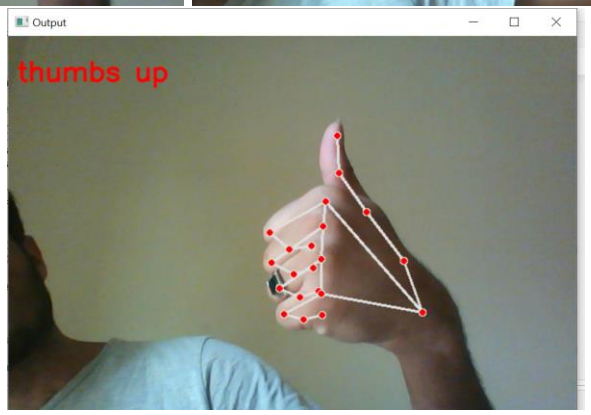


7.3 Real Time Recognition









8. Testing

Testing is basically a way of checking that things are working fire and not breaking on normal usage Testing has many types that cover things from coverage to load test and every aspect that a software can be tested.

8.1 GRAPHICAL USER INTERFACE TESTING

The Graphical user Interface testing is actually for taking a look at the Ul of the application concerning how the gadget components are introduced to the clients. GUI testing incorporates screen monitoring which enables the control of functions like menus, buttons. and symbol.

8.2 USABILITY TESTING

The usability testing is basically done to test the usability of the product to make sure that the product is working fine and usable. Ease of use really looking at ensures precisely how easy it is to use a system.

8.3 SOFTWARE PERFORMANCE TESTING

The performance testing basically refers to the performance of the application and how it is performing in different environments and different loads without breaking and getting slow.

8.4 COMPATIBILITY TESTING

Compatibility testing is required to test how our application is compatible with the gadget. and devices out there.

8.5 EXCEPTION HANDLING TESTING

In testing Handling runtime rerun, this intern ensures that the test execution flue is not interrupted Code is performing as expected while at the same time managing the exemptions Technically an exception is an object thrown at run time. Exceptional Handling decides the response of the product when the user gives questionable or disagreeable input.

8.6 LOAD TESTING

In load testing, we used to test and check our application with real world load or eccentric implication conditions. Without it, our application could fail miserably in real-world conditions.

9. Future Scope

In future more features will be added to the application and we are planning to make things bigger and better but some of the future goals are as follows.

1. Different local language will be added.
2. Will try to communicate with educationist to implement in class to teach deaf and dumb students.
3. More data and models will be created in this application.
4. Accuracy of recognitions will be 100 percent.
5. Will add voice recognition feature in this application.

10. Conclusion

A camera/webcam is used for this software to identify PSL (Pakistan Sign Language). Firstly, we provided descriptions of the proposed solutions of the real-world problems. Basic functionality of the software is also included in the descriptive models, application harmony essentials, performance, attributes, and arrangement boundary which are set in use.
In the definition section, all the functional and visual condition of process are described deeply. Details of the data objects, their assigns and the whole model data was also given. In the model of behavior section, the relationship among user and function and features is modeled. In the end, the presentation of our group, hope for plane and the process model of our group were combined.

11. REFERENCES

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3. https://towardsdatascience.com/sign-language-recognition-using-deep-learning-6549268c60bd
4. https://onlinelibrary.wiley.com/doi/10.1002/masy.202000241
5. https://www.cse.iitk.ac.in/users/cs365/2015/_submissions/vinsam/proposal.pdf

APPENDIX A: DATA FLOW DIAGRAM