REAL-TIME COMMUNICATION

COMMUNICATION SYSTEM POWERED BY AI FOR

SPECIALLY ABLED

NALAIYA THIRAN PROJECT BASED LEARNING

ON

PROFESSIONAL READINESS FOR INNOVATION,

EMPLOYABILITY AND ENTREPRENEURS

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ABSTRACT

An evolution of Information and Communication Technology has influenced every part of human life. It has modified the way we do the job, occupation, travel , acknowledge and convey. For the Deaf people group, the utilization ICT has enhance their personal satisfaction by creating frameworks that can help them discuss better with whatever remains of the world and among themselves. Gesture based communication is the essential method for correspondence in the almost totally impaired group. The issue emerges when hard of hearing individuals attempt to convey what needs be to other individuals with the assistance of these gesture based communication language structures and bad habit a versa. The application gives hard of hearing individuals a method for getting more shut to cutting edge innovation by utilizing discourse to picture interpretation. This deaf individual to learn new advances by looking toward pictures which are being changed over to pictures by utilizing discourse acknowledgment framework.

Keywords : Sign Language, Deaf and Dumb, Android Application

1.INTRODUCTION

Gesture recognition is technology that uses sensors to read and interpret hand movements as commands. In the automotive industry, this capability allows drivers and passengers to interact with the vehicle, usually to control the infotainment system without touching any buttons or screens.

Aptiv developed the technology behind the first gesture recognition system for automotive applications, introduced in the BMW 7 Series in 2015, which can recognize hand gestures that control music/audio and incoming calls.

As the technology matures, gesture recognition will move beyond infotainment and will allow drivers to control other systems within the vehicle, such as heating and cooling, and to connect with smart home systems. For example, imagine being able to check your home security camera as you drive home by simply making a hand gesture. Gestures could also be coupled with telematics systems, allowing the vehicle to provide information about nearby landmarks if it recognizes that an occupant is pointing at it.

How it works?

A gesture recognition system starts with a camera pointed at a specific three-dimensional zone within the vehicle, capturing frame-by-frame images of hand positions and motions. This camera is typically mounted in the roof module or other vantage point that is unlikely to be obstructed. The system illuminates the area with infrared LEDs or lasers for a clear image even when there is not much natural light.

Those images are analyzed in real time by computer vision and machine

learning technologies, which translate the hand motions into commands, based on a predetermined library of signs.
Commands generated by the gesture recognition software become just another type of input, similar to turning a dial, pressing a button or touching a screen. Additionally, as the quantity and quality of cabin cameras improves, other passengers in the vehicle could eventually get in on the act.

What are the most common gestures?

Each OEM might develop its own variations, but here are some of the basic hand motions:

- A single finger spun clockwise to turn the radio volume up or zoom in on a map
- A single finger spun counterclockwise for the opposite action
- A pointing gesture, with either one or two fingers, to accept a call
- A swipe gesture to reject a call
- In the BMW, a gesture of two fingers, without motion, controls a variety of other functions such as muting or unmuting the audio

A pinching motion between thumb and forefinger could also manipulate an image on the vehicle display. This would allow a driver to, for example, get a visual image of the vehicle in a tight parking spot from all angles.Benefits of gesture recognition include improved safety ,since drivers do not have to take their attention off the road as much as they would with touch controls , and the simple convenience of being able to control vehicle functions with deliberate gestures rather than a potentially complex menu scheme.

Gesture recognition is an exciting technology, but it is only one aspect of a broader camera-based interior sensing platform that can interpret the voice commands, eye movements and body movements of the driver, while giving the vehicle the capability to recognize the driver, adjust settings to the driver's preferences, monitor the driver's attentiveness and mood, take over braking functions in an emergency, and switch back and forth between autonomous and human driving modes.

1.1 PROJECT OVERVIEW

In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used. Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired person in any language.

The project aims to develop a system that converts the sign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb. We are making use of a convolution neural network to create a model that is trained on different hand gestures. An app is built which uses this model. This app enables deaf

and dumb people to convey their information using signs which get converted to human-understandable language and speech.

1.2 PURPOSE

Hand gestures can help you point to people and things in your surroundings (e.g. pointing at an object while you say “look at that”) Hand gestures can help you add emphasis and structure when you talk (e.g. showing numbers when you count, “1, 2, 3…”) Hand gestures give clues about your emotional state.

Touchless user interface is an emerging type of technology in relation to gesture control. Touchless user interface (TUI) is the process of commanding the computer via body motion and gestures without touching a keyboard, mouse, or screen.

Gesture are easier representation, makes the presentation attractive, Quick expressing of message, etc. Gestures are non-verbal communications. It can make the information to be presented easily via audio, visual, or even through silent. It is usually a substitute of verbal based communication.

2. LITERATURE SURVEY

Different approaches have been used by different researchers for recognition of various hand gestures which were implemented in different fields. In Gesture detection using video and image processing is used for enabling the communication between the deaf, dumb & normal people. It introduces new application which will detect the Indian sign language via mobile camera and converts into corresponding text or

voice output. This application uses certain image processing techniques to compare the input with the already stored signs and requires only android phone and does not require any special markers or magic gloves on the hand of the user. This application is not affordable for poor people.Sign language is used as a communication medium among deaf and dumb people. The author in helps the people to convey the message with each other. In order to bridge the gap in communication among deaf and dumb community and normal community, lot of research work has been carried out to automate the process of sign language interpretation with the help ofimage processing and pattern recognition techniques. An optimized algorithm has been implemented in the form of an android application and tested with real time data and the algorithm does not depend on skin tone of any person and hence the image processing is independent of the illumination. All students, regardless of their personal circumstances, have a right of access to and participation in the education system, according to their potential and ability. In the use of speech technology, attempts to provide solutions for some of these issues by creating an interactive system. This application will help innovate a new way that will help blind and visually impaired people to take the test on their own without using anyone's help. From this application we have taken the process of Voice Recording and it is implemented in our application.The author focuses on developing an on-line speech-totext engine. The system acquires speech at run time through a microphone and processes the sampled speech to recognize the uttered text. The recognized text can be stored in a file. It can supplement other larger systems, giving users a different choice for data entry. A speechto-text system can also improve system accessibility by providing data entry options for blind, deaf, or physically handicapped

users. User can send messages to the entered phone number. Speech recognition is done via the Internet, connecting to Google's server. The application is adapted to input messages in English. Speech recognition for Voice uses a technique based on hidden Markov models (HMM - HiddenMarkov Model). It is currently the most successful and most flexible approach to speech recognition. But the HMM process may be somewhat difficult to understand and use in their daily activities. In paper the author presents a method to design a Text to Speech conversion module with the use of Matlab by simple matrix operations. Firstly by the use of microphone some similar sounding words are recorded using a record program in the Matlab window and the recorded sounds are saved in .wav format in a directory. The recorded sounds are then sampled and the sampled values are taken and separated into their constituent phonetics. For each and every word the recording is necessary and may occupy more space in memory.

2.1 EXISTING PROBLEM

The hand gestures provide a natural and intuitive communication modality for human-computer interaction. Efficient human computer interfaces (HCIs) have to be developed to allow computers to visually recognize in real time hand gestures. This project deals with real time hand gesture recognition using AVR Microcontroller. The existing system uses Digital camera for hand gesture recognition. The camera was used as an input device and the object need to present in front of the camera for capturing gesture. It limits mobility and cannot use camera in dark area as well as cost is very high. The camera specifications significantly affect GRS (Gesture Recognition System) characteristics. The proposed system, based on the input signal from the MEMS (Micro Electro

Mechanical System) accelerometer sensors measure the acceleration such as tilt, shock & vibrate. It is reliably and accurate detect. Here, the tilt motion information produced by the human subjects and transmitted to the AVR microcontroller i.e. ATmega32A The sign sequence and template matching algorithm developed to identify the gesture in a sequence. Based on the algorithm developed the microcontroller display the position of the hand in a display unit. We conclude that the recognition algorithm based on sign sequence and template matching as presents in this project can be used for non-specific users hand gesture recognition.

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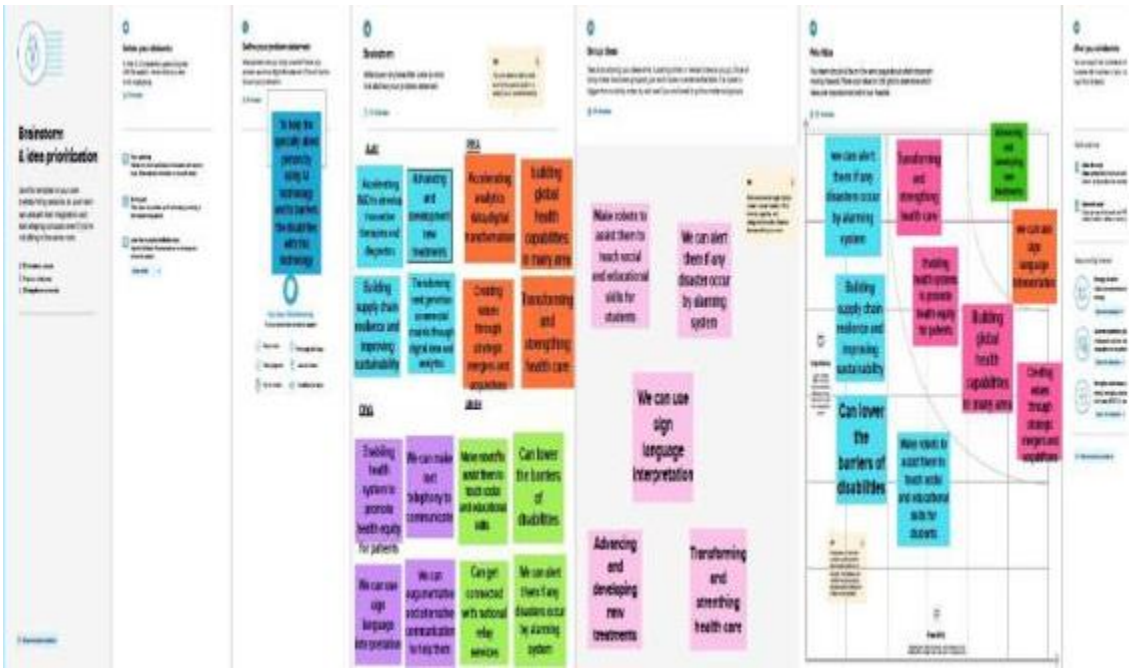
2.3 PROBLEM STATEMENT DEFINITION

Things that at first were difficult or impossible for them are now easily accessible on a daily basis. AI enables people with disabilities to step into a world where their difficulties are understood and taken into account.
AI technology can empower people living with limited physical mobility. Microsoft's AI for Accessibility program uses the potential of Artificial Intelligence to develop solutions to many physical and cognitive challenges disabled individuals face at work and in daily life to promote social inclusion for them.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

3.2 IDEATION AND BRAIN STROMING



3.3 PROPOSED SOLUTION

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statements (problem to be solved)	Skin disorders are among the most common diseases in both developing and industrialized countries. People living with skin disease experience stressful life as skin disease affects their confidence and self-esteem in so many different ways.
2.	Idea / Solution description	Create YOLO object detector helps the dermatologist. Medical imaging plays an important role for quick decision making in skin disease identification. Medical imaging is used for revealing internal structures hidden by the skin as well as to diagnose and treat disease
3.	Novelty / uniqueness	The novelty of the work is that the system automatically helps the dermatologist by detecting the disease just by images or videos, when immediate attention is

		required for the patient during treatment.
4.	Social impact / Customer Satisfaction	Make the patient more assure about their safety. We have classification model which is more accurate than a baseline model trained without segmentation, while also being able to classify multiple diseases within a single image. This improved performance may be sufficient to use CAD in the field of dermatology

5.	Business model (Revenue model)	• Able to get accurate results • Easy to use • Patient can use this detector by their own • Low cost
6.	Scalability of the solution	• This model ensures the safety and accuracy of the detection results of skin disease. • Patient and their family need not to be worried about the treating and healing time

3.4 PROBLEM SOLUTION FIT

Human Computer Interaction is an effective tool of intersection between the human intellect and computers leading to improvisation in technology. Gestures help to communicate between two persons very effectively even without saying a word but it is really ideal to note that man's immense potential and intelligence has motivated him to interact through gestures with his own invention called computer. This paper has been prepared on MATLAB using effectively a simple algorithm and basically deals with the recognition of finger gestures. It is executed by simple steps where initially the image is converted into binary which is followed by cutting the image from the point where the longest finger starts and also an amount from the bottom to get a subtle image and then simply counting the number of white objects (i.e. fingers) and this process is repeatedly done by rotating the image in all the four directions and the result is selected taking into account the outcome of the direction where maximum number of outcomes have occurred provided the background is in a solid colour which can reveal the image of the fingers displayed clearly. The application of this work includes choosing an option from any user interface by merely displaying numbers as per the number of fingers shown. This simple and innovative effort is user friendly and can be effectively used in imparting knowledge especially to differently abled.

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Functional Requirements of Face Mask Dataset:

R1.The system must have an unbiased ‘with_mask’ dataset.

R2.The dataset must have over 1500+ images in both ‘with_mask’ and ‘without_mask’ classes.

R3. The dataset must not re-use the same images in training and testing phases.

Functional Requirements of Face Mask Detector:

R1. The system must be correctly able to load the face mask classifier model.

R2. The system must be able to detect faces in images or video stream.

R3. The system must be able to extract each face's Region of Interest (ROI).

R4. There must not be any object between the system and the face of the user for a successful facedetection and hence the face mask detection.

R5. The end position of the face must be fit inside the webcam frame and must be closer to thecamera.

R6. Correctly able to detect masks in 'png', 'jpg', 'jpeg', and 'gif' format images.

R7. The system must be able to detect face masks on human faces on every frame in a live video.

R8. The results must be viewed by showing the probability along with the output of 'Mask' or not.

4.2 NON-FUNCTIONAL REQUIREMENTS

Product Operation:

R1.The face should be localized by detecting the facial landmarks

and the backgroundmust be ignored.

R2.The system will be implemented in Python script with an accuracy of the model ofover 90%.

R3.The user must not move his/her face out of camera's sight in order to get correctresults.

R4.The background must not be too bright or too dark while detecting the face mask.

Product revision:

R1.The system must be portable and can be applied to embedded devices with limitedcomputational capacity (ex., Raspberry Pi, Google Coral, NVIDIA Jetson Nano, etc.).

R2.The output response operation must be fast and under 5 seconds per person.

R3.The system must be able to correctly detect more than one face if present, and hence the presence of mask in the frame.

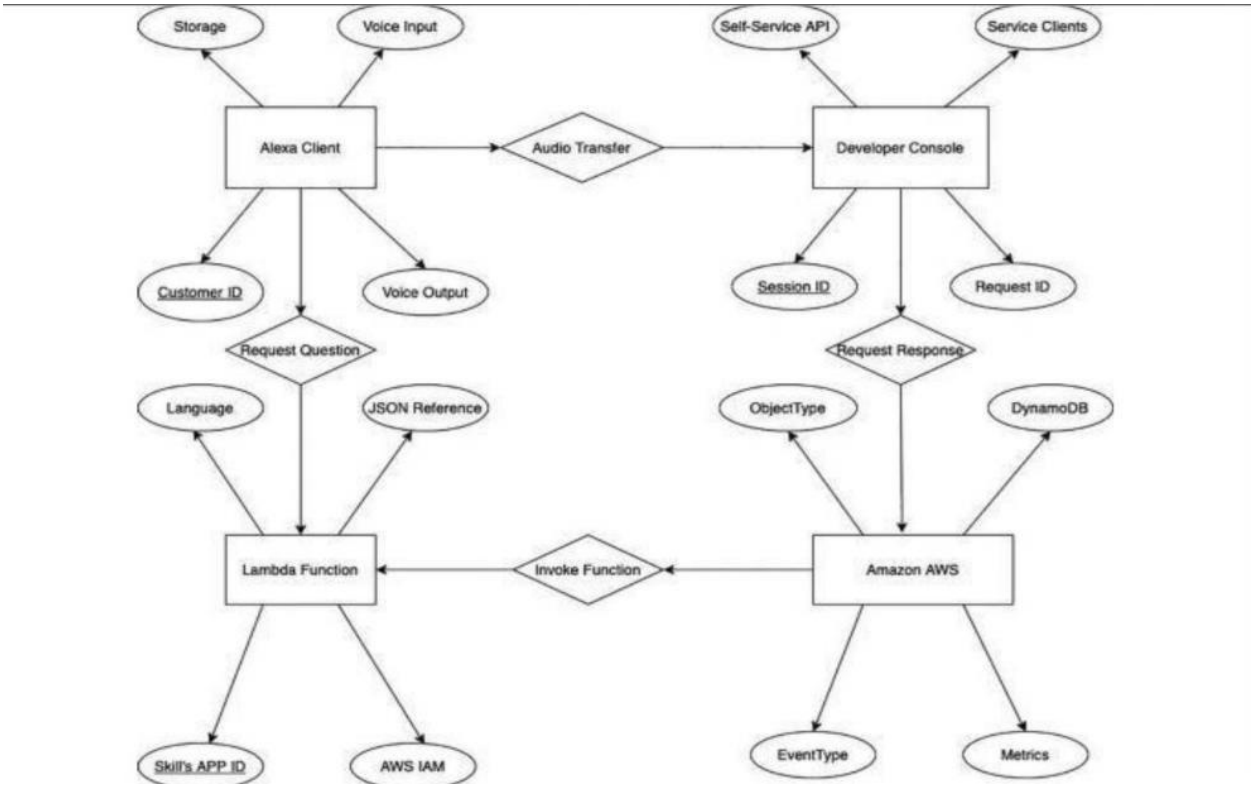
5. PROJECT DESIGN

Human-Computer interaction (HCI) with gesture recognition is designed to recognize a number of meaningful human expressions, and has become a valuable and intuitive computer input technique. Hand

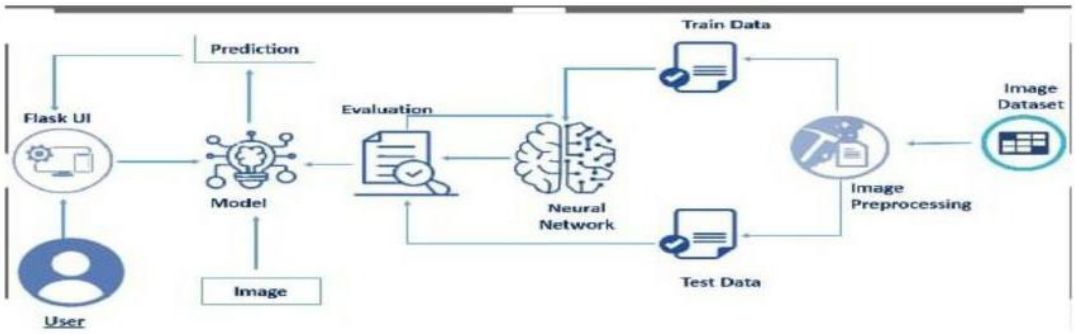
gestures are one of the most intuitive and common forms of communication, and can communicate a wide range of meaning. Vision-based hand gesture recognition has received a significant amount of research attention in recent years. However, the field still presents a number of challenges for researchers. In the vision-based hand gesture interaction process between humans and computers, gesture interpretation must be performed quickly and with high accuracy. In this paper, a low-cost HCI system with hand gesture recognition is proposed.This system uses several vision techniques. Skin and motion detection is used for capturing the region-of-interest from the background regions. A connected component labeling algorithm is proposed to identify the centroid of an object. To identify the exact area of hand gesture, the arm area is removed with the aid of a convex hull algorithm. Moreover, a real-time demonstration system is developed, based on a single-camera mechanism which allows for the use of wearable devices. Simulation results show that the recognition rate is still high, although some interference is encountered in the simulated environments.

5.1 DATA FLOW DIAGRAMS

A data-flow diagram is a way of representing a flow of data through a process or a system. The DFD also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow , there are no decision rules and no loops.



5.2 SOLUTION AND TECHNICAL ARCHITECHURE



5.3 USER STORIES

User Type	Functional	User Story	User Story/Ta	Acceptance	Priority	Release

	Requirement (Epic)	Number	sk	criteria		
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering email , password, and confirming my password.	I can access my account/ dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the	I can receive confirmation email & click confirm	High	Sprint-2

			applicati on			
		USN-3	As a user, I can register for the applicati on through google	I can register & access the dashboa rd with google	High	Sprint-1

		USN-4	As a user, I can register for the applicati on through Gmail	I can register through the emai	Mediu m	Sprint-2

	Login	USN-5	As a user, I can log into the application By entering email, password& captcha	I can receive login credentials.	High	Sprint-1

	Interface	USN-6	As a user, the interfaces should be user friendly manner	I can able to access easily.	Medium	Sprint-1
Web user	Dashboard	USN-7	As a user, I can access the specific info	I can able to know the types of interaction.	High	Sprint-1

Input	Voice	USN-8	As a user ,icon access the voice recognition.	I can able to access the total screen	High	Sprint-1
	View manner	USN-9	As a user ,I can access through site.	I can understand the display.	High	Sprint-1
	Touchless interface	USN-10	As a user ,I can access the screen by the touchless interface	I can understand the properties of display.	Medium	Sprint-2

6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement	User Story Number	User Story / Task	Story Points	Priority	Team Members

	(Epic)					
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	5	High	Gayathri A Dharshika B Snekha R Sitisamina A
Sprint-1	Data Collection	USN-1	Collecting Dataset	5	High	Gayathri A Dharshika B Snekha R Sitisamina A
Sprint-1	Image preprocessing	USN-1	Perform preprocessing	5	High	Gayathri A Dharshi

			techniques on the dataset			ka B Snekha R Sitisamina A
Sprint-2	Model Building	USN-1	Model initialization with required layers	5	High	Gayathri A Dharshika B Snekha R Sitisamina A
Sprint-2	Training	USN-1	Training the image classification model using CNN	5	Medium	Gayathri A Dharshika B Snekha R Sitisamina A
Sprint-3	Testing	USN-1	Testing the model's performance	10	High	Gayathri A Dharshika B Snekha R Sitisamina

						A
Sprint-4	Deployment of model in web/app	USN-1	Converting text to speech API	10	Medium	Gayathri A Dharshika B Snekha R Sitisamina A

6.2 SPRINT DELIVERY SCHEDULE

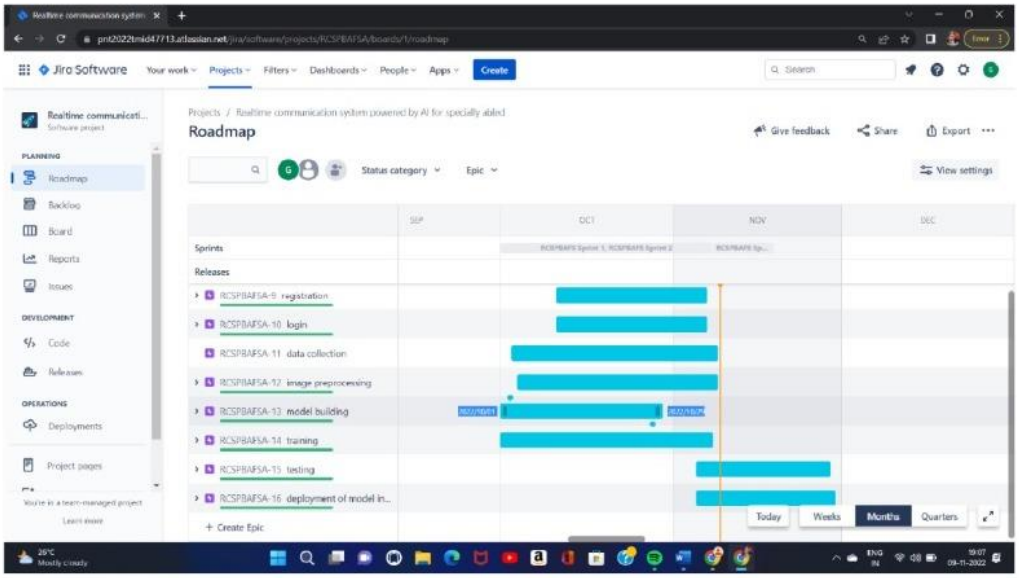
Sprint	Total story points	Duration	Sprint start date	Sprint end date	Story points completed	Sprint release date(actual)
Sprint-1	10	7 days	24 Oct 2022	31 Oct 2022	10	29 Oct 2022
Sprint-2	10	7 days	01 Nov 2022	07 Nov 2022	10	05 Nov 2022
Sprint-3	10	7 days	08 Nov 2022	14 Nov 2022	10	12 Nov 2022
Sprint-4	10	7 days	15 Nov 2022	21 Nov 2022	10	19 Nov 2022

6.3 REPORTS FROM JIRA

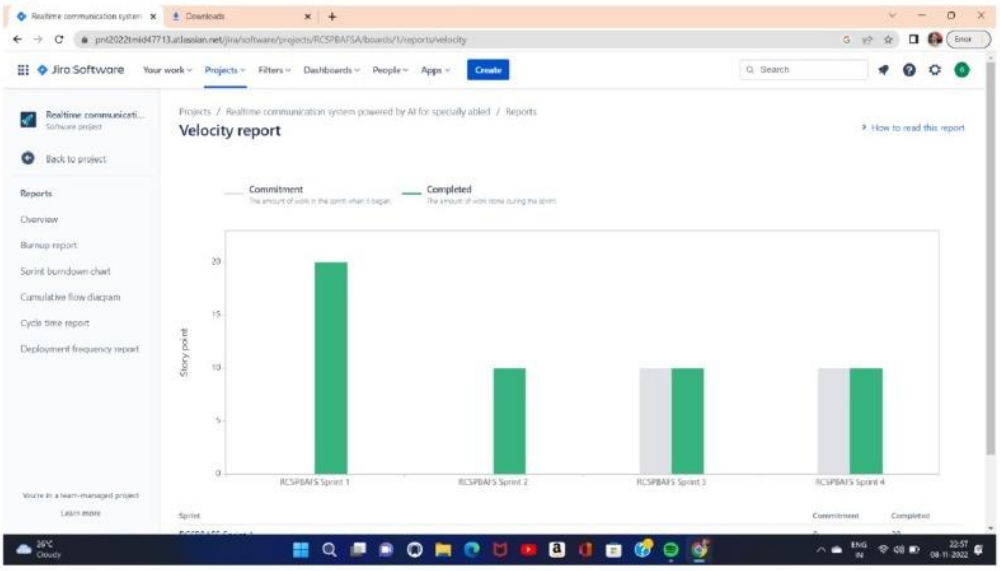
Using JIRA software the reports are collected as road maps and velocity

reports.

ROADMAP



VELOCITY REPORT



7. CODING & SOLUTIONING

7.1 FEATURES

Feature 1: Registeration
Feature 2: Login
Feature 3: User interface
Feature 4: Store database
Feature 5: Send Alert Emails to us

7.2 DATABASE SCHEMA

The first thing to note is that this is not a difficult classification problem. The gestures are quite distinct, the images are clear, and there's no background whatsoever to worry about. If you weren't comfortable with deep learning, you could do quite well with some straight-forward

feature detection -- for example the '07_ok' class could easily be detected with binary thresholding followed by circle detection. Moreover, the gestures consistently occupy only about 25% of the image, and all would fit snugly inside a square bounding box. Again if you're looking to do basic feature detection, an easy first step would be to write a short script cropping everything to the relevant 120 x 120 square.
But the point of this notebook is to show how effective it is to just throw a neural network at a problem like this without having to worry about any of the above, so that's what we're going to do.
At the moment our vector `y_data` has shape `(datacount, 1)`, with `y_data[i,0] = j` if the `i`th image in our dataset is of gesture `reverselookup[j]`. In order to convert it to one-hot format, we use the keras function to_categorical.

8. TESTING

8.1 TESTING:

- Login Page (Functional)
- Login Page (UI)
- Add Expense Page (Functional)

8.2 User Acceptance Testing

1.Purpose of Document

The purpose of this document is to briefly explain the test coverage and

open issues of [product name] project time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they are resolved.

Convexity Analysis

Convexity analysis is performed by obtaining the convex hull and convexity defects of each contour. If you are unfamiliar with these terms, they are worth reading up on. The following points on the contour are determined (note relative measurements are calculated using the size of the face):

1. Highest
2. Leftmost within a finger tips vertical distance of the highest
3. Rightmost within a finger tips vertical distance of the highest
4. Leftmost above the wrist
5. Rightmost above the wrist

The contour is then re-examined using this information to attempt to locate the thumb. This is done by checking the leftmost and rightmost points above the wrist. If they are at least half a thumbs length farther out than the leftmost and rightmost points within a finger tips vertical distance of the highest, they are marked as a potential thumb. Potential thumbs are re-examined, checking the nearby points, checking how the contour varies vertically and horizontally. If the contour travels far horizontally before having a vertical wall, it is marked as a thumb.

Defect Filtering

The defects which fall into the following categories are discarded:

1. Far point is above the start and end points
2. Any point is much lower than the highest point
3. Distance from start/end point to far point is too small
4. Distance from start/end point to far point is too large

Defect Analysis

After the presence of the thumb is determined, the defects of the contour are analysed. The following handlers for defects exist:

1. Thumb
   - If the defect set is the thumb, it is skipped
2. Two fingers
   - If the start and end points of a defect set are within a fingertips vertical distance of each other, they are labelled as two finger tips
3. Pinky finger
   - If the two fingers handler does not catch the defect set as two fingers, the pinky finger handler is executed
   - The leftmost and rightmost point in the defect set are compared to the leftmost and rightmost point above the wrist
   - If either of them are the same point, then the defect is labelled as a pinky - If the pinky is found as one of the points, the other points vertical position is checked
   - If the other point is above the pinky, it is also labelled as a finger tip
4. Single finger
   - If the other handlers fail the single finger handler is executed
   - The single finger handler just labels the highest point of the defect

set as a finger

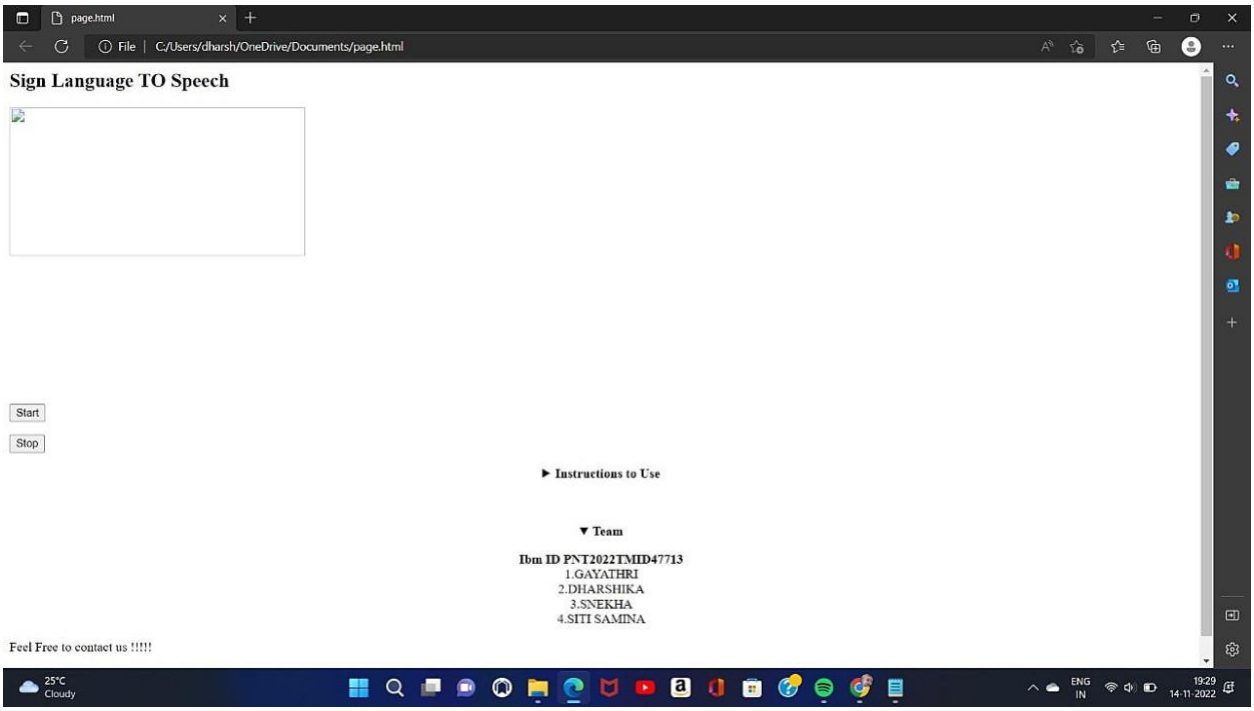
Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

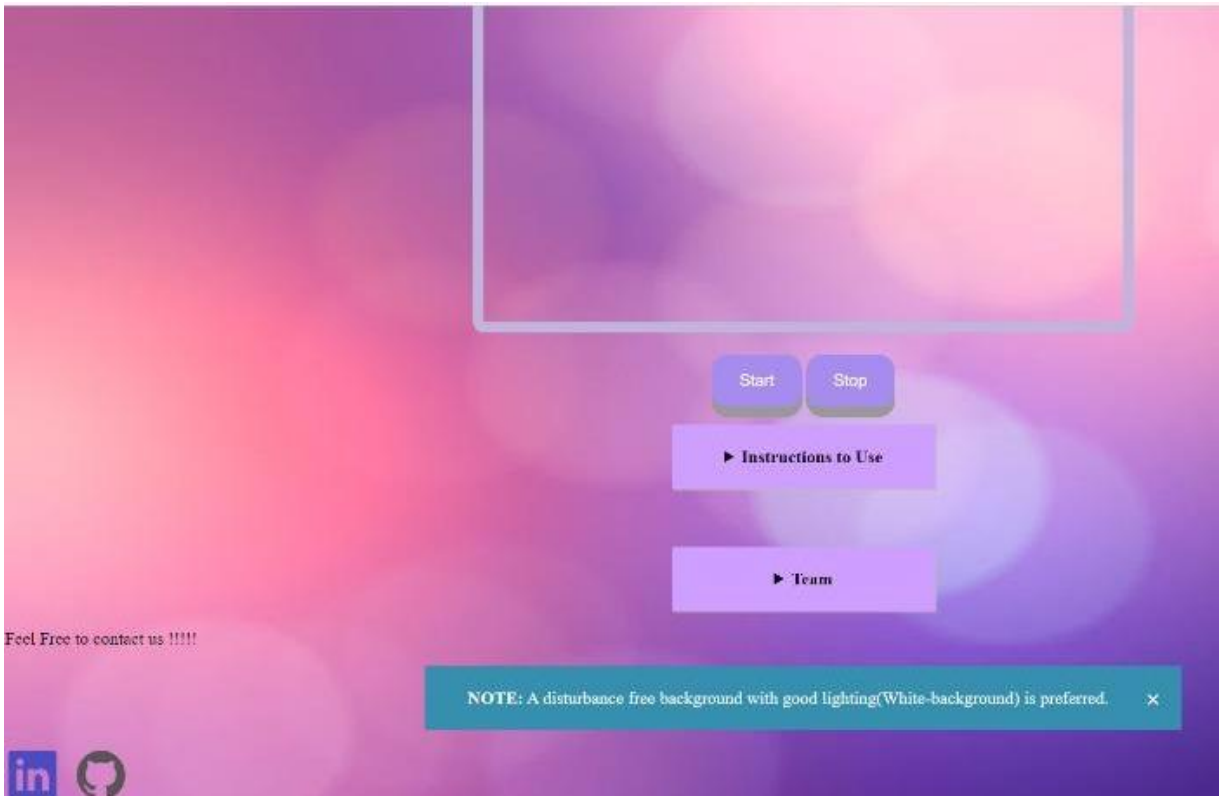
Section	Total Cases	Not Tested	Fail	Pass
Interface	7	0	0	7
Login	43	0	0	43
Logout	2	0	0	2
Limit	3	0	0	3

RESULTS

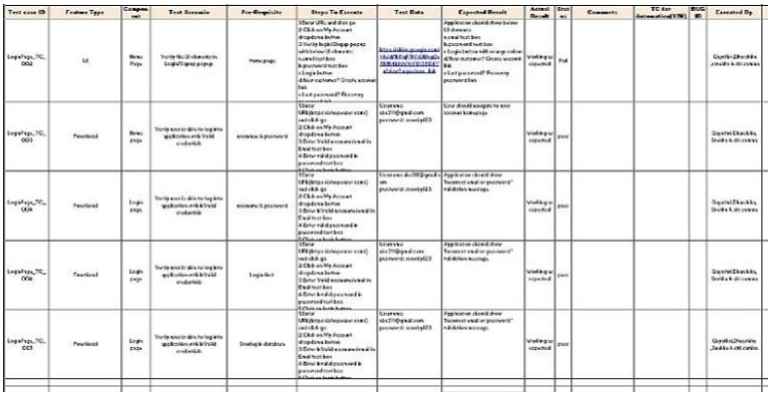
BEFORE CSS


page.html
File | C:/Users/dharsh/OneDrive/Documents/page.html
Sign Language TO Speech
Start
Stop
▶ Instructions to Use
▼ Team
Ibm ID PNT2022TMID47713
1.GAYATHRI
2.DHARSHIKA
3.SNEKHA
4.SITI SAMINA
Feel Free to contact us !!!!!
25°C
Cloudy
ENG
IN
19:29
14-11-2022

AFTER CSS


Start
Stop
▶ Instructions to Use
▶ Team
Feel Free to contact us !!!!!
NOTE: A disturbance free background with good lighting(White-background) is preferred.

PERFORMANCE METRICS



ADVANTAGES & DISADVANTAGES

ADVANTAGES

Benefits of gesture recognition include improved safety — since drivers do not have to take their attention off the road as much as they would with touch controls — and the simple convenience of being able to control vehicle functions with deliberate gestures rather than a potentially complex menu scheme.

DISADVANTAGES

These results suggest that gesture aids the listener as well as the speaker and that gesture has a direct effect on listener comprehension, independent of the effects gesture has on speech production.
There are limitations to speech recognition software. It does not always work across all operating systems. Noisy environments, accents and

multiple speakers may degrade results. Also, regular voice recognition software can lack integration with other key services

CONCLUSION

Touchless user interface is an emerging type of technology in relation to gesture control. Touchless user interface (TUI) is the process of commanding the computer via body motion and gestures without touching a keyboard, mouse, or screen.
Gesture are easier representation, makes the presentation attractive, Quick expressing of message, etc. Gestures are non-verbal communications. It can make the information to be presented easily via audio, visual, or even through silent. It is usually a substitute of verbal based communication.

FUTURE SCOPE

Proposed systems scope is related with education of dumb peoples. Dumb people faces many problems when normal person could not understand their language. They were facing communication gap with normal peoples.For communication between deaf person and a second person, a mediator is required to translate sign language of deaf person. But a mediator is required to know the sign language used by deaf person.But this is not always possible since there are multiple sign languages for multiple languages.

APPENDIX

SOURCE CODE

https://drive.google.com/file/d/1QRfvtpTLHp-4IAiS0P21f98uJdOj7d7M/view?usp=drivesdk

GITHUB LINK

GitHub - IBM-EPBL/IBM-Project-10920-1659244249: Real-Time Communication System Powered by AI for Specially Abled

Project demo link

https://drive.google.com/file/d/1QbvBS8AOirbv13ryQ7zqR-3ZmldozaDP/view