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Jnana Sangama, Belagavi - 590018

A Project Work Phase-I (18CSP77)
Report on

"HAND GESTURE RECOGNITION FOR DIFFERENTLY ABLED PEOPLE"

Project Report submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

GOUTHAM M	**1KS18CS024**
DHANANJAYA S	**1KS18CS018**
KIRAN V DAMBAL	**1KS18CS033**
GANESH A	**1KS18CS023**

Under the guidance of

Dr. Deepa S R
Associate Professor
Department of Computer Science & Engineering
K.S.I.T, Bengaluru-560109

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

K. S. Institute of Technology

#14, Raghuvanahalli, Kanakapura Road, Bengaluru - 560109

2021 - 2022

K. S. Institute of Technology

#14, Raghuvanahalli, Kanakapura Road, Bengaluru - 560109

Department of Computer Science & Engineering

CERTIFICATE

Certified that the Project Work Phase-I(18CSP77) entitled **"HAND GESTURE RECOGNITION FOR DIFFERENTLY ABLED PEOPLE"** is a bonafide work carried out by:

Goutham M	**1KS18CS024**
Dhananjaya S	**1KS18CS018**
Kiran V Dambal	**1KS18CS033**
Ganesh A	**1KS18CS023**

in partial fulfillment for VII semester B.E., Project Work in the branch of Computer Science and Engineering prescribed by **Visvesvaraya Technological University, Belagavi** during the period of October 2021 to January 2022. It is certified that all the corrections and suggestions indicated for internal assessment have been incorporated. The Project Work Phase-I Report has been approved as it satisfies the academic requirements in the report of project work prescribed for the Bachelor of Engineering degree.

……	…….	…….
Signature of the Guide	**Signature of the HOD**	**Signature of the Principal & Director**
[Dr. Deepa S R]	[Dr. Rekha B. Venkatapur]	[Dr. Dilip Kumar K]]

DECLARATION

We, the undersigned students of 7th semester, Computer Science & Engineering, KSIT, declare that our Project Work Phase-I entitled "**HAND GESTURE RECOGNITION FOR DIFFERENTLY ABLED PEOPLE**", is a bonafide work of ours. Our project is neither a copy nor by means a modification of any other engineering project.

We also declare that this project was not entitled for submission to any other university in the past and shall remain the only submission made and will not be submitted by us to any other university in the future.

Place: Bangalore
Date:

Name and USN	**Signature**
Goutham M (1KS18CS024)	**…….**
Dhananjaya S(1KS18CS018)	**…….**
Kiran V Dambal (1KS18CS033)	**…….**
Ganesh A (1KS18CS023)	**…….**

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Goutham M
Dhananjaya S
Kiran V Dambal
Ganesh A

ABSTRACT

Hand Gesture is one of the oldest techniques for conversation amongst humans. In this current technology era, gesture recognition affects the world differently, from the physically challenged individuals to robotic control. Human hand gestures provide the natural and advantageous approach of non-verbal conversation with the computer system. Hand gestures are the considerable body movements that are actions of hands, arms or fingers. Hand gestures are mainly two types, the "Static Gestures" they only require the processing of a single image at the input of the classifier and "Dynamic Gestures" that express the human feeling and communicate with computers or humans. The hand is specifically used as the way of input to the machine, for the verbal exchange purpose, for gesture identification there is no need for an intermediate medium. The deaf and mute people make use of sign language to communicate which is difficult to interpret by the individuals who are not well-aware of it.

There is a need to build a device that can interpret the gestures into text and speech. To tackle this problem. The deaf and mute community today should be able to converse without external support like a translator. This system is an attempt to help them and remove the intermediate or the middle man. The system created here will use the Deep Learning Model created using Tensorflow to interpret the gestures, capture the image and finally use it to give the result of the gesture shown by the user. Each image will have a particular label and the system is first trained with a huge dataset and then tested to find the results of the training. All the results of the training and testing will be shown through a Web application or a Mobile Application.

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Chapter 1

INTRODUCTION

1.1 Overview

In recent years, the population of deaf-mute victims has accumulated due to birth defects and different problems. Since a deaf and mute person cannot speak with a standard person they have to be compelled to some quiet communication system. Sign language is very popular among them and they use hand gestures to express themselves.

A gesture can be an image of physical conduct or an expression of emotion. It incorporates both hand and body movements. It is primarily divided into two categories: static gestures and active gestures. In the case of the prior, the body posture or hand gesture communicates a symbol. The hand motion denotes equivalent messages in the latter case. The popularity of a gesture or movement of the body or body parts is used to determine the user's purpose. Over the years, several researchers have sought to improve hand motion-detecting technology. Language recognition, video games, disabled language interpreters, and golem management are just a few of the uses for hand gesture recognition.

The significance of recognizing gestures has accrued at a really quick pace owing to the new generation of gesture interface technology. Sign language is especially a language for the differently-abled(deaf-mute) community that can’t use spoken languages to speak with others. Though they will see, the utilization of hand signs to move becomes inconvenient to precise one’s feelings without delay if a typical hand language isn't followed. A customary language features an outlined set of signs and their meanings, creating them simple to grasp. The language uses completely different gestures for communication, principally the hand. Sign languages are distinct from spoken languages. The utilization of hand gestures for interaction either with humans or with machines is relatively beyond different body gestures like head and eyes because of the actual fact that hands send additional clearer signals and also the gestures may be created ad-lib.

Nowadays, deaf and dumb individuals are getting additional more and more outgoing, and in contrast to the past, don't rely upon anybody for communication. So, for such individuals it's vital that the public around them should be ready to perceive what they require to inform them of exploitation language. For such individuals, we tend to build the hand gesture recognition system in order that although anyone doesn't grasp the meanings of the signs, they will use this system to recognize the language. Hence, the deaf and mute individuals don’t have any barrier in their communication.

The proposed system is expected to give an accuracy of 90%.

1.2 Purpose of the Project

The system's main goal is to help deaf and hard of hearing people. community and to those in need of assistance when communicating with another human being. This system will try to remove the use of translators or an intermediary so that the deaf and mute can feel more independent and have easy conversations with everyone. In India, there is no proper system that is used for the deaf-mute community to communicate. To resolve this problem, our project will create a system that will take gestures as the input and provide text or voice-based output.

1.3 Scope of the Project

This project's goal is to develop a system. Deep learning algorithms will be used to turn human hand motions into text or voice dependent on the needs of the user. The aim is to create a reliable tool for the deaf-mute community to interact with normal people.

1.4 Definitions

1.4.1 Python

Python is a high-level programming language that is dynamically semantic, interpreted, and object-oriented. Python is a simple, easy-to-learn programming language. Python is a sophisticated, adaptable, and general-purpose programming language. Python supports modules and packages, which encourages program modularity and code reuse. A python is an excellent tool for developing algorithms for usage in production. For basic data analysis and machine learning, Python has a number of packages.

1.4.2 Jupyter Notebook

The Jupyter Notebook App is a server-client tool for editing and running notebook papers that is accessible through the web. The Jupyter Notebook App can be installed on a remote server and accessed via the internet, or it can be operated locally on a computer without requiring an internet connection. Jupyter Notebook is a free and open-source web application that allows you to create and share documents that include live code, equations, visualizations, and narrative text. It can be used for data cleansing and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and a variety of other tasks.

1.4.3 Deep Learning

Deep learning is essentially a three-layer neural network and is a subset of machine learning.

These neural networks try to mimic human brain activity by allowing it to "learn" from massive volumes of data, but they fall far short of the human brain's capabilities. While a single-layer neural network can only make approximations, adding hidden layers can help to optimize and enhance accuracy. Deep learning is used in many artificial intelligence (AI) products and services to improve automation by performing analytical and physical tasks without the need for human intervention. Deep learning technology is used in everyday products and services (such as digital assistants, voice-enabled TV remotes, and credit card fraud detection), as well as prospective developments (such as self-driving cars).

1.4.4 Tensorflow

TensorFlow is a programming language for expressing and executing machine learning algorithms. With few or no adjustments, TensorFlow computations may be conducted on a wide range of heterogeneous systems, from mobile devices like phones and tablets to large-scale distributed systems with hundreds of computers and thousands of processing devices like GPU cards. The framework is adaptable and may be used to define a wide range of algorithms, including deep neural network training and inference techniques. Speech recognition, computer vision, robotics, information retrieval, natural language processing, geographic information extraction, and analytic reasoning are just a few of the applications. This document defines the TensorFlow interface as well as a Google implementation of that interface.

Chapter 2

LITERATURE SURVEY

2.1 Hand Gesture Recognition for Deaf and Dumb

The use of vision-based technology to recognize hand gestures is an important part of human-computer interaction (HCI). New types of HCI techniques are required due to the rapid growth of technology and software. Speech recognition and gesture recognition are two technologies that have received a lot of interest in the field of HCI. Deaf and dumb people lack in proper communication with traditional individuals and notice it tough to properly specific themselves. Thus, they're subjected to several problems in this regard. Linguistic communication is extremely standard among them and they use it to specific themselves. The deaf and dumb build use of linguistic communication to speak that is tough to interpret by the people WHO aren't well-aware of it. There is a need to expand a technology that can translate motion into text and speech. This could be a useful first step in improving communication between deaf and dumb persons and the wider population. We provide a way for deaf and dumb persons who are unable to communicate with others to interact with others in their environment.

2.2 Hand Gesture Movement Recognition System Using Convolution Neural Network Algorithm

Individuals communicate via gestures, which are the most rudimentary form of voice communication. These days, in the age of modern innovation, gesture recognition has an impact on individuals all over the world, from physically challenged persons to robotic management and virtual reality scenarios. With the computer interface, human hand gestures provide a natural and advantageous technique to nonverbal speech communication. Hand gestures are goodish body movements that involve the hands, arms, or fingers. From static gestures with complicated foundations to dynamic gestures that categorize human feelings and communicate with laptops or humans, hand gestures have recognizable evidence levels. Because the hand is explicitly employed because of its contribution to the machine, there is no requirement for a related intermediary medium for gesture identification. A deep convolutional neural network is provided in this paper for recognizing hand gestures in photos without the requirement for any segmentation or detection phases that would eliminate the digressive not-hand space.

2.3 Hand gesture recognition approach for real-time interactions

Hand gestures are a natural way for people to engage with their surroundings, and they can be used as input in a human-computer interface to improve usability and naturalness. Several existing solutions use vision-based systems to detect and recognize hand movements. Users of vision-based solutions, on the other hand, are frequently required to move their hands inside a small zone in order for the device to capture their movements. Vision-based systems may also face self-occlusion concerns as a result of little finger motions. We frequently employ a sensor-based motion chasing system to capture 3D hand and finger gestures. We provide a one-of-a-kind angular-speed methodology that is immediately applied to the sensor-based system's broadcasted 3D motion knowledge in order to recognize and recognize hand gestures. Our algorithm is capable of identifying both static and dynamic motions throughout time. We prefer to measure the popularity accuracy and execution performance of 2 moves programs that demand gesture input to engage with the virtual surroundings. Their testing demonstrated a high level of recognition accuracy, execution performance, and usability.

2.4 Hand Gesture Recognition on Skeletal Data

In this paper, we will introduce a new deep learning-based 3D hand gesture identification approach. We present a novel Convolutional Neural Network (CNN) that processes sequences of hand-skeletal joint locations using parallel convolutions, and we test its performance on gesture sequence categorization tasks. Our model is based solely on data from the hand skeleton and does not include a depth image. When compared to other publicly available approaches, ours delivers improved results on a difficult dataset (the DHG dataset from the SHREC 2017 3D form Retrieval Contest). Our model achieves 91.28 percent accuracy for the 14 gesture categories case Associate in Nursing, and 84.35 percent accuracy for the 28 gesture categories case.

2.5 Hand gesture recognition based on computer vision

Nonverbal communication such as hand gestures can be utilized for deaf-mute communication, automation management, human-computer interaction (HCI), home automation, and medical applications. Hand gesture research publications have used a variety of methodologies, including instrumented sensing element technology and computer vision. Hand signs are generally classified under numerous sections, such as posture and gesture, as well as dynamic and static, or a combination of the two. This study presents an overview of the research on available gesture strategies, as well as their merits and limits in specific situations. It also tabulates the results of such strategies, focusing on computer vision approaches that handle similarity and difference points, hand segmentation techniques, classification algorithms and drawbacks, range and types of motions, datasets, detection range (distance), and camera type. This article might be a complete introduction of hand gesture strategies, followed by a quick discussion of various application possibilities.

2.6 Hand gesture recognition system for Japanese sign language

In this study, they propose using a sensor-based information gathering glove to

recognize Japanese Sign Language (JSL) hand motions. The bending degree of fingers and hand movement information is monitored using five flex sensors, a mechanical phenomenon measuring unit (IMU), and three Force Sensing Resistors (FSRs). The detected data is sent to the computer by Associate in Nursing Arduino small. Using the Support Vector Machine (SVM)-based formula and the Dynamic Time Warping (DTW)-based formula, the average accuracy of hand gesture identification for a single participant is 96.9% and 94.5 percent, respectively. In addition, for cross-recognition among three participants, the planned system obtains a median identification accuracy of roughly 82.5 percent. The studies suggest that the proposed system has a lot of potential for recognizing JSL hand gestures.

2.7 Real-Time Hand Gesture Recognition Using Finger Segmentation

As we all know, employing vision-based technology to identify hand gestures is an important aspect of human-computer interaction (HCI). The keyboard and mouse have become increasingly significant in human-computer interaction in recent decades. However, because of the rapid advancement of technology and software, new types of HCI solutions have become necessary. Speech recognition and gesture recognition are two technologies that have received a lot of interest in the field of human-computer interaction. A gesture is a visual depiction of physical action or a statement of emotion. It includes both hand and body motions. Static gestures and dynamic gestures are the two forms of gestures. In the case of the former, a sign is expressed by body posture or a hand gesture. The latter uses the movement of the body or the hand to deliver messages. Humans and machines can interact with each other via gestures. It varies from standard hardware-based solutions in that it permits human-computer interaction through gesture recognition. Gesture recognition, which recognizes the gesture or movement of the body or body components, is used to determine the user's intent. Many researchers have been working on hand motion-detecting technology for decades. Many applications rely substantially on hand gesture recognition, such as sign language recognition, augmented reality (virtual reality), sign language interpreters for the blind, and robot control.

2.8 Analyzing different techniques for automated gesture recognition

Hand gesture recognition is a way to solve numerous challenges and make life easier for humans. Machines' ability to comprehend human actions and their meaning can be used in a wide range of situations. Sign language recognition is one area of research that has piqued my curiosity. This research provides a complete summary of current state-of-the-art hand gesture and sign language recognition technologies. The approaches are divided into stages: data collection, pre-processing, segmentation, feature extraction, and classification, with the various algorithms for each stage described and their merits compared. We also go over some of the broader challenges and limitations of gesture recognition research, as well as others that are specific to sign language recognition. The study's overall goal is to give readers a complete introduction to the subject of automated gesture and sign language identification, as well as to aid future research efforts in this field.

Chapter 3

PROBLEM IDENTIFICATION

3.1 Problem Statement

“ To design a Deep Learning Model which will recognize the hand gestures of Differently Abled People and then convert the gestures into text or voice-based output”

In the past few years, the number of deaf-mute victims has accumulated due to birth defects and different problems. Since a deaf and mute person cannot speak with a standard person they have to be compelled to some quiet communication system. As a result, enabling the deaf-mute community to effectively communicate with normal people for routine day-to-day tasks, a hand gesture detection system is required.

3.2 Project Scope

The proposed system focuses on hand gestures which is accepted by Indian Sign Language Organization and tries to recognize the same which is then converted to text or speech based on the user requirement.

Chapter 4

GOALS AND OBJECTIVES

4.1 Project Goals

This project's main purpose is to create a model using deep learning algorithms that can be used to recognize hand gestures and convert them into text or voice. To help the deaf-mute community to feel more independent, we are trying to remove human assistance and provide a system that gives them a text or voice-based output for their hand gestures. We will also create an API for our proposed model which will enable other developers to use this tool in their projects. (Ex: Online Meeting Platform). This project also focuses on providing a Web-based or Android Application for our users to effectively use our model in their day-to-day lives.

4.2 Project Objectives

The main objective is to create a model which accurately identifies the hand gesture and provides the proper outcome every single time. And to create a stable system that recognizes sign language which is accepted by the Indian Sign Language Organization. Since there are no proper methods for Differently Abled People to communicate in India, we want to create a system that will help everyone in their day-to-day life.

Chapter 5

SYSTEM REQUIREMENT SPECIFICATION

5.1 Software Requirement Analysis:

A software requirements specification is an abstract description of the services that the system should provide, as well as the limitations that it should function under. It ought to solely specify the external behavior of the system and isn't involved with system style characteristics. It's an answer, in an exceedingly large language and diagrams, of what services the system is predicted to produce and also the constraints below that it should operate.

Software Requirements

- Python
- Jupyter Notebook
- Tensorflow
- OpenCV

5.2 Hardware Requirement Analysis:

System Requirements The term "analysis" refers to the process of defining and analyzing a comprehensive set of functional, operational, performance, interface, quality, design, criticality, and testing criteria.

Hardware Requirements

- Windows OS version 8 or higher
- Intel i5 processor or higher
- Minimum of 4GB RAM or higher
- Web Camera
- Graphics Card 2GB or higher

Chapter 6

METHODOLOGY

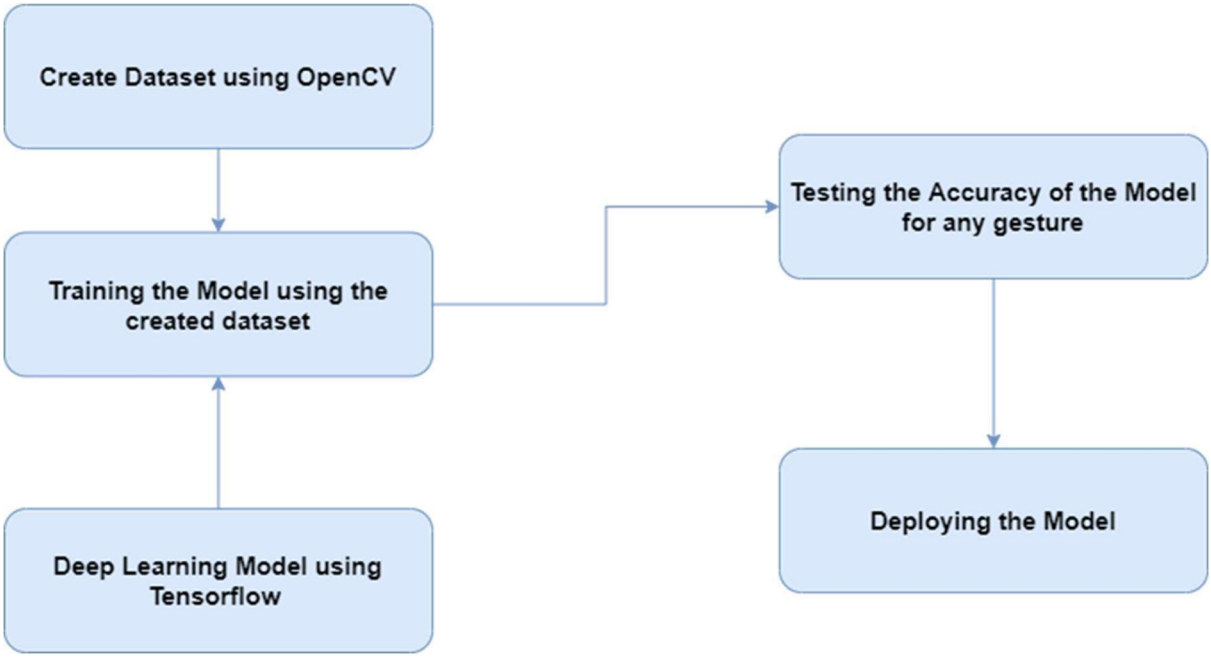

Fig 1 : Creation of Dataset and Model of the System

Dataset Preparation : The dataset will be created using OpenCV. 30 or more images will be captured per gesture. Initially images of 20 gestures will be acquired, later it will be increased based on the need.

Model Creation : A Deep Learning model will be created using tensorflow library. Tensorflow Object Detection API will be used in the creation of the model. This API has come pre existing models which will be used for building the model. Then the model goes through an extensive level of training so that it can accurately detect the gestures.

Training and Testing of Model : The deep learning model will be trained using the dataset that has been created. As mentioned above, 80% will be used for model training. Since the images are
complex and the model needs a large number of images for training, the division was chosen. The more images we use for training, the better accuracy the model outputs. With the 20% left, it will be used for testing the model. The testing is done to view how well the model is trained and how a model would work in a real-world scenario.

Deploying the Model : The trained model will then be deployed using a web application. This web application will depict the flow of the model created for the user to understand.

Internal Working of the System :

Fig 2: Internal working of the gesture recognition system

During the testing of the current system, testing begins with the capture of the image using the webcam of a computer or the camera in any mobile device.

Once the image is acquired, OpenCV will segment the region in the image where the gesture is present and that will be stored in the database. This image is now fed to the model which will be developed using deep learning algorithms from tensorflow library.

This model will now recognize the gesture and will compare it with the trained data. Once the model has compared the gesture it will now identify the gesture and begin to give the output. The output from the system will be in the form of either text or voice based on the user requirement. This will be seen through a Web based or Mobile based Application.

Chapter 7

APPLICATIONS

Hand gesture research has become a fascinating and essential field since it allows for natural contact and reduces the cost of using sensors in information gloves. Traditional interactive techniques rely on a number of devices such as a mouse, keyboard, bit screen, joystick, and consoles for gaming and machine control. The parts that follow go over some of the most common uses of hand gestures. The following are the most popular application spaces that compete with hand gesture recognition algorithms.

- **Clinical and Health**
- **Sign Language Recognition**
- **Robot Control**
- **Home Automation**
- **Virtual Environment**
- **Personal Computer and Tablet**
- **Gestures for Gaming**

Chapter 8

CONTRIBUTION TO SOCIETY AND ENVIRONMENT

- Hand gesture recognition will allow persons with disabilities to communicate and interact with regular people in public settings such as train stations and airports. It's a growing topic of study that aims to include the gestural channel into human-computer interaction.

- While touch screens are a prevalent method of input for public displays, gesture interfaces offer a number of benefits, including increased hygiene, engagement from afar, discoverability, and the ability to foster performative participation.

- It instills in them a sense of equality in society. The social acceptability implications of gestural input are a key obstacle to gesture interface adoption on consumer mobile devices like smartphones and smartwatches..

- Differently abled communities will have greater professional chances as a result of this.

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[7] Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang and Yu-Bo Yuan ,Real-Time Hand Gesture Recognition Using Finger Segmentation. Here, They presented an efficient and effective method for hand gesture recognition. The hand region is detected through the background subtraction method. Then, the palm and fingers are split so as to recognize the fingers. After the fingers are recognized, the hand gesture can be classified through a simple rule classifier. In this system the total classification accuracy for 1300 images was 89%.

[8] Ming Jin Cheok Zaid Omar Mohamed Hisham Jaward worked on analyzing different techniques for automated gesture recognition. They have reviewed different techniques such as Feature extraction, Gesture classification etc. This paper has achieved a high accuracy in recognising the gesture.

A Survey on Hand Gesture Recognition for Differently Abled People

Goutham M[1], Dhananjaya S[1], Kiran V Dambal[1], Ganesh A[1]
Dr. Deepa S R[2]

[1]Student of K S Institute of Technology, Raghuvanahalli, Bengaluru, Karnataka
[2]Associate Professor, Dept of Computer Science and Engineering, K S Institute of Technology, Raghuvanahalli, Bengaluru, Karnataka

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ABSTRACT: Hand Gesture is the most basic technique for conversation amongst humans. Today in the time of current day innovation, gesture recognition affects the world in a different way, from physically challenged individuals to robotic control. Human hand gestures provide a natural and effective approach to non-verbal conversation with the computer system. The deaf and mute make use of sign language to communicate which is difficult to interpret by the individuals who are not well-aware of it. There is a need to build a device that can interpret the gestures into text and speech. To tackle this problem, the system created here will use the Deep Learning Model created using Tensorflow to interpret the gestures, capture the image, and finally, use it to give the result of the gesture shown by the user.

Keywords: Hand Gesture, Tensorflow, Deep Learning, Image Processing, Computer vision, Text, Audio.

I. INTRODUCTION

In recent years, the population of deaf-dumb victims has accumulated due to birth defects and different problems. Since a deaf and mute person cannot speak with a standard person they have to be compelled to some quiet communication system. Sign language is very popular among them and they use hand gestures to express themselves. Gestures could be an image of physical behavior or emotional expression. It includes body gestures and hand gestures. It is mainly classified into two parts one is a static gesture and another is a dynamic gesture. For the previous, the posture of the body or the gesture of the hand denotes a symbol. For the latter, the gesture of the hand denotes equivalent messages. Gesture recognition determines the user intent through the popularity of the gesture or movement of the body or body elements. Within the past decades, many researchers have striven to spice up hand gesture recognition technology. Hand gesture recognition has nice value in several applications like language recognition, video games, language interpreters for the disabled, and golem management. The importance of gesture recognition has accrued at a really quick pace owing to the new generation of gesture interface technology. Sign language is especially a language for the differently-abled(deaf-mute) community that can't use spoken languages to speak with others. Though they will see, the utilization of hand signs to move becomes inconvenient to precise one's feelings without delay if a typical hand language isn't followed. A customary language features an outlined set of signs and their meanings, creating them simple to grasp. The language uses completely different gestures for communication, principally the hand. Sign languages are distinct from spoken languages. The utilization of hand gestures for interaction either with humans or with machines is relatively beyond different body gestures like head and eyes because of the actual fact that hands send additional clearer signals and also the gestures may be created ad-lib. Nowadays, deaf and dumb individuals are getting additional and additional outgoing, and in contrast to the past, don't rely upon anybody for communication. So, for such individuals, it's vital that the public around them should be ready to perceive what they require to inform them of exploitation language. For such individuals, we tend to build the hand gesture recognition system in order that although anyone doesn't grasp the meanings of the signs, they will use this program to recognize the language. Hence, the deaf and dumb individuals don't have any barrier in their communication.
The proposed system is expected to give an accuracy of 90%.

II. LITERATURE SURVEY

[1] Parshwa P. Patil, Maithili J. Phatak, Suharsh S. Kale developed a model for Hand Gesture Recognition for Deaf and Dumb using Adaptive Boosting, Motion Detection, Region of Interest,Thresholding techniques. This model produced decent classification results of 73.68% with a small feature vector size containing 8 features.

[2] Kundan Kumar Dubey, Ajitanshu Jha, Akshay Tiwari, K. Narmatha used OpenCV, Computer Vision, Deep Learning to create a Hand Gesture Movement Recognition System Using Convolution Neural Network Algorithm. Inception v3 was one of the techniques that was used to improve the accuracy of the model. The proposed system is capable of recognising hand gestures from the entire image without the use of any image region selection framework.

[3] Vaidyanath Areyur Shanthakumar Chao Peng Jeffrey Hansberger Lizhou Cao made a system for hand gesture recognition approach for real-time interactions.In this work they detect and recognize in-air hand gestures, which are natural and intuitive to perform and can be used to interact with touchless user interfaces.This is different from machine learning approach, their angular-velocity method do not require data preprocessing like data collection, annotation, or training.

The overall mean accuracy is 97.3%, which takes both static and dynamic gestures into account.

[4] Guillaume Devineau, Wang Xi, Fabien Moutarde, Jie Yang made a deep Learning for Hand Gesture Recognition on Skeletal Data. In this work, they use convolutional neural networks to classify (recognize) hand gestures using skeletal data. They introduce a 3D hand gesture recognition approach supported by deep learning algorithms using Convolutional Neural Network (CNN) wherever sequences of hand-skeletal joints' positions are processed by parallel convolutions. This model achieves a 91.28% accuracy for the 14 gesture classes case and an 84.35% accuracy for the 28 gesture classes case.

[5] Munir Oudah, Ali Al-Naji, and Javaan Chahl created hand gesture recognition based on computer vision. Glove-based attached sensor. Color recognition, Motion recognition, Deep Learn recognition, Depth recognition are the techniques that were used to build this model. This paper provides insight into some gesture recognition systems under various scenarios.

[6] Xianzhi Chu, Jiang Liu made a sensor-based hand gesture recognition system for Japanese sign language. They have used sensor based gloves to recognize the gesture and convert that into text or voice.Five flex sensors, an Inertial Measurement Unit, and three Force Sensing Resistors (FSRs) are to observe the bending degree of fingers and hand movement data. This system can recognize 24 static and 2 dynamic letters with about 96.5% accuracy.

[7] Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang and Yu-Bo Yuan worked on creating Real-Time Hand Gesture Recognition Using Finger Segmentation. Here, They presented an efficient and effective method for hand gesture recognition. The hand region is detected through the background subtraction method. The palm and fingers are split so as to recognize the fingers. After the fingers are recognized,the hand gesture will be classified through a simple rule classifier. In this system the total classification accuracy for 1300 images was 89%.

[8] Ming Jin Cheok Zaid Omar Mohamed Hisham Jaward worked on analyzing different techniques for automated gesture recognition. They have reviewed different techniques such as Feature extraction, Gesture classification etc. This paper has achieved a high accuracy in recognising the gesture.

III. DATASET

The Sign language dataset is to be created on the standards set by the Indian sign language organization(ISL). Since there are no proper resources which provide datasets for the Indian sign language , There is a need to create new datasets for all the gestures. The datasets will be created using OpenCV. 30-40 images (or even more depending on the complexity of the gestures) will be collected for each gesture. These images are taken on different backgrounds, with the right and left hand of the user and also with different lighting conditions. There will be 80% use of the captured images for training and roughly 20% will be used for testing.
There are also pre existing datasets for Numerals and Alphabets which will be used for the training and testing of model.

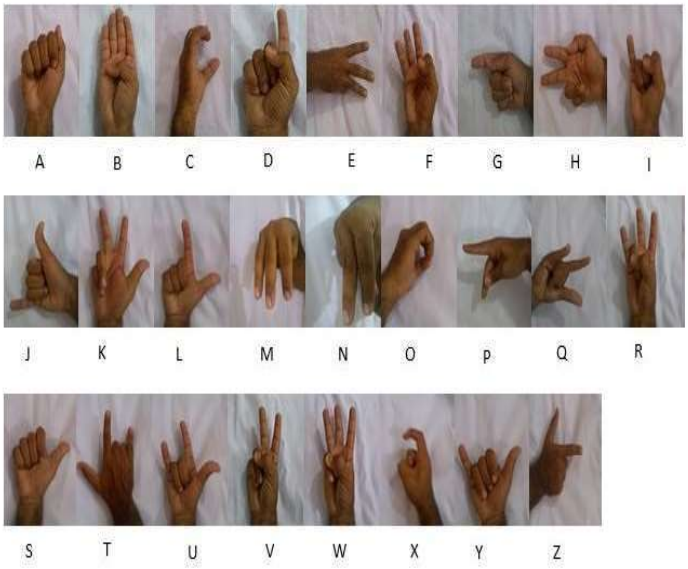

Fig1: Dataset showing gestures for English Alphabets.

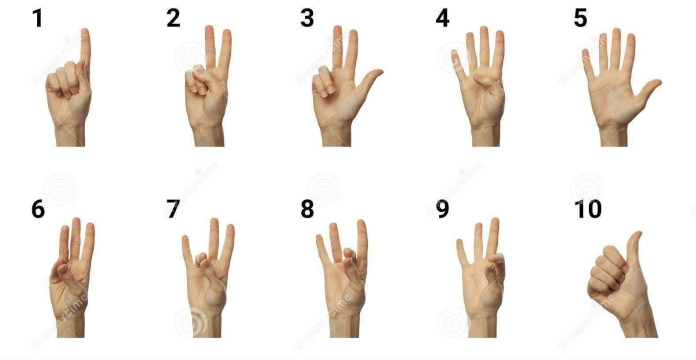

Fig2: Dataset showing gestures for Numerals.

IV. METHODOLOGY

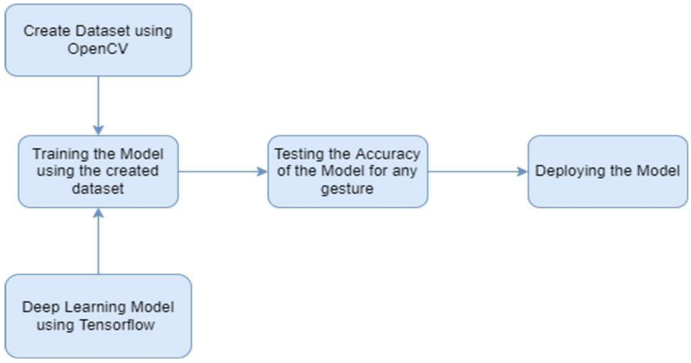

Fig3: Creation of Dataset and Model of the System

Dataset Preparation : The dataset will be created using OpenCV. 30 or more images will be captured per gesture. Initially images of 20 gestures will be acquired, later it will be increased based on the need.

Model Creation : A Deep Learning model will be created using tensorflow library. Tensorflow Object Detection API will be used in the creation of the model. This API has come pre existing models which will be used for building the model. Then the model goes through an extensive level of training so that it can accurately detect the gestures.

Training and Testing of Model : The deep learning model will be trained using the dataset that has been created. As mentioned above, 80% will be used for model training. Since the images are complex and the model needs a large number of images for training, the division was chosen. The more images we use for training, the better accuracy the model outputs. With the 20% left, it will be used for testing the model. The testing is done to view how well the model is trained and how a model would work in a real-world scenario.

Deploying the Model : The trained model will then be deployed using a web application. This web application will depict the flow of the model created for the user to understand.

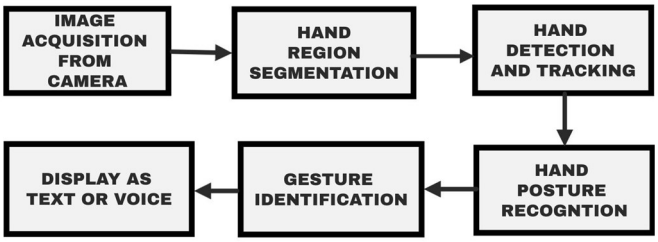

Fig4: Internal working of the gesture recognition system

During the testing of the current system, testing begins with the capture of the image using the webcam of a computer or the camera in any mobile device. Once the image is acquired, OpenCV will segment the region in the image where the gesture is present and that will be stored in the database. This image is now fed to the model which will be developed using deep learning algorithms from tensorflow library.

This model will now recognize the gesture and will compare it with the trained data. Once the model has compared the gesture itwill now identify the gesture and begin to give the output. The output from the system will be in the form of either text or voice based on the user requirement. This will be seen through a Web based or Mobile based Application.

V. TECHNOLOGIES USED

1. **OpenCV**: OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD- licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

2. **Deep Learning:** Deep learning is part of a broader family of machine learning methods based on artificial neural networks with representation learning. Learning can be supervised, semi-supervised or unsupervised.

3. **Tensorflow:** TensorFlow is a free and open- source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inferenceof deep neural networks.
.

4. **Convolutional Neural Network(CNN):** A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases)to various aspects/objects in the image and be able to differentiate one from the other.

5. **Streamlit:** Streamlit is a free, open-source, all- python framework that enables data scientists to quickly build interactive dashboards and machine learning web apps with no front-end web development experiencerequired.

VI. CONCLUSION

The planned hand recognition system is extremely helpful because it is often used as a human-computer interface similarly as it will facilitate paralytic folks. In future devices are often simply controlled through the hand gesture movement simply. In previous ideas, the device techniques were used, however, during this

ystem, no further device is required. It is often achieved by deep convolutional neural network algorithmic rule. Deep learning dealswith serious information sets. The convolutional network is a bedded algorithmic rule that is especially divided into 2 phases. The 1st one is feature extraction with a convolutional neural network and another one is the classification part with absolutely connected layers. The coaching of neural networks is completed for a significant set of knowledge and goal is achieved.

FUTURE WORK

This current system will be programmed to recognize upto 20 gestures with high accuracy. In the future the number of gestures and the accuracy of the system will be increased slowly. For the daily use of this system, a Mobile Application will be developed so that the differently abled community can easily utilize this app in their lives and not face difficulties they are facing today. Lastly, this system was developed for the Indian Sign Language, but it can be used for recognizing other country's sign language once they have been trained enough with the gestures accepted by the particular country's sign language organization.

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Hand Gesture Recognition for deaf and mute

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