**A Hybrid Approach to Gesture Recognition with Biometric Security**

**A DESIGN PROJECT III REPORT**

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**BONAFIDE CERTIFICATE**

Certified that this CSB4431 Design Project III report **A Hybrid Approach to Gesture Recognition with Biometric Security** is the bonafide work **R JAYA SINDHU (18113011), RIYA SATIJA (18113009), SROBONTI SARKAR (18113029)** who carried out the design project work under my supervision during the academic year **2022-2023**.

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**ABSTRACT**

Over the last few years, face and hand gesture recognition systems are applied in various applications similarly control systems, communications, human-computer interaction, and biometric-based security applications. Particularly, most of the innovations have been done for human-computer interaction using gesture recognition wherein non-verbal communication is a key research domain. However, it needs to be developed an appropriate method for non-verbal communication. In this research, a hybrid approach is suggested that combines facial and hand gesture recognition to get more accurate results. Nonverbal communication applications that are interactive. The facial features are extracted using a support vector machine and a blaze palm can be implemented for gesture identification where the skin tone and palm detections are involved for better classification and formation of non-verbal communication. The proposed method is compared with recent existing methods, and it provides better results in terms of accuracy and more recognition capability**.**

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# LIST OF ABBREVIATIONS

|  |  |
| --- | --- |
| AI | Artificial Intelligent |
| EMG | Electromyography |
| FACS | Facial Action Coding System |
| GPU | Graphic Processing Unit |
| ML | Machine Learning |
| NVE | Networked Virtual Environment |
| RGB | Red Green Blue |
| SVM | Support Vector Machine |
|  |  |

**CHAPTER 1 INTRODUCTION**

## Overview

## Machine learning (ML) is a field of artificial intelligence (AI) that tries to comprehend data structure and use that structure to create models that people can understand and use. In artificial intelligence (AI), machine learning refers to the process of finding patterns in data that can be understood and utilized by people. Machine learning emphasizes on understanding the structure of data and fit it into models that people can understand and use. In the past few decades, humans were not aware of non-verbal communication and so human-computer interaction was minimal. In recent years voice assistant technology has created a new impact in human-computer interactions. But still, the great use of face and gesture recognition is unnoticed. Nowadays people are focusing on technologically futuristic devices with more options for comfort and safety. For once comfort can also be put on hold but when it comes to safety, it becomes a crucial factor for the public. Human Communication has emerged as a transformation where people convey their emotions, feelings, preferences, etc. Non-verbal communication is the transmission of messages using different hand gestures, facial expressions, eye contact, etc. Also, it is a way for humans to establish a shared understanding that aids their communication more effectively. Many nonverbal communications cannot be noticed by humans. To overcome the above-said problems, it is a need to develop a computer vision-based algorithm with appropriate technology combinations. Generally, gesture recognition can be used for non-verbal communications wherein biometric security also needs to be considered.

## Global facial recognition technology markets will double by 2019, according to Markets and Markets research. Several technologies allow computers to recognize human features and gestures, but computer vision will likely drive this sector. Gesture allows individual to communicate their feelings, and emotions using different body language. Nonverbal communication is mostly used by deaf and dumb people to communicate and express their feelings to one another.

* 1. **Motivation for the project**

In the present years many different types of non verbal communication methods are being developed, but human and computer interaction is not being kept in mind so we came up with a idea of increasing human computer interaction using non verbal communication by developing a hybrid method.

* 1. **Problem Definition and Scenarios**

Over the last few decades, humans were not very conscious of non-verbal communication and therefore human computer interaction was minimal.Moreover In recent years, voice assistant technology has had a significant influence on how people interact with computers. However, the widespread usage of facial recognition and gestures goes unnoticed. Over the years, voice recognition technology has advanced significantly. Facial expression recognition is already done using machine learning. However, gesture recognition has always been more difficult and has only recently gained prominence. Gesture detection is now not only possible, but also more accurate than ever thanks to machine learning.

1.4 SIH Problem and description

**1.5 Organization of the Report**

The following is the thesis's structure is as follows. Chapter 1 introduces the motivation and problem definition of the project in detail. The reference document that was collected for this project, as well as the takeaways, are noted in the Literature Survey. In Chapter 3, the Project Description is mentioned along with existing work, proposed work, and benefits of project. In Chapter 4, the Architecture Design is mentioned along with full explanation for the project. In Chapter 5, the Software and Hardware Requirements and technologies being implememted in the project is mentioned.

In Chapter 6, the Module Description of the project is mentioned and the subdivisions are explained in detail. In Chapter 7, the whole implementation of the project is discussed. In Chapter 8, the Results and Explanations are mentioned and the outcomes of every module are shown in graphic detail.

In Chapter 9, a Conclusion for this project is made and the further ehancements are also mentioned. In Chapter 10, the Individual Report of the Team Members is mentioned along with the objective, role, and contribution of each member

* 1. **Summary**

A hybrid technique is proposed in this study, which combines gesture recognition with one of the biometric security measures, facial recognition. To extract face traits, the support vector machine, a supervised machine learning approach, is utilized. The blazing palm method, on the other hand, is employed in gesture recognition to extract critical points from the finger and aid in the analysis of gestures.

# CHAPTER 2 LITERATURE REVIEW

## 2.1 Introduction

## This chapter examines the numerous papers that have been published up to this point., as well as the project details that are supplied and addressed in length in the analysis of the article.

## 2.2 Literature Review

## Playing with Nonverbal Communication: Using Grasp and Facial Direction To Create Adaptive Interaction in a Game (2014, Ditte Hvas Mortensen; Klaus B. Bærentsen)

## Author examined the automatic adaption of facial expression and user’s grasp with a game

## using two different experiments. Identifying patterns in grip and face orientation, which were employed as an objective indication for recognising the purpose and attention, was adopted in the first 16 experiments. The findings revealed that users grasp the remote control and turn their faces towards the intention. The results of an experiment in the adaptive game were shown in experiment two. The outcome of the experiments was collated with state of art methods. The multicamera face tracking system was proposed by Josiah et. al. which was done by a large-wired camera network. A camera clustering approach is used to statically generate groups of cameras in a network tracking individual faces in A Hybrid Approach to Gesture Recognition with Biometric Security. Furthermore, as the target objects moved, the cluster propagation method assisted in spreading the computational weight of the face to multiple cameras

**A Multi –Window Majority Voting Strategy To improve Hand Gesture Recognition Tracing in Camera Networks**(2010, MD Ferdous Whid ; Reza Tafreshu ; Reza Langari)

## The networked virtual environment (NVE) technology was incorporated into the sign language

## which was proposed by Jin and Akoi . In this research, they use natural processing language to extract semantic information as an interlingua from a text, which they subsequently send to a three-dimensional articulated humanoid model. Once the data is received, synthesised SFE is used to virtually animate humans.

## The facial expression recognition system for multimodal animated avatar was approached in which was oriented to human-machine interaction. This paper has integrated an animated avatar and facial recognition system by orienting to Facial action coding system (FACS) unit recognition. This resulted in a system that could sustain bidirectional nonverbal and vocal communication, making it appear more natural to human users.

## Panwar and Mehra provided a method for recognizing hand gestures based on shape-based aspects. The single camera captures the gesture formed by the humans used and the captured gesture involved as an input to the algorithm. The Euclidean distance was determined in this procedure, and it was utilized to find the distance between all of the tips of the fingers and the centroid. The implementation was done with 390 images and got a recognition rate of approximately 92%.

## Deep Learning-Based Approach for sign Language Gesture Recognition with efficient hand gesture representation (2020 , Muneer Al-Hammadi ; Ghulam Muhammad ; Wadood Abdul)

## In this paper, the author has used different techniques to detect hand gestures and also compared different algorithms used to detect hand gestures. They used a vision-based approach where they used the camera to capture the hand gestures, an appearance-based approach in which they took the visual appearance of hand gestures and modelled it to feature extraction, 3D based approach where they used a 3d model of hand to detect the hand gestures and lastly, they used gloved based approach in which they used sensors for capturing hand position and motion.

## This paper used a novel approach recognize hand gesture for hand segmentation and sequence feature recognition using multiple deep learning architecture. They utilised the Saudi Sign Language dataset from King Saud 2 University and the open pose framework, a deep learning system that determines an image's 2D important points. A dataset of 40 dynamic hand gestures was used to test the method, and the findings revealed that it was highly successful.

## The author of this research suggested a novel face alignment method called adaptive posture alignment, which reduced the nose and intra-class differences produced by existing approaches. They learn the alignment templates adaptively based on the face positions and then send them to training and testing sets based on the templates available. They also used feature normalization to improve the feature representation of the face. They also provide a face recognition pipeline based on APA alignment. Furthermore, their findings revealed that the suggested system, when used with CPLFW datasets, achieved cutting-edge performance.

## Adversarial Cross-Spectral Face Completion for NIR-VIS Face Recognition(2020, Ran-he ; Zan-ko)

## This study employs an electromyography (EMG) signal that has the ability to recognise hand motions. They used sliding window parameters with EMG signals like window size and overlapping size. They identified that majority voting influenced gesture recognition accuracy. They used Logistic regression, linear discriminant analysis, random forest, etc machine learning algorithms. The findings revealed that rising By raising the window size and overlapping size, overall accuracy may be enhanced. Their strategy was crucial in ensuring that the prosthetic device was controlled effectively.

## This paper illustrates the role of nonverbal communication in software development teams , using distributed conditions as a conceptual palette. They investigated their studies with 38 IT professionals from Russia. The investigation showed that the method was consistent with many underlying distributed approaches to cognition. Their study provided a valuable insight that made communication more effective

## 2.6 Conclusion/GAP

## Many existing systems have different models to detect face recognition and gesture. But blaze palm and for gesture recognition and SVM for face recognition has more scope as it's one among the algorithms responsible for the incredible advances in deep learning over the last few years.

# 

# CHAPTER 3

# PROJECT DESCRIPTION

**3.1 Objective of the Project Work**

* **Objective 1**
* **Objective 2**
* **Objective 3**

**3.2 Existing System**

Mortensen and Klaus [1] are examined the automatic adaption of facial expression and user’s grasp with a game using two different experiments. Identifying patterns in grip and face orientation, which were employed as an objective indication for recognizing the purpose and attention which was used in the first 16 experiments. The results showed that users grasp the remote control and turn their faces towards the intention. The results of an experiment in the adaptive game were shown in experiment two. The outcome of the experiments was collated with state of art methods. The multicamera face tracking system] was proposed by Josiah et. al. [2] which was done by a large-wired camera network. A camera clustering approach is used to statically generate groups of cameras in a network monitoring of individual faces in a Hybrid Approach to Gesture Recognition with Biometric Security. Furthermore, as the target objects moved, the cluster propagation method assisted in spreading the computational weight of the face to multiple cameras. This study employs an electromyography (EMG) signal that has the ability to recognize hand motions..[3] They used sliding window parameters with EMG signals like window size and overlapping size. They identified that majority voting influenced gesture recognition accuracy. They used Logistic regression, linear discriminant analysis, random forest, etc machine learning algorithms. The findings revealed that rising By raising the window size and overlapping size, overall accuracy may be enhanced. Their strategy was crucial in ensuring that the prosthetic device was controlled effectively.The networked virtual environment (NVE) technology was incorporated into the sign language which was proposed by Jin and Akoi [4In this research, they use natural processing language to extract semantic information as an interlingua from a text, which they subsequently send to a three-dimensional articulated humanoid model. Once the data is received, synthesised SFE is used to virtually animate humans.The facial expression recognition system for multimodal animated avatar was approached in [5] which was oriented to human-machine interaction. This paper has integrated an animated avatar and facial recognition system by orienting to Facial action coding system (FACS) unit recognition. This resulted in a system that could sustain bidirectional nonverbal and vocal communication, making it appear more natural to human users. Panwar and Mehra [6] provided a method for recognizing hand gestures based on shape-based aspects. The single camera captures the gesture formed by the humans used and the captured gesture involved as an input to the algorithm. The Euclidean distance was determined in this procedure, and it was utilized to find the distance between all of the tips of the fingers and the centroid. The implementation was done with 390 images and got a recognition rate of approximately 92%. In this paper, the author has used different techniques to detect hand gestures and also compared different algorithms used to detect hand gestures. They used a vision-based approach where they used the camera to capture the hand gestures, an appearance-based approach in which they took the visual appearance of hand gestures and modeled it to feature extraction, 3D based approach where they used a 3d model of a hand to detect the hand gestures and lastly, they used gloved based approach in which they used sensors for capturing hand position and motion.[7] This paper used a novel approach to recognize hand gestures for hand segmentation and sequence feature recognition using multiple deep learning architectures. They utilized the Saudi Sign Language dataset from King Saud 2 University and the open pose framework, a deep learning system that determines an image's 2D important points. A dataset of 40 dynamic hand gestures was used to test the method, and the findings revealed that it was highly successful.[8] The author of this research suggested a novel face alignment method called adaptive posture alignment, which reduced the nose and intra-class differences produced by existing approaches. They learn the alignment templates adaptively based on the face positions and then send them to training and testing sets based on the templates available. They also used feature normalization to improve the feature representation of the face. They also provide a face recognition pipeline based on APA alignment. Furthermore, their findings revealed that the suggested system, when used with CPLFW datasets, achieved cutting-edge performance. [9] This paper illustrates the role of nonverbal communication in software development teams [10], using distributed conditions as a conceptual palette. They investigated their studies with 38 IT professionals from Russia. The investigation showed that the method was consistent with many underlying distributed approaches to cognition. Their study provided a valuable insight that made communication more effective.

**3.3 Proposed Solution**

In this section, we first go through the suggested SVM algorithm, which is divided into two parts: face detection and face recognition. Then we introduce the advanced gesture recognition method that can be integrated with SVM method. Finally, we integrate the face recognition with the haar cascade media pipeline.

The SVM consists of two steps: 1) Face detection 2) Face recognition.

The haar cascade technique is used to identify and recognize people’s faces. It is applied for object detection that identifies surfaces in an image or in real-time. The algorithm receives a large number of positive and negative frames to drive the data set. Positive images consist of a lot of authorized face images whereas in negative images we use unknown face images. Positive images are those that the classifier wants to recognize, whereas negative images are those that we don't want to recognize. The algorithm uses a calculative method where the darker pixels are marked as 1 and the lighter pixels are marked as 0. The algorithm recognizes the edges by marking pixels as 0 and 1 as it traverses the complete picture from top left to bottom right. This algorithm's properties make it simple to locate the edges of a face or lines in an image. It is noticed that this algorithm is more effective for face detection with higher accuracy.

Fig 3.1: Labelling of authorized user

Once the face is detected, the authorized user is allowed to go for gesture recognition. The blazing palm algorithm is utilized for gesture recognition, with an average precision of 95.7 percent in palm identification and a regression approach used to forecast continuous values. The mechanism is that first it detects the hand and predicts the state of each finger whether it is straight or bent. Once it detects the hand the regression model performs a precise key4point localization. It compares the expected key points with the specified gestures and publishes the kind of gesture after detecting all key points of the fingers.

Fig 3.2: All gestures recognized

**3.4 Benefits of Proposed System**

The proposed system is a hybrid model comprising gesture recognition and face recognition . This model achieve higher accuracy for the nonverbal interaction between human and computer.

**CHAPTER 4**

# SYSTEM DESIGN

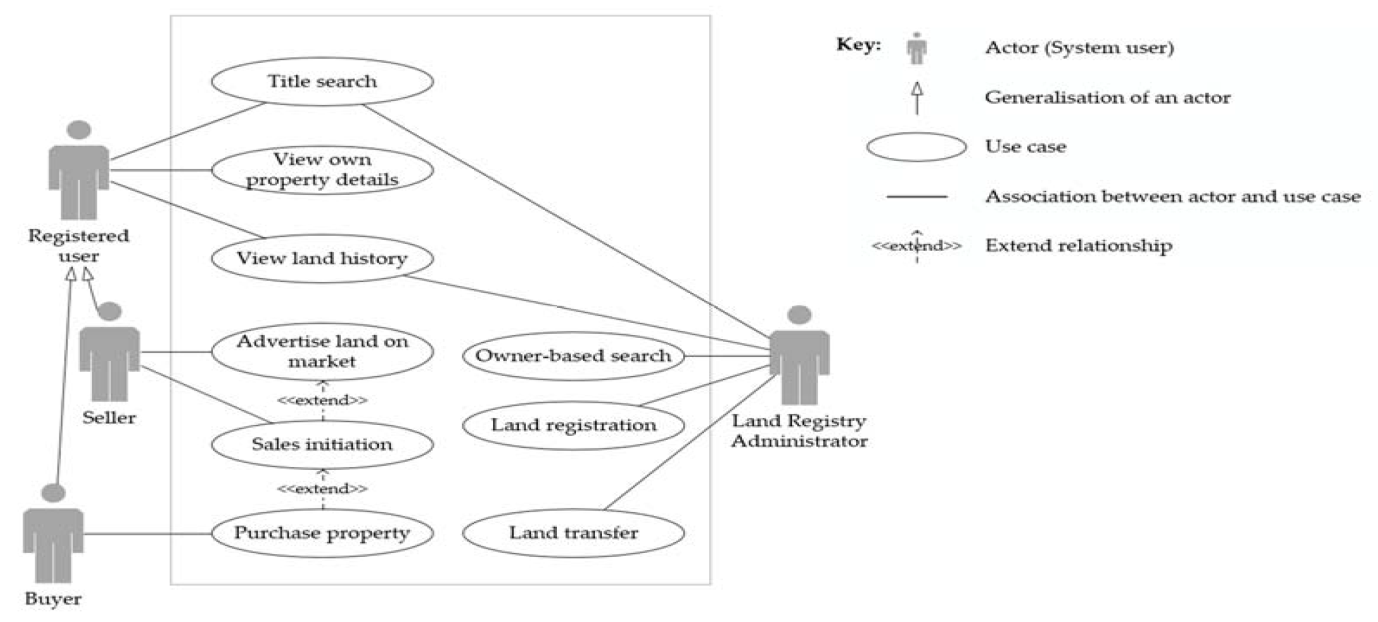
### 4.1 ARCHITECTURE DIAGRAM

### 

Fig 4.2: Architecture Diagram

The above diagram represents the fundamental structure and design of a software system. It outlines how various components and modules interact to achieve the system's goals and functionality. At its core, system architecture defines the system's building blocks, their roles, and how they communicate with each other and external systems.

4.2 USE CASE DIAGRAM



# Fig 4.2: USE CASE DIAGRAM

The above diagram is a visual representation that illustrates the interactions and functionalities of the system, focusing on how different actors and components engage with the blockchain-based real estate platform. This diagram provides an overview of the primary actors, their roles, and the specific use cases they perform within the system..

# 

# CHAPTER 5

# PROJECT REQUIREMENTS

* 1. **Hardware and Software Specification**

**5.1.1 End-user Devices:**

For end-users to access the Peer to Peer Real Estate Booking System, standard personal computers and laptops equipped with web browsers are essential. This enables users to interact with the system conveniently from their desktop devices.

**5.1.2 Blockchain Platform:**

The foundation of the system lies in the blockchain platform, which should be carefully chosen to match the project's needs. Platforms like Ethereum or Binance Smart Chain are typically preferred for their capabilities in developing and deploying smart contracts.

**5.1.3 Operating System:**

The choice of operating system plays a pivotal role in system stability and security. Utilizing a secure and stable operating system, such as Linux or Windows Server, is essential for hosting the application and blockchain nodes efficiently.

**5.1.4 Development Tools:**

Development tools are critical components in the project's success. An integrated development environment (IDE) for smart contract development, like Remix or Truffle, simplifies the creation of smart contracts

**5.1.5 Blockchain APIs and SDKs:**

interactions with the blockchain network will be made possible through the use of blockchain-specific APIs and software development kits (SDKs). These tools enhance the system's integration with the blockchain network and ensure seamless functionality.

**5.1.6 Network Infrastructure:**

Network infrastructure plays a critical role in maintaining the system's performance and security. This encompasses the use of load balancers and firewalls, which serve to manage network traffic and bolster overall security measures. Additionally, the implementation of data backup and disaster recovery mechanisms is vital to safeguard against potential data loss, ensuring system resilience and data integrity.

**5.2 Technologies Used**

**5.2.1 Blockchain Technology:**

At its core, the system leverages blockchain technology to ensure transparency and security in real estate transactions. By utilizing a blockchain platform like Ethereum or Binance Smart Chain, the system can create and execute smart contracts, automating real estate transactions efficiently.

**5.2.2 Smart Contracts:**

These self-executing contracts play a central role in the system, allowing for secure and transparent real estate transactions. Developed using blockchain-specific languages like Solidity (for Ethereum), smart contracts eliminate the need for intermediaries and ensure the immutable execution of agreements.

.**5.2.3 Web Development Stack:**

The user interface and system functionality are developed using a modern web development stack. This includes HTML, CSS, and JavaScript for front-end development. Additionally, frameworks like React, Angular, or Vue.js are used to create a user-friendly and interactive interface. Server-side logic is implemented using a backend programming language like Node.js or Python.

**CHAPTER 6**

**MODULE DESCRIPTION**

* 1. **Modules**

Module 1 discuss about face recognition using haar cascade algorithm. In module 2 we implemented hand gesture recognition using blaze palm algorithm and in the last module we integrate both the face and gesture recognition.

* 1. **Module 1 : User Authentication and Management Module:**

In the User Authentication and Management Module, technologies like user databases (utilizing the chosen database management system), authentication libraries, and frameworks for user interfaces are essential. This may involve technologies like Firebase Authentication, Passport.js for authentication, and frameworks like React or Angular for user-friendly interfaces. For role management, role-based access control (RBAC) systems may be incorporated, which can be custom-developed or provided by authentication services..

* 1. **Module 2 : Property Listing Module**

For the Property Listing Module, technologies include web forms for data input and display, multimedia handling (for images and videos), and data storage. Front-end frameworks such as React or Vue.js can help create user-friendly listing forms. Cloud storage services like AWS S3 or Firebase Storage can be used to store multimedia content efficiently. For structured data storage, the database management system (e.g., MySQL or PostgreSQL) is crucial..

* 1. **Module 3 : Search and Browse Module**

The Search and Browse Module relies on search and filtering algorithms that can be implemented using technologies like Elasticsearch or specialized database query languages. Front-end technologies such as React, Angular, or Vue.js are used to create the user interface, allowing users to input search criteria and view filtered results.

**6.5 Module 4 : Booking and Transactions Module**

In the Booking and Transactions Module, technologies include payment gateways for processing payments securely. Popular payment gateways like Stripe, PayPal, or blockchain-based payment solutions can be integrated. This module may also use backend technologies (Node.js, Python) to manage bookings, handle payment confirmations, and interact with smart contracts on the blockchain (utilizing blockchain APIs and SDKs).

**6.6 Module 5 : Property Management Module**

The Property Management Module encompasses property data management, booking request handling, and transaction history tracking. It utilizes the database management system for property data storage and retrieval. To manage bookings and transactions efficiently, server-side logic (Node.js or Python) is employed. Additionally, blockchain integration is crucial to facilitate property owners' interactions with smart contracts for accepting or rejecting booking requests. The use of blockchain-specific APIs and SDKs is essential for seamless communication with the blockchain network.

**6.7 Summary**

The Peer to Peer Real Estate Booking System incorporates multiple modules, each employing specific technologies to provide a comprehensive and efficient real estate booking platform:

# CHAPTER 7

# IMPLEMENTATION

The proposed method was implemented using the OpenCV library a programming function that is mostly used in real-time computer vision. It's a fantastic image-editing program. For capturing the images webcam on a laptop is used. The implementation process was separated into three divisions such as face recognition using Haar Cascade, gesture recognition using Blaze’s palm, and finally, these two methods were integrated into the third module which is called a hybrid approach.

In face recognition part, the Haar Cascade algorithm is used to recognize faces in images or in real-time. It's an Object Detection Algorithm that detects faces in images and real-time videos. Edge or line detection characteristics are used in the method. To train on, the algorithm is given a large number of positive photos with faces and a large number of negative images with no faces. Later the algorithm first traverses the whole image from top left to bottom right to detect the color of each pixel. If the color of a pixel is dark it is labeled as ‘1’ and light color is labeled as ‘0’. This process is helpful to recognize the edges or lines of a face. Each of them is in charge of determining a certain characteristic in the image. Any structure in the image with a quick shift in intensities, such as an edge, a line, or any other. The haar feature, for example, may detect a vertical border in the picture above that has darker pixels on the right and brighter pixels on the left. The detected face is mapped to a pre-defined face and if the face is authorized the face is recognized else the face is detected and shown as unknown but does not recognized.

Once the face is detected, hand gestures are recognized using the blaze palm algorithm using a regression model. Here we are using blaze palm algorithm which is a sub division of mediapipe algorithm. Hands by MediaPipe is a high-resolution hand and finger tracking system. Machine learning (ML) is used to deduce 21 3D landmarks of a hand from a single shot. Blaze palm algorithm is used to detect the key points of a finger and the regression algorithm helps for continuous prediction of the key points even if the hand keeps on moving. Once the key spots have been identified, the status of the fingers is detected, translated to the pre-defined gestures, and the gesture type is printed. Our hand tracking system makes use of a machine learning pipeline that consists of many models that operate together: An orientated hand bounding box is returned by a palm detector model (named BlazePalm) that acts on the whole picture. A hand landmark model that delivers high-fidelity 3D hand keypoints from the cropped picture region determined by the palm detector.

A gesture recognizer that divides the previously computed keypoint configuration into a series of individual gestures.

The final step is integrating the face and gesture recognition together where the face and hand gestures algorithm is integrated that can be used for various applications including human-computer interaction, and biometric security devices. a hybrid approach is used that combines gesture recognition with one of the biometric securities that is facial recognition. Initially authorised users face are stored as positive images in the trained dataset. So whenever an authorised user's face is detected it recognizes the face and prints their name along with a welcome message. The facial features are extracted using the support vector machine which is a supervised machine learning algorithm. Once the face is recognized the authorised user is requested to show their hand gestures using fingers.Here the blaze palm algorithm is used in gesture recognition which takes the key points from the finger and helps in analyzing the gestures. The user gestures is recognized and it prints the gesture type.

**7.1 Summary**

The chapter explains each section on how the sysem works . the algorithm used in face detection and then once the face is recognized it is integrated with the gesture recognition which uses blaze palm algorithm and a hybrid system is developed.

# CHAPTER 8

# RESULT & ANALYSIS

# 8.1 Results Obtained

# A dataset of 67 images was used wherein the authorised image samples are around 45 and unknown image samples are 22.

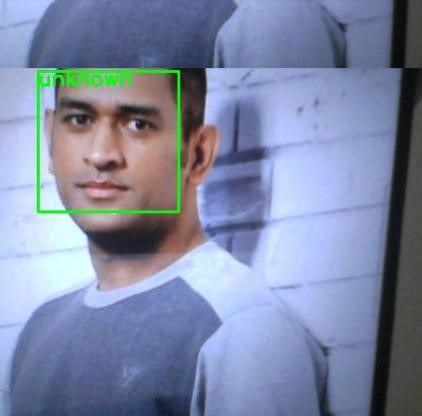


Fig 8.1: Detecting unknown user

Fig 8.2: Detecting and recognizing user

Here fig 4 depicts the result of face recognition of an unknown user and fig 5 depicts the result of an authorised user. A thorough evaluation has been conducted with a dataset of authorised users, When compared to existing face detection algorithms, the results showed a 93 percent gain in accuracy.

Fig 8.3: Recognizing face & taking input

Fig 8.4: Gesture Recognized

Here we train the model using key points of hand in which we are using the regression technique which is mainly used for detecting continuous values. After integrating gestures recognition with face recognition, the final accuracy is 89%.

# CHAPTER 9

# CONCLUSION AND FUTURE WORK

**9.1 Conclusion**

We created a novel system that detects both hand motions and faces in this research. The Blaze Palm algorithm was utilized to represent hand motions in the proposed system. This is very useful for two tough sign language hand movements. A face recognition algorithm named haar cascade is used for the face estimation of an authorized user. By using this proposed hybrid approach, we mainly focus on achieving a high precision model for non-verbal communication in human-computer interaction.

* 1. **Future Work**

With the knowledge we have gained by developing this project, we are confident that in the future we can make the application more effectively by adding this services.

* Extending this application by making it as a hardware project.
* Adding various type of hand gestures to make non-verbal communication more convenient.
* To maintain or improve the accuracy of the gesture recognition.

**9.3 Summary**

This chapter concludes the project and talks about the targets that were set for the project and the success in achieving them. It also mentions the list of future developments that can be done to scale up the project and increase the usefulness of the system for the user.

# 

# CHAPTER 10

# INDIVIDUAL TEAM MEMBER’s

# REPORT

# 10.1 Individual Objective

# Name: Jaya Sindhu R

# The objective was to plan the phases and set up a proper roadmap for the project in the first place. Also, plan and design the flow, time planner, and implementation. Contributing to the research paper.

# Name: Srobonti Sarkar

# The objective was to review the available concepts and literature and referring to documents on various sites. To do the testing part and identifying the errors and various corner cases. Contribute to the team report and presentation.

# Name: Riya Satija

# The objective was to integrate both the face and gesture recognition modules and to do the testing part. Contributing to the research paper, team report and presentation.

# 10.2 Role of the Team Members

# Name: Jaya Sindhu R

# Role: Programmer and Project Management

# Name: Srobonti Sarkar

# Role: Programmer and Documenting work.

# Name: Riya Satija

# Role: Testing and Programmer.

# 10.3 Contribution of the Team Members

# Name: Jaya Sindhu R

# Contribution: Project Management; Coding For face recognition; Testing; Team Presentation; Team Report.

# Name: Srobonti Sarkar

# Contribution: Coding For gesture recognition; Testing; Documentation; Programming; Team Presentation; Finding publication resources.

# Name: Riya Satija

# Contribution: Code for integrating face and gesture recognition; Documentation; Programming; Team Presentation; Finding publication resources; Testing; Team Report.

# 10.4 Summary

This chapter talks about the role and individual contribution of each member, and how every input added contributed significantly to the overall success of the project. The combined efforts of every member were equally important in every aspect, and helped achieve the target set out for the project.

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**APPENDIX A**

**SAMPLE CODE**

from google.colab import drive

drive.mount("/content/drive")

!pip install face\_recognition

!pip install mediapipe

from google.colab import drive

drive.mount('/content/drive')

!unzip drive/MyDrive/dataset.zip -d .

#import the necessary packages

from imutils import paths

import face\_recognition

import pickle

import cv2

import os

# grap the paths to the input images in our dataset

print("[INFO] quantifying faces...")

imagePaths = list(paths.list\_images("dataset"))

# initialize the list of known encodings and known names

knownEncodings = []

knownNames = []

# loop over the image paths

for (i, imagePath) in enumerate(imagePaths):

  # extract the person name from the image path

  print("[INFO] processing image {}/{}".format(i + 1,

    len(imagePaths)))

  name = imagePath.split(os.path.sep)[-2]

  # load the input image and convert it from RGB (OpenCV ordering)

  # to dlib ordering (RGB)

  image = cv2.imread(imagePath)

  rgb = cv2.cvtColor(image, cv2.COLOR\_BGR2RGB)

  # detect the (x, y)-coordinates of the bounding boxes

  # corresponding to each face in the input image

  boxes = face\_recognition.face\_locations(rgb,

    model="cnn")

  # compute the facial embedding for the face

  encodings = face\_recognition.face\_encodings(rgb, boxes)

  # loop over the encodings

  for encoding in encodings:

  # add each encoding + name to our set of known names and

  # encodings

  knownEncodings.append(encoding)

  knownNames.append(name)

# dump the facial encodings + names to disk

print("[INFO] serializing encodings...")

data = {"encodings": knownEncodings, "names": knownNames}

f = open("drive/MyDrive/lift/encodings.pickle", "wb")

f.write(pickle.dumps(data))

f.close()

# import the necessary packages

from sklearn.preprocessing import LabelEncoder

from sklearn.svm import SVC

import pickle

# load the face encodings

print("[INFO] loading face encodings...")

data = pickle.loads(open("drive/MyDrive/lift/encodings.pickle", "rb").read())

# encode the labels

print("[INFO] encoding labels...")

le = LabelEncoder()

labels = le.fit\_transform(data["names"])

# train the model used to accept the 128-d encodings of the face and

# then produce the actual face recognition

print("[INFO] training model...")

recognizer = SVC(C=1.0, kernel="linear", probability=True)

recognizer.fit(data["encodings"], labels)

# write the actual face recognition model to disk

f = open("drive/MyDrive/lift/recognizer.pickle", "wb")

f.write(pickle.dumps(recognizer))

f.close()

# write the label encoder to disk

f = open("drive/MyDrive/lift/le.pickle", "wb")

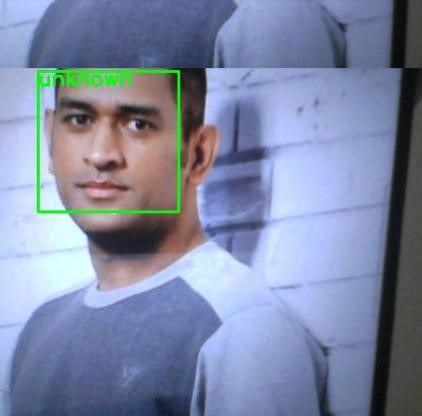
f.write(pickle.dumps(le))

f.close()

# import the necessary packages

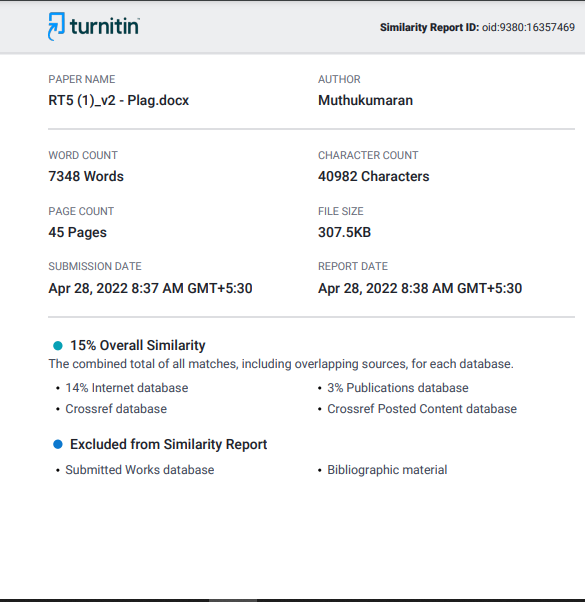
### PPENDIX B

### SAMPLE SCREEN



**APPENDIX C**

**PLAGIARISM REPORT**

****

**APPENDIX E**

**TEAM DETAILS**

|  |  |
| --- | --- |
| **NAME** |  |
| **ROLL NO** |  |
| **EMAIL** |  |
| **CONTACT NO** |  |
|  |  |
| **NAME** |  |
| **ROLL NO** |  |
| **EMAIL** |  |
| **CONTACT NO** |  |
|  |  |
| **NAME** |  |
| **ROLL NO** |  |
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