***A Project Report***

***On***

**The SUMMER TRAINING**

***At***

**Hindustan Aeronautics Limited**

**Transport Aircraft Division, Kanpur Nagar**



*Submitted By:*

**Shruti Subhramanyam**

**(Rama University, Kanpur)**

**Gaurav Hora**

**(Manipal University, Jaipur)**

**Prachi Verma**

**(Gautam Buddha University, Greater Noida)**

1

*Certificate*

*This is to certify that "****Facial Recognition****” is a document of work done by* ***Shruti Subhramanyam, Gaurav Hora*** *and* ***Prachi Verma*** *fulfill the requirements of Industrial training program at* ***Hindustan Aeronautics Limited, Transport***

***Aircraft Division, Kanpur*** *under our supervision and guidance, during the period of 11th June, 2024 to 10th July, 2024.*

***Mr. Mahesh Ch. Srivastava***

***Senior Manager (IT)***

***HAL, Transport Aircraft Division***

***Mr. Rajveer Singh***

***DGM (MS, IT, Lean)***

***HAL, Transport Aircraft Division***

2

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***Shruti Subhramanyam***

***Gaurav Hora***

***Prachi Verma***

3

*Table of Content*



|  |  |  |  |
| --- | --- | --- | --- |
| Serial No. | Topic | Page No. | |
|  |  |  |  |
| 1 | History of HAL | 5 – | 6 |
|  |  |  |  |
| 2 | Transport Aircraft Division, HAL | 7 |  |
|  |  |  |  |
| 3 | Abstract | 8 |  |
|  |  |  | |
| 4 | Face Recognition – Computer Vision | 9-10 | |
|  |  |  | |
| 5 | Convolutional Neural Networks | 11-12 | |
|  |  |  |  |
| 6 | Flow chart | 13 |  |
|  |  |  |  |
| 6 | Source Code | 14 – | 15 |
|  |  |  |  |
| 7 | Running the project / Output | 16 |  |
|  |  |  |  |
| 8 | Conclusion | 17 |  |
|  |  |  |  |
| 9 | References | 18 |  |
|  |  |  |  |

4

*History of HAL*

HAL (Hindustan Aeronautics Limited):



Hindustan Aeronautics Limited (HAL) based in Bangalore, India, is one of Asia's largest aerospace companies. Under the management of the Indian Ministry of Defence, this state-owned company is mainly involved in aerospace industry, which includes

manufacturing and assembling aircraft, navigation and related communication equipment.

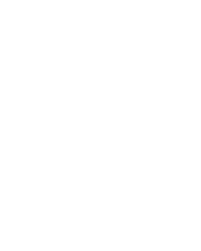
HAL built the first military aircraft in South Asia and is currently involved in the design, fabrication and assembly of aircraft, jet engines, and helicopters, as well as their components and spares. It has several facilities spread across several states in India including Nasik, Korwa, Kanpur, Koraput, Lucknow, Bangalore and Hyderabad. The German engineer Kurt Tank designed the HF-24 Marut fighter-bomber, the first fighter aircraft made in India.

Hindustan Aeronautics has a long history of collaboration with several other international and domestic aerospace agencies such as Airbus, Boeing, Sukhoi Aviation Corporation etc.

History:



Hindustan Aeronautics Limited (HAL) came into existence on 1st October 1964. The Company was formed by the merger of Hindustan Aircraft Limited with Aeronautics India Limited and Aircraft Manufacturing Depot, Kanpur.



The Company traces its roots to the pioneering efforts of an industrialist with extraordinary vision, the late Seth Walchand Hirachand, who set up Hindustan Aircraft Limited at Bangalore in

association with the erstwhile princely State of Mysore in December 1940. The Government of India became a shareholder in March 1941 and took over the Management in 1942.

Today, HAL has 20 Production Division and 10 Research & Design Centres in 8 locations in India. The Company has an impressive product track record - 15 types of Aircraft/Helicopters manufactured with in-house R & D and 14 types produced under license. HAL has manufactured over 3658 Aircraft/Helicopters, 4178 Engines, and Upgraded 272 Aircraft and overhauled over 9643Aircraft and 29775 Engines.

5

During the 1980s, HAL's operations saw a rapid increase which resulted in the development of new indigenous aircraft such as the [HAL Tejas](https://en.wikipedia.org/wiki/HAL_Tejas) and [HAL Dhruv.](https://en.wikipedia.org/wiki/HAL_Dhruv) HAL also developed an advanced version of the [Mikoyan-Gurevich MiG-21,](https://en.wikipedia.org/wiki/Mikoyan-Gurevich_MiG-21) known as MiG-21 *Bison*, which increased its life-span by more than 20 years. HAL has also obtained several multimillion-dollar contracts from leading international aerospace firms such as [Airbus,](https://en.wikipedia.org/wiki/Airbus) [Boeing](https://en.wikipedia.org/wiki/Boeing) and [Honeywell](https://en.wikipedia.org/wiki/Honeywell) to m a n u f a c t u r e a i r c r a f t s p a r e p a r t s a n d e n g i n e s .

By 2012, HAL was reportedly bogged down in the details of production and has been slipping on its schedules. On 1 April 2015, HAL reconstituted its



Board with TS Raju as CMD, S Subrahmanyan as Director (Operations), VM Chamola as Director (HR), CA Ramana Rao as Director (Finance) and D K Venkatesh as Director (Engineering & R&D). There are two government nominees in the board and six independent directors.



In March 2017, HAL's chairman and managing director T Suvarna Raju announced that the company had finalised plans for an indigenisation drive. The company plans to produce nearly 1, 000 military helicopters, including , LCH (Light Combat Helicopter) ALH (Advanced Light Helicopter), and over 100 planes over the next 10 years. HAL will manufacture the Kamov 226T helicopter under a joint venture agreement with Russian defence manufacturers.

The Kamov 226T will replace the country's fleet of Cheetah and Chetak helicopters. Over the next 5 years, HAL will carry out major upgrade of almost the entire fighter fleet of Indian Air Force including Su-30MKI, Jaguars, Mirage and Hawk jets to make them "more lethal". The company will also deliver 123 Tejas Light Combat Aircraft to the IAF from 2018 to 2019, at a rate of 16 jets per year. LCH production will now take place in a newly built Light Combat Helicopter Production Hangar at Helicopter Division in HAL Complex .

6

*Transport Aircraft Division, HAL*



HAL TAD Kanpur refers to the Transport Aircraft Division (TAD) of Hindustan Aeronautics Limited (HAL) located in Kanpur, India.

The Transport Aircraft Division was established in 1960 as a part of Hindustan Aircraft Limited, which later merged with Aeronautics India Limited and Aircraft Manufacturing Depot, Kanpur to form Hindustan Aeronautics Limited (HAL) in 1964.

The TAD Kanpur is one of the major divisions of HAL and is responsible for the design, development, production, and overhaul of transport aircraft, including military transporters, trainers, and helicopters. The division has played a significant role in the development of India's aerospace industry and has contributed to the country's self-reliance in defense production.

Some of the notable projects undertaken by HAL TAD Kanpur include:

HS-748 Avro: A transport aircraft developed in collaboration with the UK-based Hawker Siddeley Aviation.



Hindustan 228: A light transport aircraft developed by

HAL TAD, Kanpur.

AN-32: A medium-lift transport aircraft developed in collaboration with the Ukrainian company Antonov.

Cheetah/Chetak Helicopters: Light helicopters developed in collaboration with the French company Sud-Aviation (now Airbus Helicopters).

The TAD Kanpur has also been involved in the development of indigenous aircraft, such as the HAL HTT-40 basic trainer and the HAL LUH (Light Utility Helicopter).

Today, HAL TAD Kanpur continues to play a vital role in India's aerospace industry, with a focus on design, development, production, and overhaul of transport aircraft, helicopters, and other aerospace systems.

7

*Abstract*



This project involves the development of a real-time face recognition system using Python, OpenCV, and the face\_recognition library. The system aims to identify individuals by matching their faces with pre-existing images stored in a designated folder and log the identification events, including the person's ID, name, time, and date, into a CSV file. The system also includes a mechanism to handle unrecognized faces by capturing their images, assigning them a new unique ID, and updating the employee records accordingly. Additionally, to prevent redundant logging, the system tracks the last recorded time for each individual and ensures that new entries are recorded only if a specified amount of time has elapsed since the last entry. This functionality is crucial for applications requiring precise tracking and logging of individual appearances over time, such as attendance systems and security monitoring. The project leverages efficient image processing techniques and CSV handling to create a robust and scalable face recognition and logging solution.

8

Face Recognition – Computer Vision



Face recognition in computer vision is a technology that enables computers to identify and verify individual faces. It works by detecting faces, extracting unique features, and comparing them to a database or template. This technology has various applications, including security, identity verification, emotion recognition, and law enforcement. While it offers advantages like increased security and efficiency, it also raises concerns about data privacy, bias, and surveillance.

**Challenges in Face Recognition**

Here are some challenges in face recognition:  
  
Pose variation: Face recognition software struggles with different facial angles.  
Illumination variation: Changes in lighting or direction of light can affect the accuracy of facial recognition software.  
Facial expressions: Different facial expressions can affect the accuracy of facial recognition software.  
Facial occlusion: Obstruction of the face, such as by sunglasses or a mask, can affect the accuracy of facial recognition software.

⁠Aging: Facial recognition software can struggle with faces that have aged significantly.  
Legal issues: Facial recognition software can be used to track individuals without their consent or as a form of surveillance.

**Object Detection Techniques**

•⁠ ⁠Viola-Jones algorithm: This method is based on training a model to understand what is and isn't a face.  
•⁠ ⁠Knowledge- or rule-based: These approaches describe a face based on rules.  
•⁠ ⁠Feature-based or feature-invariant: These methods use features such as a person's eyes or nose to detect a face.  
•⁠ ⁠Template matching: This method is based on comparing images with previously stored standard face patterns or features.  
•⁠ ⁠Appearance-based: This method uses statistical analysis and ML to find the relevant characteristics of face images.  
•⁠ ⁠Convolutional neural network-based: A type of deep learning ANN used in image recognition and processing that's designed to process pixel data.

*Convolutional Neural Network*



**Convolutional Neural Networks (CNNs)**

Convolutional Neural Networks (CNNs) are a type of deep learning algorithm that have revolutionized the field of computer vision. They are designed to process data with grid-like topology, such as images, and have been instrumental in achieving state-of-the-art performance in various computer vision tasks, including object detection, image classification, and image segmentation.

**Architecture of CNNs**

A typical CNN architecture consists of multiple layers, including:

**Convolutional layers**: These layers apply filters to small regions of the input image, scanning the image in a sliding window fashion. The output of the convolutional layer is a feature map, which represents the presence of certain features in the input image.

**Activation functions**: These functions introduce non-linearity into the model, allowing it to learn complex patterns in the data. Common activation functions used in CNNs include ReLU (Rectified Linear Unit) and Sigmoid.

**Pooling layers**: These layers downsample the feature maps, reducing the spatial dimensions and the number of parameters in the model. This helps to reduce overfitting and improve the robustness of the model.

**Flatten layer**: This layer flattens the feature maps into a one-dimensional vector, preparing the output for the fully connected layers.

**Fully connected layers**: These layers consist of a fully connected neural network, where every input is connected to every output. They are used for classification and regression tasks.

**How CNNs Work?**

CNNs work by scanning the input image with a set of filters, which are learned during training. These filters are designed to detect specific features, such as edges, lines, and textures. The output of the convolutional layer is a feature map, which represents the presence of these features in the input image.

The feature maps are then fed into a pooling layer, which downsamples the feature maps, reducing the spatial dimensions and the number of parameters in the model. This process is

11

repeated multiple times, with each convolutional and pooling layer learning to detect more complex features.

Finally, the output of the convolutional and pooling layers is fed into a fully connected layer, which produces a probability distribution over the possible classes.

**Advantages of CNNs**

**Ability to learn hierarchical representations**: CNNs can learn hierarchical representations of the input data, allowing them to detect complex patterns and features.

**Robustness to translation and rotation**: CNNs are robust to translation and rotation of the input data, making them suitable for image classification and object detection tasks.

**Ability to handle large datasets**: CNNs can handle large datasets and are often used for tasks such as image classification and object detection.

**Applications of CNNs**

CNNs have numerous applications in various fields, including:

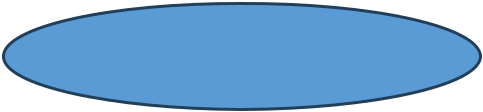
**Computer vision**: CNNs are widely used in computer vision tasks such as image classification, object detection, and image segmentation.

**Natural language processing**: CNNs are used in natural language processing tasks such as text classification and language modeling.

**Speech recognition**: CNNs are used in speech recognition tasks such as speech-to-text and voice recognition.

12

*Flow chart*



13

*Source Code*



CODE

*Dataset*

15

17