A Mini-project

Report on

FACE RECOGNITION SYSTEM FOR SECURITY SYSTEM

Submitted to The Charutar Vidya Mandal University for the partial

fulfillment for the award of Minor Degree /Honours Program in

Internet of Things

under

BACHELOR OF ENGINEERING

By

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Table of Contents

List Of Figures

COMPLIANCE CERTIFICATE

This is to certify that the research work embodied in this Mini- project report entitled "**FACE RECOGNITION SYSTRM FOR SECURITY SYSTEM**" is carried out by the following students **Darshak Kakani (12002080501007)** at (**G. H. PATEL COLLEGE OF ENGINEERING & TECHNOLGY**) for partial fulfillment of the requirements for the award of Minor Degree/Honours Program in **Internet of Things** under Bachelor of Engineering to The Charutar Vidya Mandal University. This research is the authentic record of work carried out by us and is not submitted in past to any institute or university.

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Darshak kakani	12002080501007	

Signature of the Supervisor

Dr. Mehul Shah

Assistant Professor

EC Department

Date:

Place :

CERTIFICATE

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Electronics & Communication

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Dr. Hitesh Shah

G.H Patel College of Engineering & Technology

Date:

Place :

MINI-PROJECT REPORT APPROVAL CERTIFICATE

This is to certify that the research work embodied in this project report entitled "**FACE RECONITION SYSTEM FOR SECURITY SYSTEM** "is carried out by the following students at G. H. Patel College of Engineering & Technology is approved for the award of Minor Degree/Honours Program in Interet of Things under Bachelor of Engineering, The Charutar Vidya Mandal University.

[Signature of External Examiner]

(Name of the Examiner)

[Signature of Internal Examiner]

(Name of the Examiner)

Date:

Place:

Acknowledgement

We are very thankful to the Principal and Management of G H Patel College of Engineering & Technology for providing IoT lab facilities for conducting experiments for our project experiment. Our deep gratitude to HOD Sir of EC & our guide for continuous encouragement and giving timeto-time valuable suggestions for completion of real-time experiment successfully. Here We are thankful to all those who are co- operative and encouragement during this completion of project.

ABSTRACT

By observing someone's face, you may distinguish one person from another with ease. A facial recognition system studies a person's physical characteristics to ascertain their identity. Human face recognition essentially involves two stages: face detection, which happens quickly in individuals unless the object is nearby, and introduction, which identifies faces as belonging to specific persons. The stage is then replicated and made into a model for facial image recognition, a professional biometrics approach that has undergone substantial research and development. These days, two different approaches are employed to create face recognition patterns: the Eigenface method and the Fisher face method. In the Eigenface method for facial image recognition, the three-dimensional space of the face is reduced using Principal Component Analysis (PCA) for facial features. The main objective of using PCA on face identification using
Eigen faces was to find the eigenvector that corresponds to the largest eigenvalue of the face picture.

Keywords: Face detection, Eigen face, PCA

Extension: There are vast number of applications from this face detection project, this project can be extended that the various parts in the face can be detect which are in various directions and shapes.

CHAPTER-1
INTRODUCTION

Face recognition is a biometric technology that identifies an individual by analysing their unique facial features. It identifies an individual by analysing their unique facial features, making it a valuable tool for security, law enforcement, and personal identification. One of the most common applications of face recognition is in security systems, where it is used to control access to secure areas or buildings. It can also be used in law enforcement to identify suspects or persons of interest in criminal investigations. In addition, face recognition can be used for personal identification in various settings such as airports, banks, and other public places. It can also be used for attendance tracking in schools and workplaces. A face recognition system typically involves capturing an image or video of a person's face and then using algorithms to extract and analyse the facial features. The system then compares these features to a database of known faces to identify the individual. In this report, we will explore the various components of a face recognition system, including image capture devices, algorithms, and databases.

1.1 FACE DETECTION:

Image windows must be divided into two classes to detect faces. A classification job is used in the initial stage to identify any faces in the input image. The second phase involves a task called "face localization," which aims to take an image as input and output the location of any face or faces inside it as a bounding box.

The face detection process can be divided in the following steps: -

1. **Pre-Processing:** Before being uploaded to the network, the photographs are processed to reduce the diversity in the faces. All the positive examples, which are portraits of people, were created by cropping front-facing images to only show the front. The lighting is then corrected using standard techniques for all the clipped images.

2. **Classification:** By training on these will neural networks are put into practice to categorize the photos as having faces or not. To improve the outcomes, various network configurations are tested.

3. **Localization:** The trained neural network is then employed to scan a picture for faces and, if any are present, localize them within a bounding box. Work has been done on several facial traits, including Position, Scale, Orientation, and Illumination.

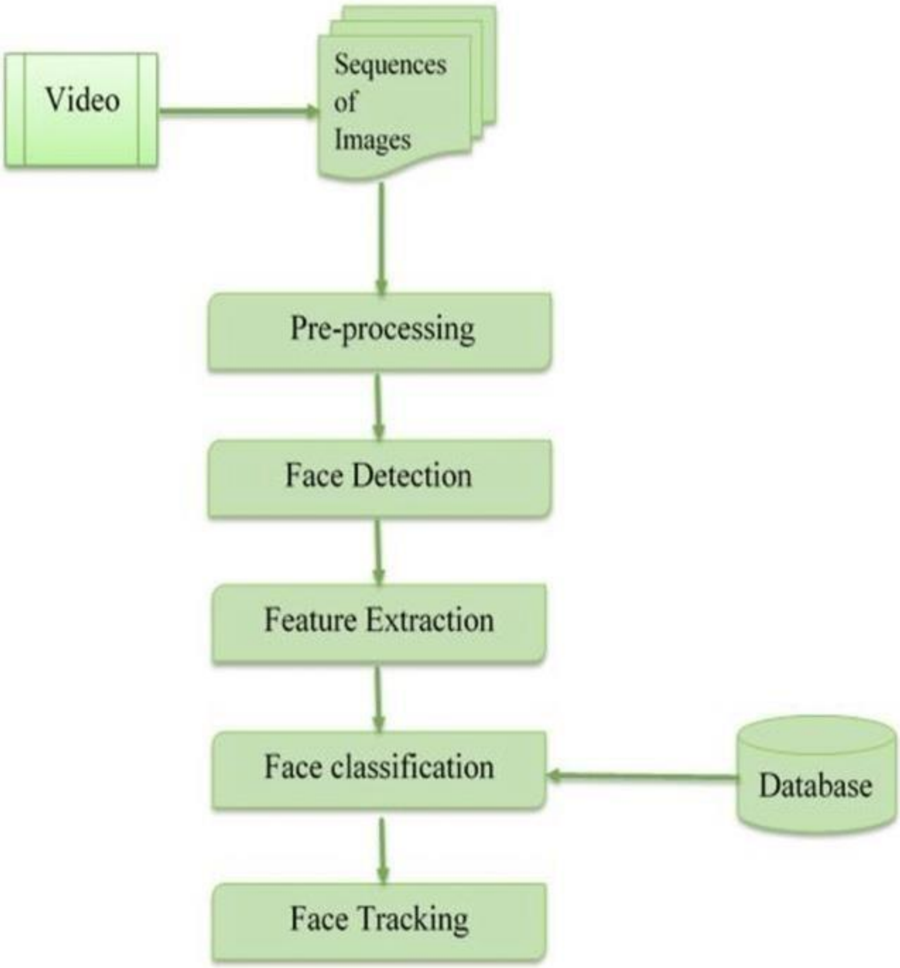

Figure 1 Face Detection Process

Utilizing computer technology, face detection finds and counts human faces in arbitrary photographs. Face localization is the process of determining the positions and dimensions of a known number of faces.

CHAPTER-2
FEATURE BASE APPROACH

Feature-based and picture-based techniques are the two main ways to identify facial features in an image. The feature base technique aims to extract features from the image and compare them to the features of the face.

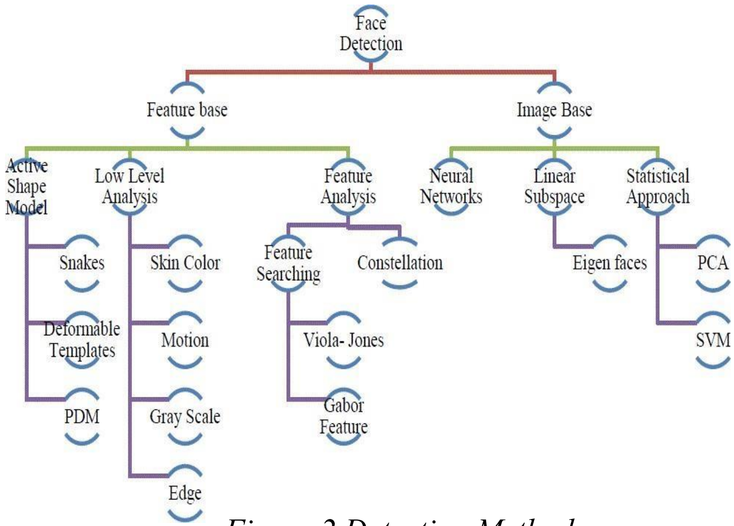

Figure 2 Detection Methods

2.1 FEATURE BASE APPROCH

Focus is placed on complicated, non-rigid elements like actual physical characteristics and higherlevel appearances of characteristics in active shape models. This indicates that Active Shape Models (ASMs) seek to automatically locate landmark points that characterize the shape of any statistically modelled item in an image. consider the appearance of the eyes, lips, nose, mouth, and eyebrows. Building a statistical model is a component of an ASM's training stage.

2.4 FEATURE ANALYSIS

These algorithms seek to identify structural elements that persist regardless of the perspective, illumination, or position. These features are then used to identify faces. These techniques are primarily intended for face localization.

2.4.1 Feature Searching

HOG Method

The HOG (Histogram of Oriented Gradients) algorithm used for object detection, including human detection and face detection.

It is based on the analysis of gradients in an image to capture shape and texture information. Here's an overview of the HOG algorithm:

1. **Image Preprocessing:** Convert the input image to grayscale.
2. **Gradient Computation:** Calculate the magnitude and orientation of the gradients for each pixel.
3. **Image Block Division:** Divide the image into small overlapping cells (e.g., 8x8 pixels).
4. **Histogram Calculation:** Group multiple cells into blocks (e.g., 2x2 cells).
5. **Sliding Window and Detection:** Slide a detection window across the image, typically with varying scales.
6. **Post-processing:** Apply non-maximum suppression to eliminate overlapping detections.

Viola Jones Method

Paul Viola and Michael Jones presented an approach for object detection which minimizes computation time while achieving high detection accuracy. The technique relies on the use of simple Haar-like features that are evaluated quickly using a new image representation. Based on the concept of an ―Integral Image‖ it generates a large set of features and uses the boosting algorithm AdaBoost to reduce the overcomplete set and the introduction of a degenerative tree of the boosted classifiers provides for robust and fast interferences.

2.5. Connecting Imultis with HOG:

1. Install imutils library install it using pip - **pip install imutils**
2. Import the necessary modules in your Python script.
3. Load the pre-trained HOG model for object detection.
4. Read an image or capture video frames from a video source.
5. Resize the image to a desired width for faster processing.
6. Perform object detection using the HOG algorithm.
7. Draw bounding boxes around the detected objects.
8. Display the image with bounding boxes

CHAPTER-3
ALGORITHM

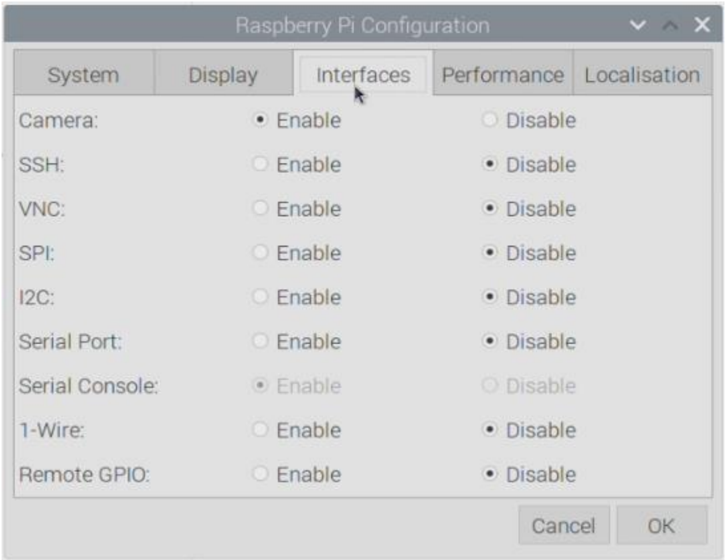

Figure 3 Configuration of Raspberry Pi

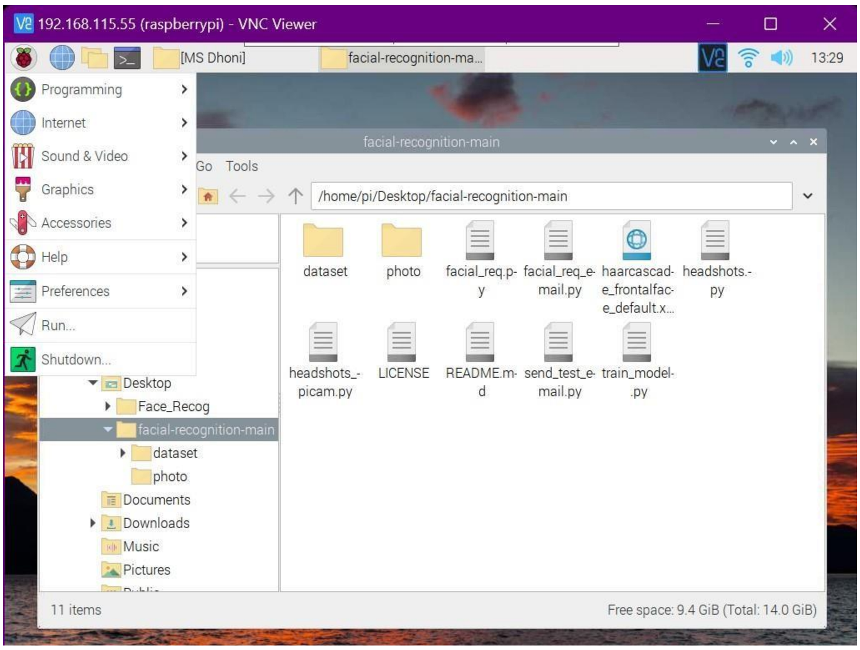

Figure 4 Face Recognition folder in Raspberry Pi

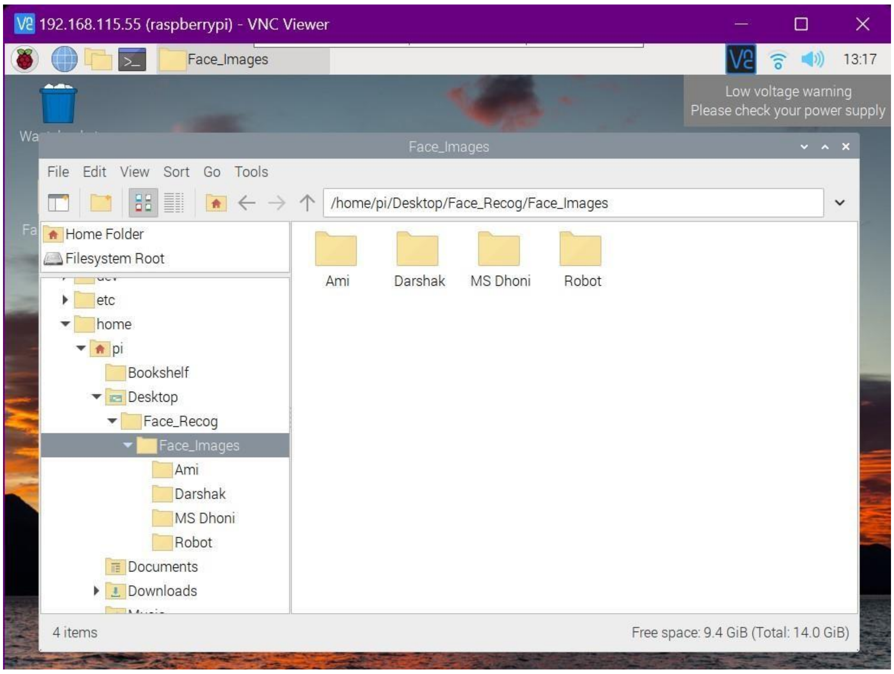

Figure 5 Images

Training the System :

Our code performs face encoding using the **HOG (Histogram of Oriented Gradients) method** and saves the encodings to a pickle file. **Initialization steps :**

Import the necessary modules:

Define the directory where the images are located:

Iterate over the image paths:

Load the image and convert it to RGB:

image = cv2.imread(imagePath)

rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

Detect the face bounding boxes using the HOG method:

boxes = face_recognition.face_locations(rgb, **model="hog")**

Compute the face encodings for each detected face:

encodings = face_recognition.face_encodings(rgb, boxes)

for encoding in encodings:

knownEncodings.append(encoding)

knownNames.append(name)

Serialize and save the encodings and names to a pickle file:

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

data = {"encodings": knownEncodings, "names": knownNames}
f = open("encodings.pickle", "wb") f.write(pickle.dumps(data)) f.close()

Face Recognition Algorithm :

This code demonstrates a facial recognition system using the **face_recognition** library and **imutils** for video processing. Explanation of the algorithm step by step:

Import the required modules : from imutils.video import VideoStream
import face_recognition import imutils import
pickle **Load the saved encodings and face**
detector : currentname = "unknown" encodingsP
= "encodings.pickle" print("[INFO] loading
encodings + face detector...") data =
pickle.loads(open(encodingsP, "rb").read())

Start the video : vs =
VideoStream(usePiCamera=True).start() time.sleep(2.0)
while True:
frame = vs.read() frame =
imutils.resize(frame, width=500) **Detect faces in**
the frame :
boxes = face_recognition.face_locations(frame)
encodings = face_recognition.face_encodings(frame, boxes) names
= []

Iterate over the detected face encodings:
for encoding in encodings: matches =
face_recognition.compare_faces(data["encodings"], encoding) name =
"Unknown"

If a match is found, determine the recognized person's name:
if True in matches: matchedIdxs = [i for (i, b) in
enumerate(matches) if b]
counts = {} for i in matchedIdxs:
name = data["names"][i]
counts[name] = counts.get(name, 0) + 1
name = max(counts, key=counts.get) if
currentname != name: currentname =
name print(currentname)
names.append(name)

Draw rectangles around the detected faces and display their names: for
((top, right, bottom, left), name) in zip(boxes, names):
cv2.rectangle(frame, (left, top), (right, bottom), (0, 255, 225), 2)
y = top - 15 if top - 15 > 15 else top + 15 cv2.putText(frame, name, (left, y),

cv2.FONT_HERSHEY_SIMPLEX, .8, (0, 255, 255), 2)

Display the processed frame: cv2.imshow("Facial Recognition is Running", frame)
key = cv2.waitKey(1) & 0xFF

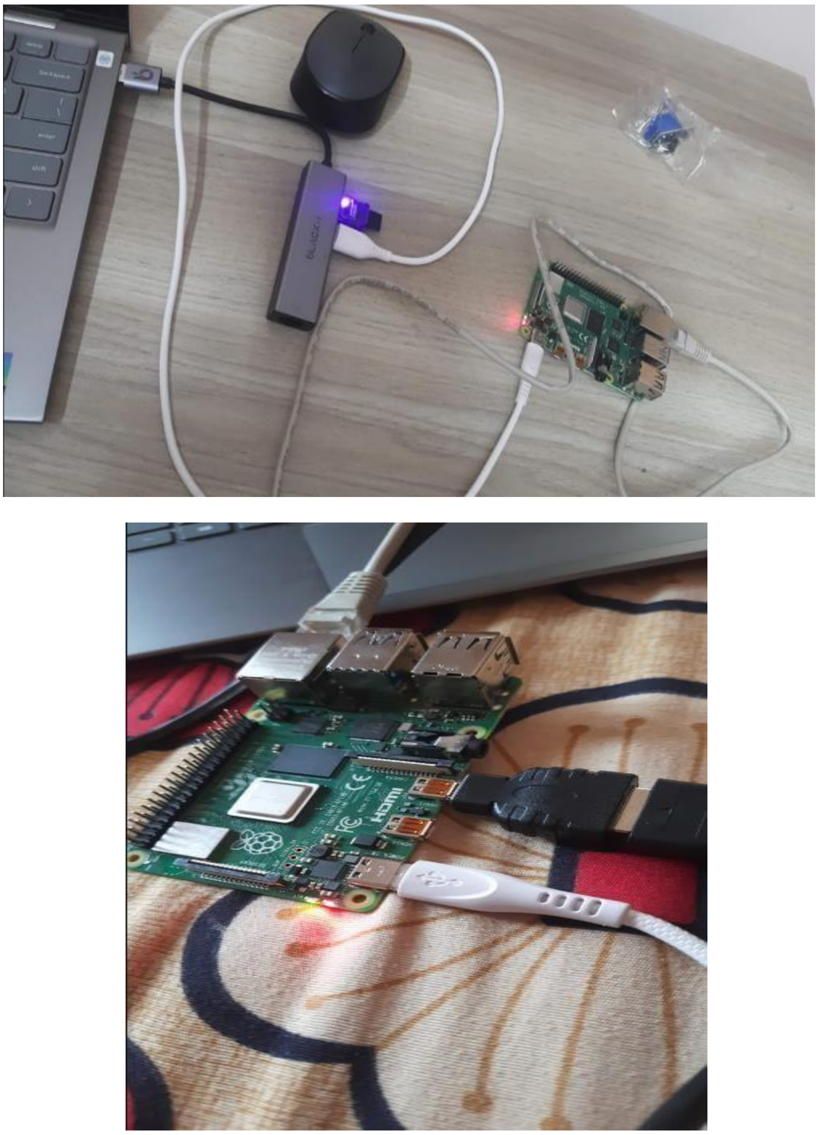

Figure 6 Connecting Raspberry to Laptop

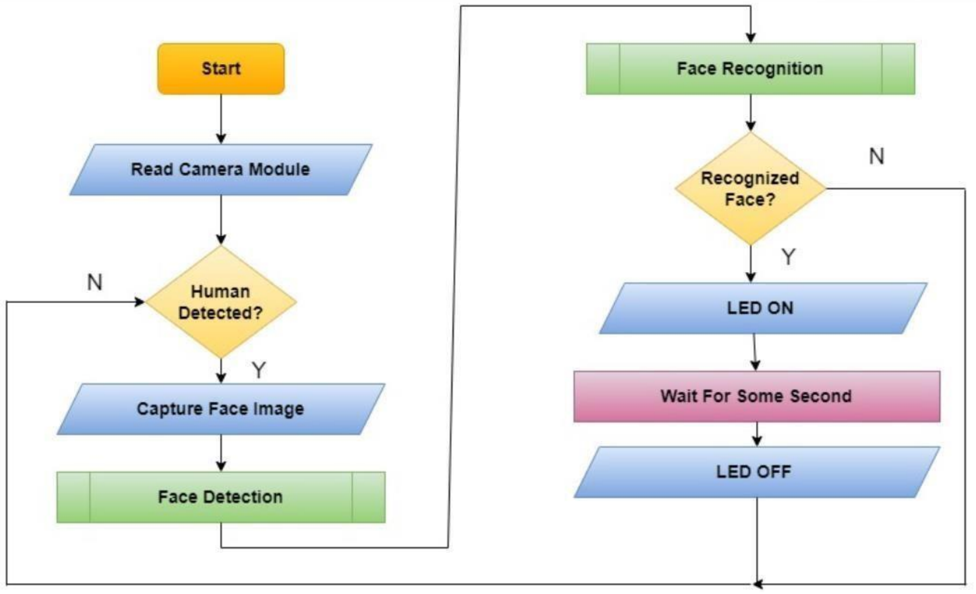

Figure 7 Flowchart

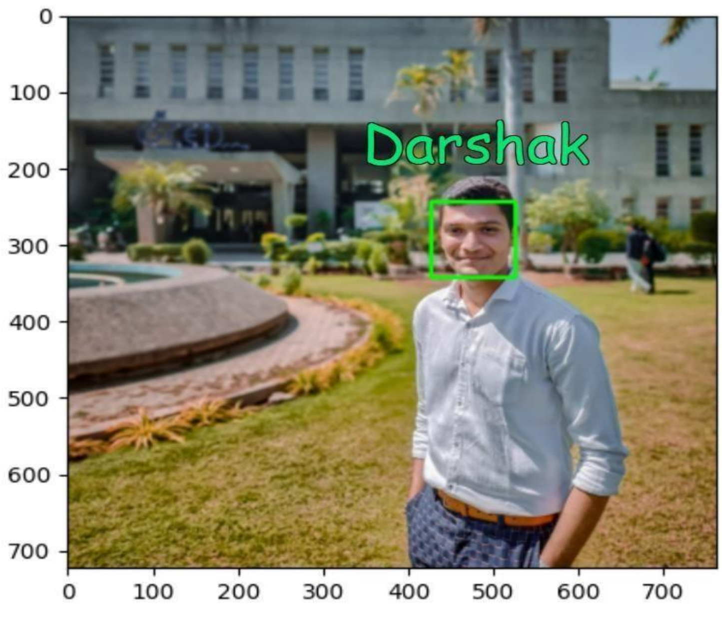

Figure 8 Output - Detected face of a human

CONCLUSION

The computational models, which were implemented in this project, were chosen after extensive research, and the successful testing results confirm that the choices made by the researcher were reliable. The system with manual face detection and automatic face recognition did not have a recognition accuracy over 90%, due to the limited number of eigenfaces that were used for the PCA transform. This system was tested under very robust conditions in this experimental study, and it is envisaged that real-world performance will be far more accurate. The fully automated face detection and recognition system was not robust enough to achieve high recognition accuracy. The only reason for this was the face recognition subsystem did not display even a slight degree of invariance to scale, rotation, or shift errors of the segmented face image. The automated vision systems implemented in this thesis did not even approach the performance, nor were they as robust as a human's innate face recognition system.

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