Design & Development of Face Recognition System

A

MINOR PROJECT-I REPORT

Submitted in partial fulfillment of the requirements

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COMPUTER SCIENCE & ENGINEERING

By

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CERTIFICATE

I hereby certify that the work which is being presented in the B.Tech. Minor Project-I Report entitled **Design & Development of Face Recognition System,** in partial fulfillment of the requirements for the award of the degree of ***Bachelor of Technology*** in ***Computer Science & Engineering*** and submitted to the Department of Computer Science & Engineering, *Sagar Institute of Science & Technology (SISTec)***,** Bhopal (M.P.) is an authentic record of my own work carried out during the period from Jul-2022 to Dec-2022 under the supervision of **Dr. Komal Tahiliani(Assistant Professor).**

The content presented in this project has not been submitted by me for the award of any other degree elsewhere.

Signature

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Date:

Dr. Komal Tahiliani	**Prof. Rahul Dubey**	**Dr. Keshavendra Choudhary**
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ABSTRACT

The growing interest in computer vision of the past decade. Fueled by the steady doubling rate of computing power every 13 months, face detection and recognition has transcended from an esoteric to a popular area of research in computer vision and one of the better and successful applications of image analysis and algorithm based understanding. Because of the intrinsic nature of the problem, computer vision is not only a computer science area of research, but also the object of neuro-scientific and psychological studies, mainly because of the general opinion that advances in computer image processing and understanding research will provide insights into how our brain work and vice versa. Because of general curiosity and interest in the matter, the author has proposed to create an application that would allow user access to a particular machine based on an in-depth analysis of a person's facial features. This application will be developed using Intel's open source computer vision project, OpenCV and Microsoft's .NET framework.

ACKNOWLEGMENT

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LIST OF ABBREVIATIONS

ACRONYM	FULL FORM
VS code	Visual Studio code
CSS	Cascading Style sheets
HTML	Hyper Text Markup Language
JS	Java Script
OpenCV	Open Source Computer Vision Library
tk	Tkinter

Chapter-1
INTRODUCTION

CHAPTER-1
INTRODUCTION

1.1 ABOUT PROJECT

Face recognition is an easy task for humans. Experiments have shown, that even one month old babies are able to distinguish between known faces. So how hard could it be for a computer? It was shown by David Hubel and Torsten Wiesel , that our brain has specialised nerve cells responding to specific local features of a scene, such as lines, edges, angles or movement. Since we don't see the world as scattered pieces, our visual cortex must somehow combine the different sources of information into useful patterns.

Facial recognition is a technology that can match a human face from a digital image or video, against a database of stored faces. Facial recognition generally uses biometrics to help identify facial features. This type of identification is helpful for various commercial and law enforcement applications. When it comes to digital authentication, facial recognition falls under the category of biometrics.

1.2 PROJECT OBJECTIVE

The main objective of facial recognition is to identify individuals, whether individually or collectively. The number of false positives can vary, depending on the technology used for facial recognition. The best face identification algorithm has an error rate of 0.08%. Facial recognition systems that operate with *liveness detection*, have higher rates of accuracy.

Chapter-2
SOFTWARE REQUIREMENTS

CHAPTER-2
SOFTWARE REQUIREMENTS

2.1 INTRODUCTION

To install and use application efficiently, we required certain software and hardware components of computer system. The system requirements on the package will be listed by the application manufacturer. After installation of application, you could face technical issues, if your computer system does not meet the system requirements. System requirement for operating system will be hardware components, while other application software will list both hardware and operating system requirements and Brower. System requirements are most commonly seen listed as minimum and recommended requirements. The minimum system requirements need to be met for the web application to run at all on your system, & the recommended system requirements, if met, will offer better software usability.

2.2 SOFTWARE REQUIREMENTS

Required software to work on this project:

- Languages:
  - HTML
  - CSS
  - JavaScript
  - Python

- Frame Works & Libraries:
  - Frontend
    - Html
  - Backend
    - Django
    - OpenCV

- Tools:
  - Visual Studio Code

2.2.1 HTML, CSS, JavaScript

The **Hyper Text Markup Language**, or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as **Cascading Style Sheets** (CSS) and scripting languages such as **JavaScript.**

- **HTML**

  Stands for "Hypertext Markup Language." HTML is the language used to create webpages. "Hypertext" refers to the hyperlinks that an HTML page may contain. "Markup language" refers to the way tags are used to define the page layout and elements within the page.

- **CSS**

  Stands for "Cascading Style Sheet." Cascading style sheets are used to format the layout of Web pages. They can be used to define text styles, table sizes, and other aspects of Web pages that previously could only be defined in a page's HTML.

- **JavaScript**

  JavaScript has been around for a few years now, and it allows us to write code in a clever way which basically makes the code more modern and more readable.

- **Python**

  Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. Its language constructs and object oriented approach aim to help programmers write clear, logical code for small- and large-scale projects.

2.2.2 Framework and Libraries

- **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 an Apache 2 licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

  The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 18 million. The library is used extensively in companies, research groups and by governmental bodies.

  It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. A full-featured CUDA

and OpenCL interfaces are being actively developed right now. There are over 500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has a templated interface that works seamlessly with STL containers.

- **Django**

Django is a high-level Python web framework that encourages rapid development and clean, pragmatic design. Built by experienced developers, it takes care of much of the hassle of web development, so you can focus on writing your app without needing to reinvent the wheel. It's free and open source.

Django was designed to help developers take applications from concept to completion as quickly as possible.

Django takes security seriously and helps developers avoid many common security mistakes. Some of the busiest sites on the web leverage Django's ability to quickly and flexibly scale.

- **OpenCV Haar Cascades**

Cascade Classifiers and Haar Features are the methods used for Object Detection.

It is a machine learning algorithm where we train a cascade function with tons of images. These images are in two categories: positive images containing the target object and negative images not containing the target object.

There are different types of cascade classifiers according to different target objects. In our project, we will use a classifier that considers the human face to recognize it as the target object.

Haar Feature selection technique has a target to extract human face features. Haar features are like convolution kernels. These features are different permutations of black and white rectangles. In each feature calculation, we find the sum of pixels under white and black rectangles.

OpenCV provides pre-trained models on Haar features and Cascade classifiers. These models are located in OpenCV installation. You can find the necessary XML files at:

```
/home/<username>/.local/lib/<python-version>/site-packages/cv2/data/
```

2.2.3 Tools for development

- **Visual Studio Code**

  Visual Studio Code is a source-code editor made by Microsoft for Windows, Linux and macOS.[9] Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git.

Chapter-3
SOFTWARE REQUIREMENTS SPECIFICATIONS

CHAPTER-3
SOFTWARE REQUIREMENTS SPECIFICATIONS

3.1 FUNCTIONAL REQUIREMENTS

ACTORS

- User

Functional Requirements:

- **User**
  1. Upload image
  2. View Output of processed Image
  3. View the number of count of faces present in the image

3.2 NON-FUNCTIONAL REQUIREMENTS

1. Flexibility
2. Maintainability

Each Non-Functional requirement is described below:

1. Flexibility:

If need arises in the future,software can be modified to change the requirements.

2. Maintainability

Software can be easily repaired and modified if a fault occurs.

Chapter-4
SOFTWARE DESIGN

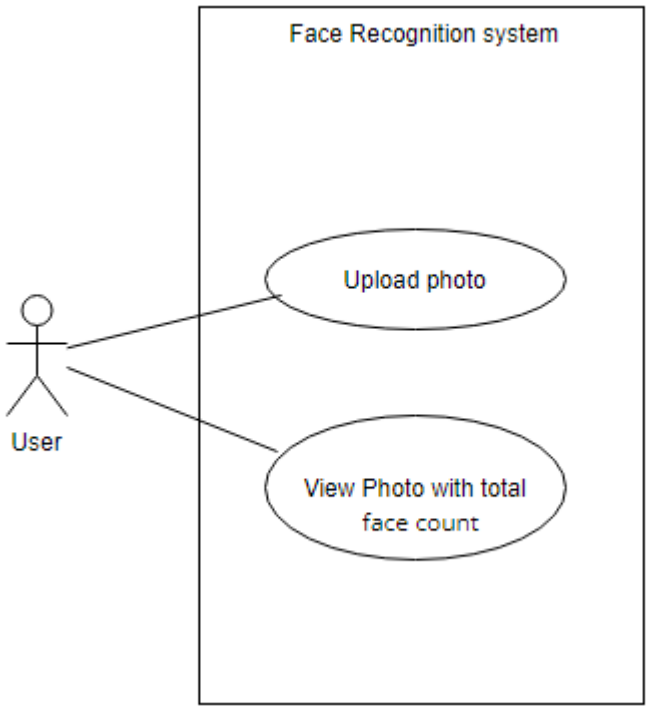
CHAPTER-4
SOFTWARE DESIGN

4.1 Use Case Diagram

The purpose of use case diagram is to capture the dynamic aspect of a system. However, this definition is too generic to describe the purpose, as other four diagrams (activity, sequence, collaboration, and State chart) also have the same purpose. We will look into some specific purpose, which will distinguish it from other four diagrams.

Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements. Hence, when a system is analyzed to gather its functionalities, use cases are prepared and actors are identified.

fig. 4.1 Use-case diagram



Chapter-5
OUTPUT SCREEN

CHAPTER-5
OUTPUT SCREEN

Fig.5.1 home page

Fig. 5.2 showing detected faces

APPENDIX-1 GLOSSARY OF TERMS

(In alphabetical order)

C

CSS CSS is an acronym that stands for Cascading Style Sheets which is a style sheet language that is used to express how a structured document like an HTML document should look. Together with HTML and JavaScript, CSS is one of the cornerstones of the World Wide Web.

E

ES6 JavaScript ES6 (also known as ECMAScript 2015 or ECMAScript 6) is the newer version of JavaScript that was introduced in 2015. ECMAScript is the standard that JavaScript programming language uses. ECMAScript provides the specification on how JavaScript programming language should work.

H

HTML HTML is an acronym for Hypertext Markup Language and is the standard language for documents that have been designed to be displayed in a web browser. You have certainly met HTML in one way or another, as all web pages on the Internet are written using a version of HTML.

I

IDE IDE is an acronym for Integrated Development Environment. It is the software suite used by developers in a development environment and is designed to maximize productivity and efficiency for the developer.

J

JS JavaScript is a lightweight, interpreted programming language. It is designed for creating network-centric applications. It is complimentary to and integrated with Java. JavaScript is very easy to implement because it is integrated with HTML. It is open and cross-platform.

M

ML Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values.

U

URL URL is an abbreviation for Uniform Resource Locator. It is often referred to as a web address. A URL is referring to a web resource and specifies the location of the resource on the network. Typically a web browser displays the URL of a webpage in the address bar.

V

VS Code Visual Studio Code is a streamlined code editor with support for development operations like debugging, task running, and version control. It aims to provide just the tools a developer needs for a quick code-build-debug cycle and leaves more complex workflows to fuller featured IDEs, such as Visual Studio IDE.

W

www WWW is an abbreviation of the World Wide Web. Which is what we generally refer to as the web. In general terms, it is an information system where a document or other web resources like images or video can be identified by a URL. The documents are accessible through the HTTP protocol and are accessible through a web browser. It is very often labeled as

the internet - which it is not synonymous with.

X

XML XML is an abbreviation for Extensible Markup Language. It is a markup language that sets a definition for encoding documents in a format that is readable by both humans and machines. XML is often used to describe data, thus making it a flexible way to create and share electronic data via the internet. XML uses tags to define the structure of the document, and describe how it should be stored and transported.

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