A Major Project Report On

MISSING CHILD IDENTIFICATION USING DEEP LEARNING AND MULTI CLASS SVM

Submitted in partial fulfillment of the requirements for the award of the

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In

Department of Computer Science and Engineering

By

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CERTIFICATE

This is to certify that the major project phase-I work entitled **"Missing Child Identification using Deep Learning and Multi Class SVM**" is submitted by **Govindolla Akshara (21241A0585)** in partial fulfillment of the award of a degree in BACHELOR OF TECHNOLOGY in Computer Science and Engineering during the academic year **2024-2025.**

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DECLARATION

We hereby declare that the major project phase-I entitled “Missing Child Identification System using Deep Learning and Multi Class SVM” is the work done during the period from **2024-2025** and is submitted in the partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering from **Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous).** The results embodied in this phase-I of project have not been submitted to any other University or Institution for the award of any degree or diploma.

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ABSTRACT

The rising trend of missing child cases requires the creation of effective identification systems capable of assisting authorities and concerned parties in finding and retrieving children. This project, "**Child Identification System Using Face Recognition**," is a web-based application created using the Flask web framework, supported by OpenCV for image processing and machine learning for facial recognition.

The main functionality of this system is to identify missing children by matching uploaded photographs with a trained set of photos using facial recognition methods. There are two levels of users, Authorities, and General Users, provided with role-based access for register, login, and image uploading. Users have the facility of uploading images of missing or found children along with descriptive metadata such as name, city, landmark, and remark. The images that have been uploaded are saved in a structured dataset, from which a K-Nearest Neighbors (KNN) model is trained for facial recognition.

The system provides a search function wherein the user uploads the image to identify it. The image, once uploaded, goes through a comparison process using the trained set for matching purposes. On a successful match, the system's status is updated about the case, and user information with relation to it is rendered visible. Another live webcam feed in real time through OpenCV provides live imagery for immediate viewing through capture from any web-facing machine.

A MySQL database handles user data, image metadata, and case status. Session management provides secure and personalized access to the application capabilities. The system provides a scalable, efficient, and user-friendly environment to help the child's identification and recovery and is an essential tool for both the authorities and the public.

Keywords: Child Identification, Flask, OpenCV, Face Recognition, KNN, Machine Learning, Webcam, MySQL

CHAPTER 1

Introduction

In today's world, the protection and security of youngsters have turn out to be a growing problem due to the increasing range of lacking infant cases. Parents, guardians, and authorities often face severe challenges in locating kids who go missing in crowded regions, public locations, or even residential neighbourhoods. Traditional methods such as manual identity checks, police patrolling, and public bulletins aren't usually efficient, particularly when time is essential. In such situations, a technologically superior device that can aid speedy identification and monitoring turns into vital. This project titled "Child Identification System" aims to bridge that gap by using advanced facial popularity strategies, including a consumer-pleasant net interface, and advance the usage of the Flask framework in Python.

The child identification system is a smart application that provides a platform for both users and the authorities to collaborate in the identification and search process. The main idea is that image processing and machine learning should be used to identify faces from photos or live camera feed and match them with a dataset of the images uploaded. The system includes main components such as user registration, login functionality, photo uploading, live video streaming and face recognition -based search functionality. Integration of OpenCV, Python Imaging Library) and KNN-based face identification algorithm increases the system's ability to detect and identify faces with appropriate accuracy.

The web application is structured to support two primary roles: authority and user. Both can register and log in to the systems. When users are logged in, users can upload a child's images relevant details such as names, cities, websites and any specific comments. These images are stored in a dataset, which is classified under the unique hair side automatically under uploads. The system captures and stores both image and text data safely in the backend database. These stored data are then used to train a face identification model that can be used later to match with new or unknown images.

Officers have the ability to search by uploading a picture of a missing child. The system processes the uploaded image, compares it to trained models, and is most likely to return matches. If a match is found, the information of the affected child is extracted from the database and the user is

displayed. If no match is found, the system gives a message indicating that no result was found. In addition, when a match is successfully identified.

The system additionally features a stay digital camera module the usage of OpenCV, that can seize actual-time video feeds from a webcam. This module is useful for destiny extensions where the utility can carry out real-time face detection and identity at once from stay video enter. The integration of this option showcases the flexibility and scalability of the project, allowing it to adapt into extra advanced and actual-time surveillance systems inside the future.

Security is some other important component considered inside the improvement of this utility. The use of consultation management guarantees that every person's sports are tracked accurately and unauthorized get right of entry to is restrained. Furthermore, right exception managing and secure filename practices are carried out to make certain sturdy and mistakes-free functioning of the utility.

The impetus for this project is not just to illustrate the practical application of artificial intelligence in real-world situations but also to create a socially useful tool that can help towards child safety. Through the integration of the disciplines of computer vision, machine learning, and web development, this project is a stepping stone towards creating more holistic and intelligent safety solutions in the future.

In precise, the Child Identification System suggests how new technologies can be applied to correctly address real-world problems. By its ability to maintain, system, and examine facial facts, this software is an effective tool within the process of toddler recovery and public protection development. The device is scalable, easy to apply, and in addition superior with extra features like GPS monitoring, mobile app integration, or AI-driven predictions, so it is a great candidate for real-world application.

CHAPTER 2

Literature Survey

2.1 Introduction

The issue of missing children continues a significant challenge worldwide, especially in countries with densely populated countries. Despite the development of digital infrastructure and advanced technologies, most hair recognition processes are slow, manual and often ineffective. Traditional methods such as physical comments, TV broadcasting and manual police investigations can be useful, but are limited in speed and accuracy. Since time is an important factor in such cases, delayed action can reduce the chances of regaining the child.

With the emergence of artificial intelligence (AI) and machine learning (ML), especially in the field of data, new opportunities have emerged to develop intelligent systems that can automate the identity process. Face Recognition Technology has proven to be a reliable solution in many security and monitoring applications. To identify patterns in facial features, it is possible to match a given image with the current post, according to the training model. These abilities can be utilized to create the systems that identify missing children by comparing images presented with a trained data set.

The integration of the AI model into web-based platforms has further improved the accession and appropriateness. Everyone allows KOLB as a framework, developers with units such as OpenCV and arrow to create scalable applications with real -time photography, insulation of user measurement (eg user and officials), and face -matching features. In addition, storing relevant details such as city, websites and images as well as comments to act as a comprehensive database for missing children's reports.

Although many efforts had been made in this route, most existing systems both lack a real-time reaction mechanism, fail to offer user-friendly interfaces, or are constrained to offline environments. There stays a need for a lightweight, on hand, and green answer that bridges the distance among picture recognition and practical identity of missing children. This project goals to expand this kind of solution—a actual-time, net-based totally Child Identification System using system learning and face popularity, intended to aid both government and the general public in identifying and locating lost youngsters more efficiently.

2.2 Related Work

The research paper "Missing Person Identification System Using Deep Learning Algorithm (CNN) and Machine Learning Classifiers" [1] highlights the advantage of combining CNNs with traditional gadget gaining understanding of classifiers to improve missing character identity accuracy. This combination leverages the deep getting to understand ability in characteristic extraction and ML methods' class accuracy to develop a trustful identity machine.

In "Identification of Missing Person Using Convolutional Neural Networks" [2], the authors pay attention most effective on CNNs for identifying lacking persons. The paper emphasizes better device overall performance and performance with growing layers of learning, allowing the model to perceive facial functions higher beneath different situations like lighting, perspective, and differences in age.

The research "Missing Child Identification Using Deep Feature Extraction and Multi Classification" [3] shows an answer that employs deep function extraction techniques together with multiclass class to decorate the identification technique. The machine is skilled to control more than one output training, making it appropriate for big-scale infant identity databases.

There is another paper, "NEST-Missing Child Tracking and Identifying Using Facial Recognition" [4], that addressed the application of state-of-the-art facial recognition techniques for location and tracking of children. Although designed in 2008, it formed the foundation of real-time identification systems and focused on monitoring and alerting mechanisms in real time.

The "Deep Learning and Multiclass SVM for Missing Child Identification System" [5] integrates the superiority of deep learning with Support Vector Machines (SVMs) in a multiclass setup. The resulting hybrid model is designed for more accurate identification, particularly in recognizing minor facial feature variations among children.

In "Identifying Missing Children: Face Age-Progression via Deep Feature Aging" [6], the work introduces a new method for identification using face aging models. The system applies deep feature aging methods to model the facial appearance of a child over time, thereby enhancing recognition even in situations where significant time has elapsed since the child went missing.

The paper "Missing and Unidentified Persons Database" [7] deals with the development of a centralized, comprehensive database that will help make identification faster and more extensive. It acts as a support mechanism to recognition systems by allowing data to be accessed and matched speedily.

The paper "Making Decisions in Missing Person Identification Cases with Low Statistical Power" [8] is about problems identifying missing individuals where there is not a lot of data. The study investigates models of decision making that remain effective under low statistical evidence using strong face recognition approaches.

In "Identifying the Reported Missing Child Based on Face Recognition" [9], the authors develop a facial image processing algorithm and compare them with a reported case database. While the title is partially misplaced in relation to the material, the basic idea serves to further the efficiency of face recognition in sensitive applications.optimum use in such critical situations, integrating real-time detection and alert capabilities to help authorities respond during emergencies.

The paper "Development of a Face Prediction System for Missing Children in a Smart City Safety Network" [11] discusses the possibility of predicting the current appearance of missing children by combining FaceNet and StyleGAN2 methods. This system enables parents to confirm potential matches through similarity comparison and style mixing, demonstrating higher prediction accuracy and more natural image quality compared to other aging models like CAAE, HRFAE, and IPCGAN.

The paper "MISSING CHILD DISTINGUISHING FRAMEWORK USING DEEP LEARNING AND MULTICLASS SVM" [12] highlights the efficiency of integrating deep learning with Support Vector Machines (SVM) for distinguishing and categorizing features in images of missing children. Utilizing a pre-trained CNN model, VGG-Face, for feature extraction, the system achieves a classification performance of 99.41%, offering a valuable tool for law enforcement agencies in locating missing children.

The paper "Facilitating Swift Reunions: A Comprehensive Web Application for Missing Children Tracking Using Face Recognition" [13] aims at accurately identifying and tracking missing children through a web application. By employing a Siamese Neural Network and a pretrained ArcFace deep architecture based on MTCNN, the system ranks similarity between inputs, making it effective even with smaller datasets containing limited samples per class.

The research work "Finding Missing Children: Aging Deep Face Features" [14] explains a practical implementation of an age-progression module that enhances the ability to identify children who have aged significantly since being reported missing.

2.3 Gaps Identified

- Limited participation scope, proscribing the search method to authorities with out concerning the general public.
- Lack of actual-time picture seize options, depending completely on formerly taken pix which may be previous or unclear.
- Manual identity and matching processes which might be time-ingesting and susceptible to human errors.
- Unorganized dataset management leading to inefficient schooling and retrieval throughout identity duties.
- Absence of dynamic gadget learning version updates whilst new facts is delivered into the system.
- Inability to music the modern-day repute of cases, leaving the resolution fame of uploaded pictures doubtful.
- Minimal or little need of synthetic intelligence or gadget studying for automating the recognition process.
- Separation of user roles and not using a incorporated device for both public users and authorities to engage or percentage information.
- Weak login validation systems with confined feedback on registration or authentication disasters.
- No centralized interface for authorities to review, control, or update uploaded photo statistics and status.
- Poor assistance for some picture formats and sizes, which creates compatibility problems during uploads.
- Failure to provide solid storage methods for personal stats and uploaded pics, increasing privacy and stats security concerns.
- Lack of specific identifiers or reference numbers for entered times, making it even more complicated to fine-tune or correct them.
- No webcam-primarily based taking pictures mechanism within the software, forcing users to depend on external uploads.
- Insufficient feedback to customers after uploading pics or performing searches, main to confusion approximately the system.
- Poor blunders handling in previous structures, frequently crashing or returning doubtful messages whilst issues arise in the course of uploads or predictions.

2.4 Problem Statement

The increasing wide variety of toddler missing cases presents a critical social undertaking, demanding instant and green mechanisms to resource in identity and reunion efforts. Traditional methods of child identity are in large part are time-consuming, and dependent on human observation and memory, which won't usually yield correct or timely results. Existing structures frequently lack the integration of wise reputation technologies, actual-time photo uploads, or interactive structures that involve both authorities and the general public.

In maximum cases, the identification manner will become not on time because of a lack of centralized picture databases, inefficient statistics control, and lack of automatic popularity talents. Furthermore, users, whether or not parents or authorities, frequently face difficulties in uploading or searching for missing child info because of rigid or outdated interfaces and constrained get entry to system capabilities. The inability to deal with a couple of enter assets like webcam captures, stable person authentication, and real-time search functionality similarly aggravates the scenario.

Therefore, there's an urgent need for an automatic, consumer-pleasant, and wise machine that permits fast photograph matching and effective coordination between public users and authorities to address child lacking cases.

2.5 Proposed Solution

To address the inefficiencies and demanding situations present in conventional and existing toddler identity structures, we advise a web-based automatic toddler identity platform that leverages image recognition technologies, device mastering, and Flask-based totally internet development. The system facilitates quick and accurate identification of lacking youngsters by evaluating uploaded pictures with a skilled dataset using a K-Nearest Neighbors (KNN) classifier. This proposed gadget provides awesome roles: Authority and User. Each function comes with its set of functionalities on hand through a stable login gadget. The authority can upload photographs of located children in conjunction with relevant facts such as name, area, and remarks. On the opposite hand, the person can add photos and look for missing youngsters. The gadget intelligently handles these snapshots and stores them in a dependent dataset that is later used for schooling a face recognition version.

Main components in the solution:

- **Web interface with Flask:**

  The application is designed using Kolben's python framework to provide a simple but powerful network interface. The interface is a user -friendly, so authorities and users can initially interact with the system.

- **Secure registration and login system:**

  The platform has a safe certification system where users and authorities must register and log in before they reach the functionality. This ensures the integrity and controlled use of the stage.

- **Image upload and data set control:**

  Images uploaded by both officers and users are stored in designated folders using a secure file management mechanism. Places, comments and uploads -IDs such as metadata are stored in the relevant identity database.

- **Face recognition using KNN classifies:**

  The core of the system is built around K-Narest Neighbours (KNN) Classifierfire, which is trained on the image date set. It removes facial properties of using pre-proclamation techniques and maps them for face coding models. During search operations, the system compares images uploaded with a trained model to identify matches.

- **Real -time search and status update:**

  When a user uploads an image to find a missing child, the image is analyzed using a trained classifies. If a battle is found, the records of the affected child are marked as "Resolved" in the database, and the user is informed of the match with further details.

- **Webcamera integration:**

  The application includes real -time webcam catch features that allow officers or users to take images directly from the camera and use it to upload or search. This reduces the dependence of the system pre-secure image files and provides the system's flexibility.

- **Database and Backend Integration:**

  A well-structured database schema manages the storage and retrieval of user credentials, photo uploads, child records, and identification statuses. The backend logic ensures that the user experience remains smooth while managing multiple concurrent tasks securely.

Advantages of the Proposed System:

- Seconds the quick and more accurate identity of missing children.
- The communication difference between the authorities and the public brings the difference.
- The matching process manual work automatically reduces work.
- Offers real -time, accessible and scalable solution through a network interface.
- Introduce a centralized platform to maintain child records with status tracking.
- The image is uploaded and real time both supports webcam -based findings.

The purpose of this broad system is to work as a modern digital help in identity and extraction of missing children, and bring technology and human efforts together on an integrated platform.

2.6 Summary

In nowadays's world, the number of missing infant cases is growing at an alarming fee. Despite the efforts of many companies and authorities government, there stays a full-size gap in correctly monitoring and identifying lacking youngsters in real-time.The literature and earlier systems reviewed in this chapter shed light on the evolution of this problem and the technology that has been used to address it so far.

From the studies and mission analyses conducted, it's far obtrusive that whilst many structures have applied face detection and popularity technology, most of them consciousness heavily on manual information entry and absence automated identity techniques. Some of them rely on previous techniques or require tremendous hardware setups, making them much less handy and difficult to scale. Also, they often fail to maintain a centralized and steady database of accumulated photographs and statistics, which results in statistics redundancy and bad coordination among authorities.

Another primary statement from the existing literature is the shortage of user-pleasant structures in which both government and the overall public can interact efficiently.In most previous projects, the interaction between users and the system was limited to either basic data entry or manual browsing through photos. There was no clear pathway for authorities to track and follow up on reports unless they manually searched and matched records, which is extremely time-consuming and prone to human error.

Moreover, earlier systems seldom took advantage of modern machine learning techniques or real-time video capture functionalities, which could significantly enhance detection accuracy and speed. The integration of KNN classifiers and deep learning-based face recognition models was either missing or not effectively implemented in previous works. This led to delayed responses and, in some cases, inaccurate results.

Through this survey, it's clear that the current technologies used in missing child identification can be greatly enhanced. It additionally highlights the urgent want for a streamlined, actual-time, AI-assisted machine that lets in both public users and licensed employees to play a function in identity. A strong, scalable, and easy-to-use utility that helps each picture uploads and live detection can substantially enhance reaction instances and fulfillment fees in identifying lacking children.

To finish, this literature survey now not handiest identified the technical and practical shortcomings in preceding implementations however additionally helped in defining the clean course ahead. It serves as the muse for developing a greater smart, green, and responsive gadget—one which meets the real-international desires of a extraordinarily touchy and critical social trouble. By filling in the gaps left by means of in advance structures, we will make sure that technology serves its motive in saving lives and reuniting households.

CHAPTER 3

System Requirements Specification

3.1 Introduction

The Child Missing Identification System is designed to tackle one of the most emotionally difficult and time-sensitive problems in society—the sudden disappearance of children. Every year, countless cases of missing children are reported, and in many of these cases, the delay in identification and communication creates serious consequences. This project aims to assist in reducing that delay by using face recognition technology to support the quick identification of missing children.

The system is built as a web application that allows two types of users: the general public and authorized personnel. Through a user-friendly interface, both users and authorities can register, log in, and use the platform to upload or scan images of missing or found children. Once uploaded, the images are processed using a trained machine learning model that attempts to match the photo with existing entries in the database. This streamlines the identification process and improves the chances of reuniting children with their families more quickly.

From a technical point of view, this application integrates Python libraries like OpenCV for image processing, Flask for web development, and MySQL for data storage. It also uses a machine learning algorithm (K-Nearest Neighbors) to identify and compare facial features from input images. The camera module provides real-time video capture to allow live detection directly from the user's device.

This System Requirements Specification (SRS) document outlines all the important functional and non-functional aspects of the system.It establishes a clear roadmap for developers, testers, and stakeholders, making certain that everyone has a common understanding of what the system is supposed to do. The project also explains the software environment, user interactions, and design constraints to act as a foundation for the software development life cycle.

Apart from exhibiting the application of technical knowledge to a real-world problem, the project also shows the contribution of innovation and empathy towards software development. Through bridging the gap between authorities and families, the system yields a useful tool that can contribute positively towards society.

3.1.1 Purpose

The purpose of this System Requirements Specification (SRS) document is to define the overall purpose of the Child Missing Identification System and to provide a shared understanding—developers, testers, users, and project guides—to everyone regarding what must be accomplished by the system. This system tries to overcome the problems of tracing and identifying missing children by utilizing the power of face recognition software to speed up the process, guarantee accuracy, and make it more accessible to both government agencies and individuals.

Child safety has been a central topic of concern for the last few years with thousands of missing child incidents reported every year. These traditional identification techniques like posters, manual verification, and mouth-to-mouth alert are typically time-consuming, inefficient, and less accurate. The delays have devastating effects. The objective of this project is to replace the current techniques with a smarter, AI-based system incorporating real-time face recognition and data centralization so that missing children can be found and identified more quickly and more accurately.

This document outlines the system's architecture, key features, and performance expectations. It is designed to guide the development process from early design stages right through to deployment and testing. It will also serve as a reference point whenever changes or upgrades are needed in the future.

The system will be intended to serve two general categories of users—registered authorities and general users. Authorities have the ability to upload images and related information of missing children, while users will be able to upload images of recovered or unidentified children. The system will thereafter match facial characteristics based on a trained machine learning model to determine matches from the existing database.

Lastly, the aim of this project and that of the project overall is to contribute to the greater goal of reuniting families and safeguarding children using considered technology. It ensures all the stakeholders involved in the project have a very clear idea of what the system will do, why it is being built, and how it is expected to act.

3.1.2 Scope

Child Missing Identification System has been created with the aim to be an efficient and useful mechanism for assisting identification and recovery of missing children by applying face recognition technology. Child Missing Identification System utilizes machine learning, computer vision, and web development to help build a unified system where responsible authorities and everyone in general are able to assist each other by reporting, uploading, and identifying missing children.

This project hopes to solve the key problem of missing children, a problem on the rise across the world and particularly in crowded places. In most instances, late identification or the lack of communication between individuals and authorities has caused considerable delay in locating missing children. Our system hopes to reduce this gap through quicker, more intelligent, and more precise identification using image processing and AI-powered facial recognition algorithms.

Two kinds of users have been provided within the system: Authorities (including police, child protection officials, etc.) and General Public Users. Authorities may register, log in, and upload pictures and information of lost children. General users can post a photo of a lost or unidentified child he encounters and furnish basic information such as city, landmarks, and comments. After the photo is uploaded, the system identifies the image against the images in the current database to check for any match. In case a match is established, the authorities are informed, and the case can be updated.

From a technical angle, the device has some of integrated elements:

- Web interface for government and customers to get entry to and engage with the device.
- Image upload module enabling images to be securely uploaded.
- Face reputation engine primarily based on OpenCV and KNN algorithms for matching faces.
- Camera integration to allow real-time capture and matching.
- Database backend to store consumer records, toddler information, and photo information.
- Search and result module to enable show of in shape consequences and comply with-up.
- Status tracking so that the authorities may replace the case decision.

This undertaking is an internet application, ensuring ease of get admission to from any internet-enabled tool. It is constructed on Python (Flask framework), OpenCV for face reputation, and KNN-primarily based classifiers for predicting the probably fits. The gadget in addition has safety features such as replica UID assessments, function-based totally get admission to, and session control to ensure records confidentiality and protection.

The scope is intentionally centered on face-based totally identification, as that is the most not unusual and practical manner to recognize individuals. It does no longer include other biometric techniques like fingerprint or iris detection. Additionally, the machine presently capabilities as a standalone internet software without integration to national or worldwide databases. However, it's miles designed in a manner that it can be scaled or extended inside the destiny to guide such integrations with external databases, cloud-based totally APIs, or cellular applications.

This gadget is not an alternative choice to police research or felony child healing techniques however acts as a supportive technology device for the identity and reporting degrees. Once a child is identified, it is assumed that authorities will manage the case the use of their mounted protocols.

In precise, the scope of the project consists of the layout, implementation, and deployment of a face reputation-based totally child missing identity device. It emphasizes accessibility, usability, and efficiency in assisting early-degree identification efforts. While it does now not deal with criminal complaints or reunification, it performs a vital position in detection and reporting, filling a important gap inside the present day systems and empowering each government and the general public in efforts to bring missing children home.

3.1.3 Definitions, Acronyms and Abbreviations

Definitions

- **Child Missing Identification System (CMIS):** A web-primarily based utility that enables in figuring out and finding missing kids the usage of facial recognition era and photograph contrast.
- **User:** Refers to any man or woman who accesses the machine, inclusive of each the overall public and authority figures. Each person has one of a kind get entry to rights and functionalities depending on their function.

- **Authority:** An authorized reliable or consultant from a regulation enforcement or toddler safety company who can add missing child statistics and take important movements based on in shape results.
- **Facial Recognition:** A biometric technology that makes use of an individual's facial functions to perceive or verify their identity. In this machine, it's far used to suit uploaded snap shots in opposition to saved facts.
- **Session:** A transient interaction period where a person is logged into the gadget. Sessions are used to control steady get right of entry to and user-unique facts in the course of a visit.
- **Training Data:** A series of photos used to train the facial reputation set of rules to recognize and distinguish among distinctive kid's faces.
- **Prediction:** The stop result given by using the tool after comparing a new uploaded photograph with the existing dataset. If a healthy is observed, the device identifies the child.
- **Dataset:** The organized series of pictures of lacking kids stored within the device, used for schooling and trying out the facial popularity version.
- **Status (Resolved/Pending):** Indicates whether or not the case of a lacking child has been correctly recognized (Resolved) or continues to be beneath assessment (Pending).
- **Camera Module:** An element of the device that captures stay video feed to help with real-time picture popularity and consumer interaction.

Acronyms and Abbreviations

Acronym	Full Form	Description
CMIS	Child Missing Identification System	Name of the proposed system.
UID	User Identifier	A unique ID assigned to each user during registration.
UI	User Interface	The graphical part of the application that users interact with.
DB	Database	The backend component used to store user, image, and case-related data.

HTML	HyperText Markup Language	Used for designing the structure of web pages.
CSS	Cascading Style Sheets	Used for styling the UI components of the application.
KNN	K-Nearest Neighbors	A machine learning algorithm used for face recognition in this project.
AI	Artificial Intelligence	Technology used to replicate human intelligence in machines.
ML	Machine Learning	A branch of AI used for training the facial recognition model.
API	Application Programming Interface	Used for future integration or communication with external services.
JPG	Joint Photographic Experts Group	A commonly used image format supported by the system.
DBMS	Database Management System	Software used to manage the system's database.
CV	Computer Vision	A field of AI that enables computers to interpret visual data.
SRS	System Requirements Specification	A document describing the requirements and design details of the system.
OS	Operating System	The environment where the application is deployed and run.

Table 3.1.1 Acronyms and Abbreviations

3.1.4 References

In designing this project, various technical resources, research papers, and documentation were referred to in order to have a solid grasp of theoretical as well as practical concepts. The following references were instrumental in directing the system design, development, and implementation:

1) Face Recognition with Python (face_recognition Library)- Official face_recognition GitHub repository documentation and tutorials were referred to in order to implement the basic facial recognition features using deep learning-based models.

2) OpenCV Library Documentation- OpenCV (Open Source Computer Vision Library) was used to perform image processing operations, get webcam video inputs, and include live stream detection in the system.

3) Flask Web Framework Documentation- Flask was developed for the web interface in the application . Its documentation led to the development of routes, user session handling, rendering templates, and secure handling of form submissions.

4) MySQL Database and SQL Queries- Online documentation and MySQL documentation were used to create the relational database schema, optimize SQL queries, and integrate the application backend with the database using Python.

5) IEEE Papers on Missing Children Identification Systems- A few IEEE research papers and articles on facial recognition, surveillance deep learning, and human identification were reviewed to learn about current methods and limitations.

6) Python Programming Language- Official Python documentation was employed in writing and debugging scripts, particularly those for threading, file I/O, and combining various libraries.

7) Government and NGO Websites- Official toddler safety companies and non-profit company facts and case studies were reviewed to examine real-global wishes and how technology can help in bridging the distance in figuring out missing children.

8) Academic Textbooks on Machine Learning and AI- Standard texts like "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" gave insights into how to train and test class models for facial popularity duties.

9) Stack Overflow and Developer Forums- Community forums and answers assisted in solving precise errors and implementation problems, mainly regarding Flask, OpenCV, and record managing whilst importing images and making predictions.

These references had been the idea for developing a reliable, technically sound, and green application for lacking infant identity.

3.1.5 Overview

This document presents functional and non-functional requirements to create an online child identification system. It aims to act as a complete guide for developers, sensors, project interests and future systems maintenance. The main purpose of this document is to give a clear picture of high -level architecture, user interactions, system behaviour and underlying technologies used for construction of the proposed solution.

The system facilitates two main classes of users: officers (eg police, child welfare agencies) and general users (eg the public, relatives). The authorities registered by uploading photographs and adding important details about the location, comments and sites, remember the details of the children. General users can upload images of the found child or have discovered to see if a child matches a registered case. The system then uses image recognition and classification techniques to match the images driven by OpensV and machine learning and to return the results accordingly.

The document begins by explaining the purpose and scope of the system and defines all main words and abbreviated names. Then it provides references to technologies, structures and educational letters that support the basis for the system. Then decomposes documents detailed functional requirements such as user registration, login certification, image uploading and searching. It further describes non-functional requirements such as performance, safety and scalability. SRS also provides a comprehensive system model, uses case charts and describes faith and obstacles that control the design and implementation of the application.

In summary, this SRS serves as a blueprint for all stages of the project—from development and implementation to testing and deployment—ensuring that the final system effectively meets both technical and user expectations.

3.2 General Description

The Child Identification System is an online application that uses facial recognition technology to assist in finding and identifying missing children. It is a support application for the public and authorities. The application is built using Python's Flask framework, augmented with OpenCV for real-time image processing and a KNN-based machine learning model for facial recognition. This system provides two user roles: Authorities and Users. Authorities can resolve and manage cases, while Users are able to report and upload images of missing children. Both roles have independent registration and login modules, providing safe access. The system provides a facility for uploading photos along with respective details like the name of the child, city, landmarks, and remarks. All these records are kept in a central database and divided into status (Pending/Resolved).

One of the major functionalities is the search module, where images that have been uploaded are matched with the trained data set. Upon a match, the system updates the case status and presents the matched record to the authority for action. There is also a live webcam module for real-time image capture to facilitate easy scanning of people on the spot.

The system expects that the users will upload clear and up-to-date images to maintain higher accuracy. It is dependent on external libraries like OpenCV, PIL, and a well-configured database connection. The overall workflow is conceived with simplicity, usability, and performance in mind, with the goal of making real-world impact by accelerating the process of child identification.

3.2.1 Product Perspective

The Child Identification System is a standalone web application that leverages machine learning and facial recognition technology to aid in the identification of missing children. The system is meant to augment current law enforcement infrastructure through the offering of a digital platform that streamlines and expedites the process of identifying children based on facial image analysis. It is an isolated system, although it can easily be linked with other missing persons databases or portals of law enforcement if the necessity arises in the future.

It has a client-server system-based architecture, in which users operate with the frontend via a web browser and the backend handles information and stores data securely in a database. The backend logic is constructed utilizing Python's Flask framework, which offers a light and scalable web server, while the face recognition capability is fueled by OpenCV and a K-Nearest Neighbors

(KNN) classifier. This classifier is trained on a collection of images gathered through the application, allowing the system to efficiently recognize and match faces.

There are primary user roles in the device: Users (those who need to file or look for missing children) and Authorities (officers who manage and music case closures). Both of those roles are assigned a awesome user interface, for instance, registration, login, and position-structured dashboards.These interfaces offer each class of user with get right of entry to to the functions relevant to their duties.

The application gives an interface via which users can upload images of lacking children in conjunction with metadata just like the name of the kid, final recognized vicinity, landmarks, and in addition remarks. The information is kept in a centralized MySQL database. After an image is uploaded, it gets saved within the dataset folder and is utilized for training the recognition model. Authorities later search using new images, and the application would try to find matches from the available dataset.

One of the core features of the system is the live webcam integration. With the help of OpenCV, the system enables authorities to take images in real-time and immediately compare them with the trained model. This feature brings utility in real-time application such as at railway stations, bus stands, and public events, where authorities can scan people instantly to see if they match.

The application is optimized to run in typical computing platforms and does not need high-level infrastructure. Yet, it requires a functional webcam, stable network connection, and access to latest libraries such as OpenCV, NumPy, PIL, and the Flask library. The application also presumes that the image being uploaded is a clear and frontal face photograph to achieve enhanced recognition accuracy.

This system gives a simple-to-use interface and efficient backend good judgment to facilitate the technique of toddler identification. It bridges the gap among the general public and the authorities, encourages community involvement, and employs AI to make the surroundings steady. Although presently being applied as an unbiased system, it could be developed right into a more whole solution with integration into countrywide missing toddler databases and public safety networks.

3.2.2 Product Functions

The Child Identification System offers various central functions that allow effective reporting, monitoring, and identification of lost children. The system is meant to be easy to use, secure, and extremely functional for the public as well as authorities. Following are the major functions of the system:

User and Authority Registration/Login:

The system has two user roles—Users and Authorities. Both have a distinct registration and login module. The Users like parents or guardians can register and log in to enter missing children. Authorities like police officers or child welfare workers can log in to handle cases and track the identification process.

Photo Uploading Module:

Registered users may upload a photo of the missing child as well as other information such as name, city, landmarks, and comments. The uploaded image is stored in a structured dataset folder, while its metadata is saved in the database for future reference. Each upload is also labeled with a specific case ID to identify it easily.

Search and Identification Using Face Recognition:

They may upload or snap a photo for identification. The system then compares the uploaded image with the trained dataset using a KNN-based facial recognition model.If there is a match, the system returns the case information of the matched child and updates the case status to "Resolved."

Live Webcam Capture:

A webcam interface built into the system enables real-time image capture. This can be very effective for the authorities to scan people quickly in public areas and match their identities against the available dataset.

Case Status Management:

Every case within the system also has a status field like "Pending" or "Resolved." As soon as a match is found through the recognition system, the status is updated automatically. Authorities can refer to this to monitor the status and take action further.

Secure Session Handling:

The device handles secure classes for logged-in users. User records is secured with session-based authentication, and best legal roles have get entry to to their respective modules and functionalities.

Database Integration:

Data of every type—user facts, uploaded snap shots, and recognition outcomes—are all positioned in a MySQL database. This organized storage enables green retrieval and monitoring of facts during searches or audits.

They function together in crafting a tough and purposeful utility that guides the identification of lost children on the basis essentially completely of edge AI and image processing techniques.

3.2.4 General Constraints

Child Identification System is also faced with numerous limitations that could impact its operation, performance, and deployment. The limitations are factored during the system design and implementation to provide interoperability, usability, and reliability across various environments.

1) Image Quality and Orientation: The accuracy of facial recognition by the system is highly dependent on uploaded image quality, lighting, and frontal orientation. Low-quality or aspect-profile snapshots can bring about incorrect or unsuccessful predictions.
2) Real-Time Processing Constraints: While the device employs a webcam for actual-time picture acquisition, processing velocity is issue to exchange relying on the hardware specifications of the tool. Lower-spec systems may have slower detection or processing time.
3) Dataset Size and Scalability: The KNN classifier employed for face identification works better with smaller datasets. As images increase, recognition time and accuracy can be affected unless further optimization or algorithm improvements are made.
4) Internet Connectivity: Being a web application, good internet connectivity is necessary for smooth functioning. Uploading images, retrieving records, and server-side database access all depend on an active internet connection.

5) Cross-Browser Compatibility: The web-based application is mainly tested with contemporary web browsers like Google Chrome and Mozilla Firefox. Complete compatibility with all the web browsers and mobile devices can involve further testing and tuning.

6) Hardware Dependency (Webcam): The webcam functionality relies on access to a working camera device. In public computers or environments where webcams are not present or are not allowed, real-time capture will be inhibited.

7) Security and Privacy: The system employed basic session-based authentication but does not implement more advanced encryption or security protocols such as SSL/TLS.SSL/TLS is genuinely vital in protecting sensitive records environments.

8) Minimal language help: The present-day version of the utility best helps English, which limits the use to users who are more comfortable using local languages.

These barriers factor out which future system enhancements, improvements, or planning for deployment inside diverse environments are to be taken under consideration. Resolving those obstacles in the next releases will serve to improve the device's typical balance and impact.

3.2.5 Assumptions and Dependencies

The operation and design of the Child Identification System rely on some assumptions about third-party infrastructure, hardware, users, and the environment. The assumptions help establish the scope and limits of the system. On top of these, the system has some dependencies that are instrumental to its smooth operation and installation. These should be met for the system to work as desired.

Assumptions

1) **Users Will Provide Accurate and Clear Inputs:** It is presumed that the users who are uploading images of children and related information (name, city, and comments) will enter up-to-date and correct information. This ensures that the facial recognition software runs perfectly and recognizes the right child.

2) **Photos Are Frontal Face Images:** The system assumes that uploaded images are high-resolution frontal facial images. The face recognition model based on KNN performs optimally when the input images are so. Non-frontal or vague images can result in decrease accuracy.

3) **Access to Search Module is Given Only to Authorized Authorities:** It is assumed that simplest legal authorities might be granted access to the real-time webcam search and face popularity feature. This is required to keep away from misuse or unauthorized use of touchy functions.

4) **Dataset Is Continuously Updated:** The program is based on a continuously increasing dataset of images of children. It is presumed that users will contribute actively towards the dataset in order to update it regularly, enhancing the model of recognition with time.

5) **Webcam Access Will Be Allowed by Users' Browsers:** We expect users to grant camera access via their browsers when they utilize the live capture feature. If this permission is not granted, real-time scanning cannot be implemented.

6) **Moderate Number of Concurrent Users:** The system is first intended for a moderate number of users. It presumes that the number of concurrent users will be small and within the performance range of the existing Flask application and database server.

Dependencies

Python Libraries and Frameworks

The fundamental functionalities inclusive of face detection, photo processing, and server routing are depending on libraries including:

- Flask – for web app improvement
- OpenCV – for actual-time computer vision
- NumPy – for matrix operations in photo processing
- PIL (Pillow) – for image manipulation
- Face Recognition – for facial characteristic extraction and matching

Machine Learning Model (KNN)

Face reputation system relies on a facial encoding-based K-Nearest Neighbors (KNN) classifier. It needs to be retrained every time sparkling child statistics is uploaded for the motive of maintaining recognition accuracy.

File System for Image Storage

Images uploaded are stored in organized folders within the dataset and checking out directories. The gadget attracts upon a standardized folder employer and filename convention to keep and retrieve photographs well.

MySQL Database

The whole backend relies on a MySQL database to hold user credentials, photo data uploaded, case status, and other metadata. Connection and performance of queries are important to ensure system dependability.

Operating System Compatibility

The application will run on either Windows or Linux operating systems with standard hardware support for webcam integration and Python runtime environments.

Browser Support

The system depends on modern web browsers such as Google Chrome or Firefox that support HTML5 video streaming, form submission, and camera access.

These assumptions and dependencies form the foundation of system functionality and deployment. Any change or failure to satisfy these components may require code changes, workarounds, or infrastructure updates.

3.3 Specific Requirements

3.3.1 Functional Requirements

Functional

These are facilities and abilities that should provide the system:

1. **User and Government Authority Registration**

The system will facilitate the registration of trendy users and registered authorities government the use of a specially designed role-based totally registration module.

- The registration page must be made to be had through function-precise URLs, e.G., /user_reg
- for users and /authority_reg for authorities.
- The device need to seize the following fields for registration:
    - Full Name
    - Unique Identifier (UID)
    - Password (PWD)
    - Email Address (E-Post)
    - Mobile Number (MNO)

- After submission, the device wishes to verify whether the UID is precise throughout the corresponding database table (authority or customers). In case the UID isn't always particular, then registration needs to be declined with an appropriate blunders message to be proven to the consumer.
- Upon successful registration, there needs to be redirection closer to the login page along with a success message.

2. User and Authority Login

The system should allow function-based totally login functionalities for each registered users and government officials.

- Users and authorities ought to be able to log in the use of their registered UID and password credentials.
- On a successful login:
    - Users are redirected to the userhome.Html interface.
    - Authorities are redirected to the authorityhome.Html interface.
- If the login credentials are invalid, the gadget must provide an errors message along with "Invalid Credentials" without revealing which precise field was incorrect to maintain safety.
- Sessions need to be initiated upon successful login to save the authenticated role and UID.

3. Upload Child Information with Photo

The device have to provide a characteristic for authenticated customers or government to upload a toddler's image together with relevant facts.

- The image upload shape need to collect:
    - Child Name (CNAME)
    - City
    - Landmark (Lmrks)
    - Remarks or additional remarks (Rmrks)
- The uploaded photo must be saved in a listing with a system-generated baby identifier (CID), following the structure: dataset/CID/.
- The photograph file ought to hold its original filename for traceability.

- Metadata consisting of CNAME, city, landmark, comments, picture filename, uploader UID, uploader position, and CID ought to be inserted into the uploadphotos database desk with the fame set as "Pending".
- Proper directory shape have to be created mechanically if no longer already present.

4. Missing Baby Disconnection (Face Recognition)

The center capability of the device involves figuring out missing youngsters using facial popularity.

- Users or government can also upload a picture of a doubtlessly lacking baby to the system.
- The uploaded picture is briefly stored in a testing/ listing for model input.
- The gadget ought to teach a K-Nearest Neighbors (KNN) classifier the use of the images present within the dataset/ folder.
- The trained model performs prediction at the uploaded test photo.
- If a face match is detected:
    - The corresponding CID of the matched photo is retrieved.
    - The repute of the matched access in the uploadphotos database is up to date from "Pending" to "Resolved".
    - All relevant info (CNAME, metropolis, landmark, remarks, uploader info, photo) are retrieved and offered to the searcher thru the interface.
- If no fit is observed:
    - A “No Results Found” message is exhibited to the person.
    - No database change is made.

These functional needs are constructed in to assist an green and streamlined workflow via the Child Identification System. From registration to function-based login, right person administration and authentication is preserved through the gadget to provide secure access to its capability.

The center point of the functionality is to upload child information as well as images and to identify missing children using face detection. When a user uploads an image for identification, the model trained for face identification compares it with the records. When a match is established, the system updates the status automatically and brings forth the details of the matched child, providing an efficient and smart solution to help solve missing child cases.

3.3.2 Non-Functional Requirements

These define the satisfactory attributes of the system:

1. Usability:

- Simple HTML templates like index.Html, function.Html, rolehome.Html, and so on., offer a UI.
- Navigation based totally on role improves user experience.

2. Performance:

- Face popularity (teach and predict) might take time relying on dataset length
- Real-time webcam feed have to keep first rate body rate.

3. Scalability

- Not relatively scalable in its modern form (e.G., synchronous version training each time a search is finished).
- Can be progressed with history jobs, version caching, or asynchronous venture queues.

4. Security

- Uses consultation for user authentication.
- Passwords are stored in undeniable textual content (⚠️ safety flaw, ought to be hashed).
- Secret_key is hardcoded and ought to be saved mystery.
- No role-based totally get entry to control — any logged-in person could probably get right of entry to certain routes.

5. Reliability and fault tolerance :

- Code handles exceptions using a tri-expert, but:
- The user does not return the error message.
- Better errors require logging and feedback from the user.

6. Stability

- Some arguments are hard -coded (eg file track, table name).
- A configuration file or environmental variable can benefit from.
- File uploads and model training arguments may be more modified.

7. Portability:

- The application runs on Kolben and OpenCV, which is compatible cross platforms.
- Python environmental layout with essential libraries will be required.

3.3.3 User Interface Requirements

These requirements define how the user interacts with the system, what the screens should contain, and how they should behave.

1. Home Page (`index.html`)

- Should display a welcome message.
- Provide navigation buttons/links to:
  - **User Registration**
  - **Authority Registration**
  - **User Login**
  - **Authority Login**

2. User Registration Page (user_reg.html) & Authority Registration Page (authority_reg.html)

- Must contain the following input fields:
  - Full Name (name)
  - User ID (uid)
  - Password (pwd)
  - Email (email)
  - Mobile Number (mno)
- A **Register** button to submit the form.
- Space to display error messages (e.g., "User ID already exists..!").

3. Login Page (`user.html`, `authority.html`)

- Input fields for:
  - User ID (`unm`)
  - Password (`pwd`)
- A **Login** button.
- A link to the registration page if the user is not yet registered.
- Display error message area (e.g., "Invalid Credentials").

4. User/Authority Home Page (userhome.html, authorityhome.html)

- Display a welcome message.
- Buttons/links for:
  - Uploading a photo (child report)
  - Searching for a missing child
  - Webcam access
  - Logout

5. Upload Photo Page (`user_upload_photo.html`, `authority_upload_photo.html`)

- Input fields:
  - Child Name (`cname`)
  - City
  - Landmarks (`lmrks`)
  - Remarks (`rmrks`)
- File upload field to upload image.
- Submit button to upload photo.
- Display area for success message (e.g., "Photo Uploaded Successfully..!").

6. Search Page (`user_search.html`, `authority_search.html`)

- File upload field for uploading a test image.
- A **Search** button.
- Display area for:
  - Results if a match is found (child details from DB).
  - Message like **"No Results Found"** if no match is detected.

7. Webcam Page (`camera.html`)

- Display live video feed from the webcam.
- A frame to show the video.
- (Optional) Buttons to:
  - Capture image
  - Submit captured frame for processing

8. General UI Behavior

- Use consistent design for both user and authority interfaces.
- Error and success messages should be clearly visible and well-styled.
- Ensure forms do not allow submission with empty required fields.
- Redirect users to the appropriate home pages after login or successful actions.

3.3.4 Metadata and Schema of Database

Schema acts as a structured blueprint that performs the data required for this project. It underlines large institutions, their characteristics and relationships between them.

1. Table: users

Column Name	Data Type	Constraints	Description
Name	VARCHAR(100)	NOT NULL	Full name of the User
Uid	VARCHAR(50)	PRIMARY KEY	Unique User ID
pwd	VARCHAR(100)	NOT NULL	User password
email	VARCHAR(100)	NOT NULL	User email address
mno	VARCHAR(15)	NOT NULL	Mobile Number

Table 3.3.1 User Table

2. Table: authority

Column Name	Data Type	Constraints	Description
Name	VARCHAR(100)	NOT NULL	Authority Name
Uid	VARCHAR(50)	PRIMARY KEY	Unique authority ID
pwd	VARCHAR(100)	NOT NULL	Authority password
email	VARCHAR(100)	NOT NULL	Authority email address
mno	VARCHAR(15)	NOT NULL	Mobile number

Table 3.3.2 Authority Table

3. Table: uploadphotos

Table 3.3.3 Upload Photos

Column Name	Data Type	Constraints	Description
cname	VARCHAR(100)	NOT NULL	Name of the missing child
City	VARCHAR(100)	NOT NULL	City where the child was last seen
lmrks	TEXT	NOT NULL	Known landmarks near last seen location
rmrks	TEXT	NULL	Additional remarks or observations
filename	VARCHAR(200)	NOT NULL	Name of the uploaded image file
uid	VARCHAR(50)	FOREIGN KEY	ID of the uploader(user or authority)
role	VARCHAR(20)	NOT NULL	Either ‘User’ or ‘Authority’
cid	VARCHAR(100)	PRIMARY KEY	Unique Child ID
status	VARCHAR(20)	DEFAULT ‘Pending’	‘Pending’ or ‘Resolved’

Notes on Metadata & Design:

The machine structure is designed with a rallying point of simplicity and scalability. Each user - either a favorite person or a specialist - is specifically recognized through UID (user -ID), which works as number one key for their respective tables. Similarly, each uploaded baby image is marked with a unique CID (Child ID), which allows structured and tracked storage in the dataset of the system. UID in the Uploadphotos table is like a foreign key, which refers to both customers or authority table based on the role of uploading. While this dynamic reference calls for additional good judgment at the utility level or a committed mapping mechanism, it offers a flexible manner to control multiple roles without duplicating information structures.

The contemporary schema is intentionally generalized to support speedy development and checking out. However, for destiny iterations, it's miles encouraged to normalize the statistics further through creating separate tables for particular user roles and sub-classes. In phrases of security, improvements such as password hashing using libraries like Bcrypt or werkzeug.Safety ought to be applied to ensure that touchy statistics is not saved in plaintext. Additionally, incorporating right position-based get admission to manipulate mechanisms will help ensure that users best access functionalities which might be relevant to their permissions, enhancing each usability and safety.

3.3.5 Hardware Requirements

- Processor: Intel Core i7 or AMD Ryzen 7 (or comparable)
    - Needed for optimal processing of image processing and machine learning tasks.
- RAM: 16 GB minimum
    - Guarantees hassle-free multitasking and model training without performance slowdown.
- Storage: Minimum 1 TB SSD
    - Offers quick data access and ample space for holding datasets, models, and application files.
- Graphics (Optional but Recommended): Dedicated GPU (e.g., NVIDIA GTX/RTX Series)
    - Useful in speeding up face recognition and image classification tasks.
- Network: Fast internet connectivity
    - Necessary for smooth uploads of data, real-time computation, and API communications.

3.4 Architecture and UML Diagram.

3.4.1 Architecture Diagram

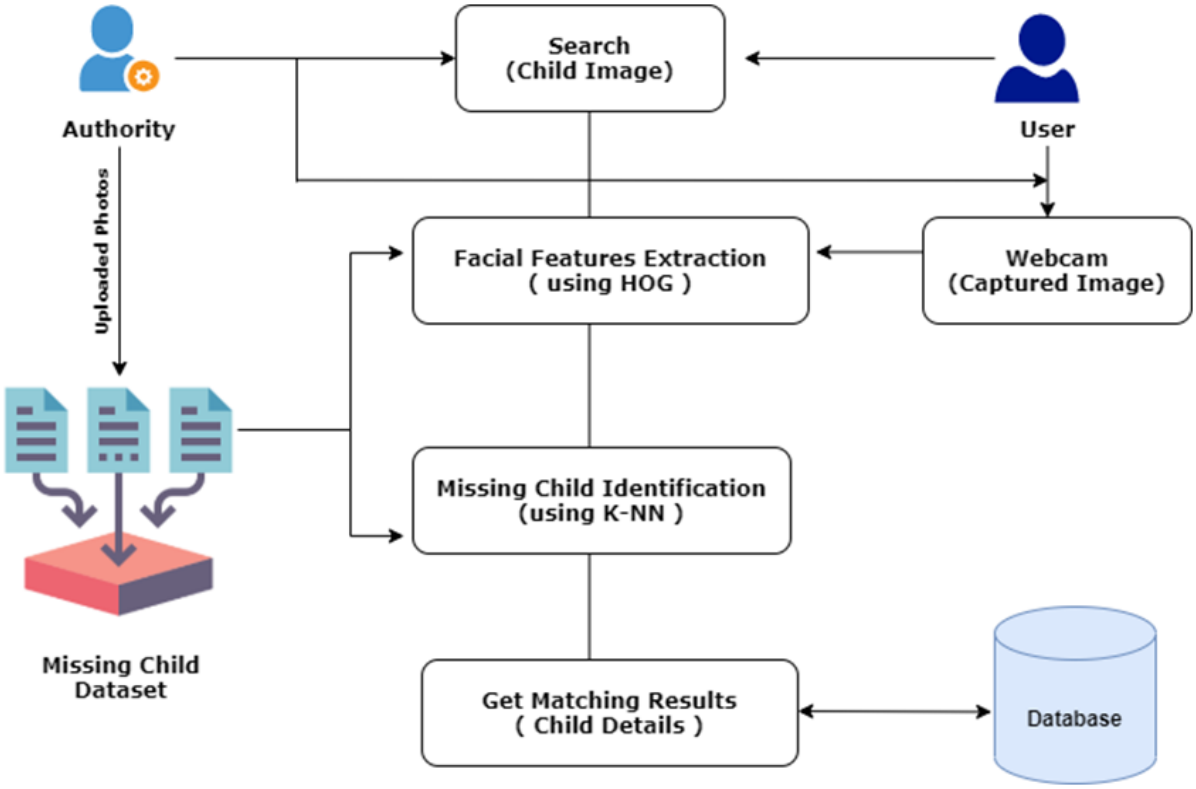

Figure 3.4.1 Architecture Diagram

The given system architecture diagram depicts the operation of a Missing Child Identification System that combines both user and authority roles for effective child search and identification. Authorities upload images of missing children along with necessary information into the system. These images are stored and categorized into a central repository known as the Missing Child Dataset. Conversely, users (e.g., citizens or police officers) can upload or take a picture using a webcam to trigger a search. This search image is fed into the system where facial feature extraction is done through the Histogram of Oriented Gradients (HOG) method.

After the facial functions are extracted, they're enter into the identification version based on the K-Nearest Neighbors (K-NN) algorithm to in shape the input picture with the database. If a match is identified, the system pulls out the information of the corresponding child from the database and displays them as outcomes. This allows real-time identification and helps in fixing missing infant instances. The combination of facial reputation, database interaction, and role-primarily based get entry to gives a continuing and steady transition from photograph enter to toddler identification.

3.4.2 Use Case Diagram

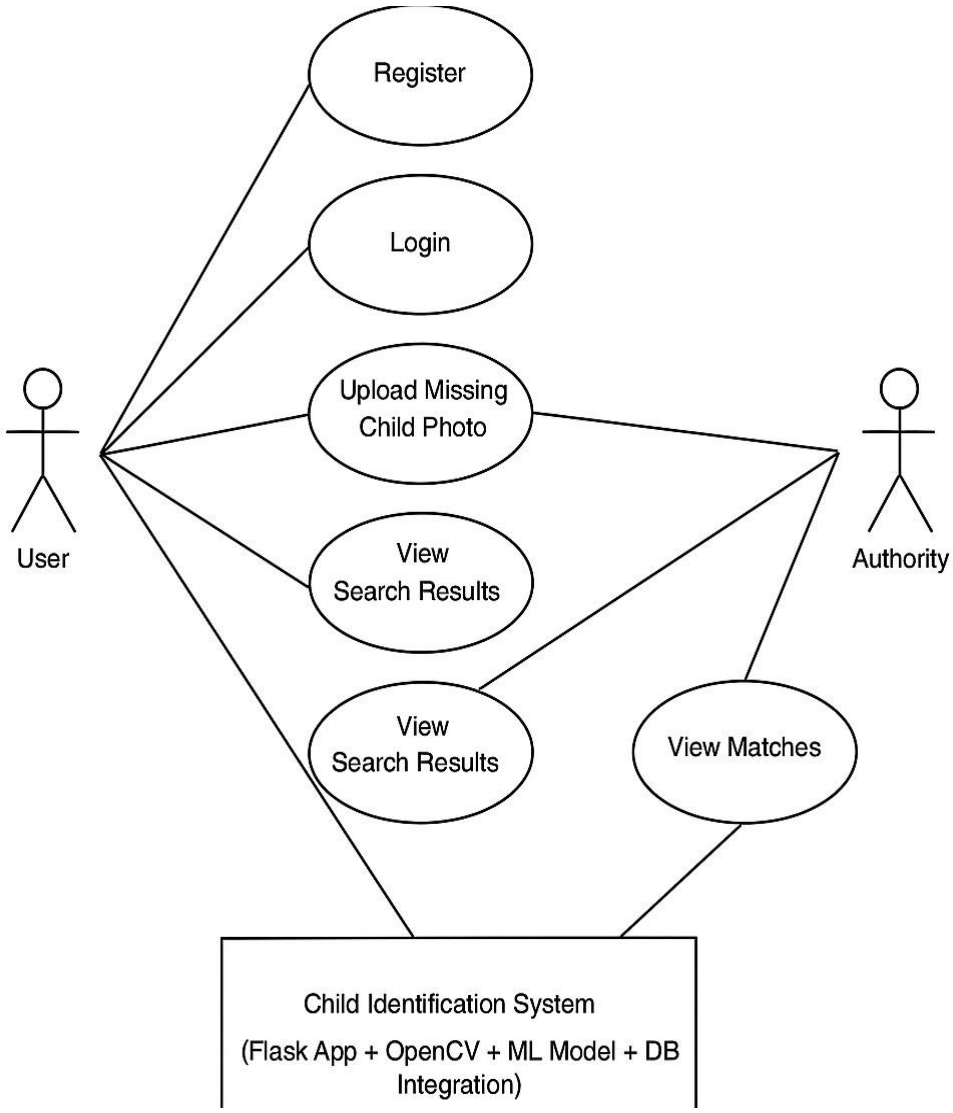

Figure 3.4.2 Use Case Diagram

The use of you shared by case charts represents functional aspects of the child identity system, which highlights the interaction between users, authorities and the system. Here is the collapse of cases of use based on chart:

Use cases:

1.Register (user):

- Everyone allows new users to create an account in the system to report or find missing children.

2. Log in (user):

- Registered users who can reach their accounts and use the system's functionality safely.

3.Missing child photo (user and authority)

- Both users and officers can upload pictures of missing children. These images are used by the system for extraction of functions and matching.

4.See search results (user and authority)

- After submitting a discovery (using uploaded or captured images), users and officers can see the system's identified matches or similar conditions.

5.See only the fight (only authority)

- Officers have the ability to see verified or potential matches identified by the machine learning model, which means that they are able to take further measures or validate the results.

System overview:

- **Actor:**
  - **User:** The public who can report or discover the missing children.
  - **Authority:** Official personnel who are valid, monitored and work with the battles found.
- **System:**
  - Child Identification System Basket (Web Framework), Openkav (Image Processing), a machine learning model (for face identification using HOG + K-NN) and database is designed using integration.

This diagram explains the most important functionality of the system, and shows how both the profit and the officer interact with the application to help the missing children identify and find out.

3.4.3 Class Diagram

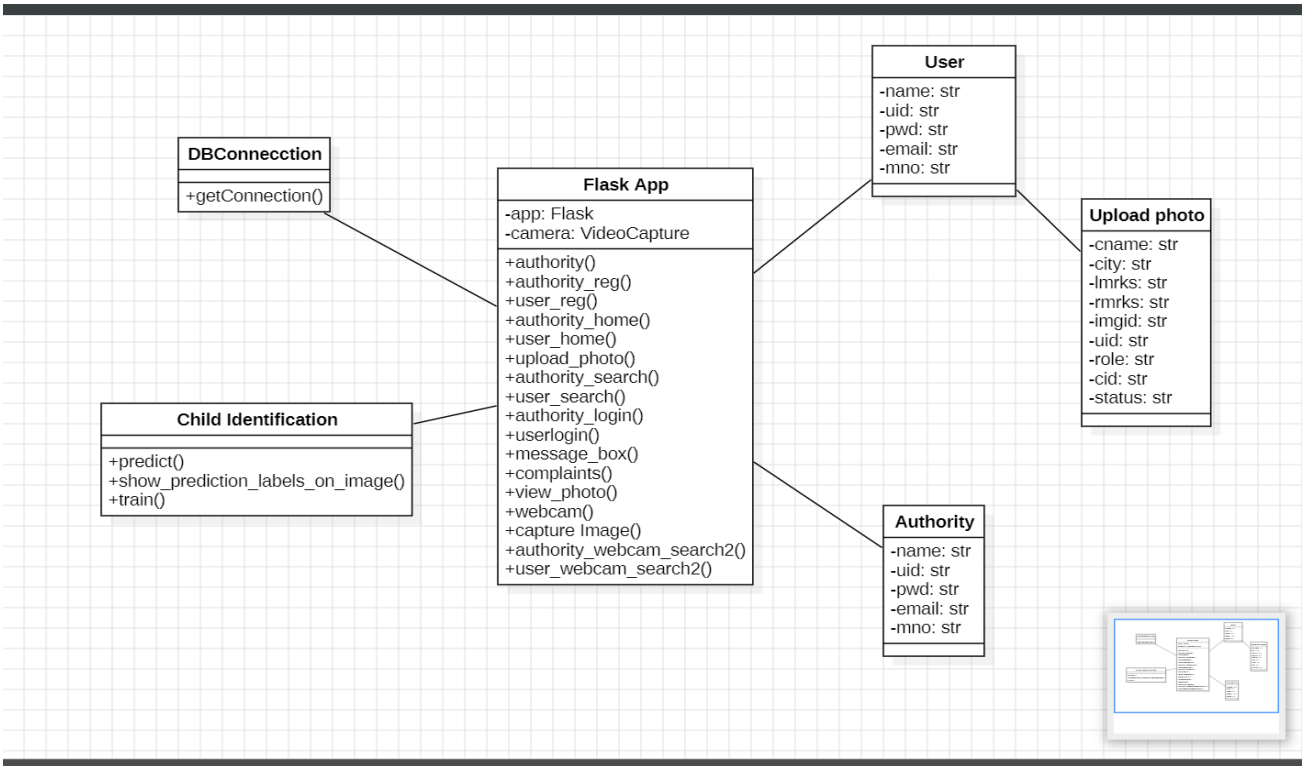

Figure 3.4.3 Class Diagram

Missing Child Database Class

Classes:

1.Flask App

- Main application controller.
- Handles routing, video capture, registration, login, photo upload, webcam, and search operations.
- **Uses:** cv2.VideoCapture, Flask, render_template, request, session.

2.User & Authority Entities

- Both have: name, uid, pwd, email, mno attributes.
- Registered using role-based registration pages (user_reg.html, authority_reg.html).
- Can login and execute role-specific operations.

3.Upload Photo Table

Stores photo-related metadata: cname (child name), city, landmarks, remarks, imgid (filename), uid, role, cid, status.

4.Child Identification

- Module that executes image processing and facial recognition.

Main methods:

- predict() – for face match identification.
- train() – for training the face recognition model.
- show_prediction_labels_on_image() – for displaying visually.

5. DBConnection:

Handles database connection with a function getConnection().

6.Functionality Overview

1.Registration & Login

- Authorities and users can register and login with role-based authentication.
- Sessions are preserved according to the role (session['userid'] or session['auid']).

6.Upload Function (Authority)

- Authorities upload images of missing children.
- Saved at./ChildIdentification/dataset/.

7.Search Function (User & Authority)

- Image is uploaded or captured using webcam.
- Facial features are detected by HOG (Histogram of Oriented Gradients).
- Matching is performed using K-NN (K-Nearest Neighbors) algorithm.
- Matched child information is fetched from the database.

8.Webcam Integration

- Real-time image capture through OpenCV integrated through /video_feed.

3.5 Summary

The architecture and the UML diagrams together present a detailed insight into how Missing Child Identification System works both from a functional and structural point of view. The architecture diagram shows a clean sequential process of operations—beginning from the initial image input, either from a webcam (user) or image uploading (authority). These images are then processed via facial feature extraction with HOG (Histogram of Oriented Gradients), which extracts distinctive

facial features by calculating gradient directions in local regions of the image. These features are then input into a K-NN (K-Nearest Neighbors) model, which compares the input image to a database of images that have been previously uploaded. If a match is established, the system pulls information of the child in detail from the database and shows it to the user or authority, facilitating quick identity and reaction.

The UML diagram runs simultaneously to support the architecture by way of emphasizing the item-oriented nature of the system. At its center is the Flask software, which acts as the controller that handles HTTP routes and consumer interaction. The DBConnection magnificence manages secure and green database interplay, and the ChildIdentification module encapsulates version schooling common sense and photo prediction. Classes like User, Authority, and UploadPhoto are representations of actual-global entities with their corresponding attributes (which include UID, CNAME, and so forth.), highlighting how statistics is prepared and used in the gadget. This easy separation of worries, with wonderful roles and functionalities, indicates how the backend is dependent to facilitate operations consisting of registration, login, picture uploads, and popularity. Combined, the diagrams offer an normal view of a modular, scalable, and interactive system based to assist in fixing missing baby instances via shrewd photograph processing and device studying algorithms.

CHAPTER 4

Methodology

4.1 Modules

- **Flask**: The main framework used for building the web application.
- Flask: Initializes the Flask app.
    - render_template: Renders HTML templates with dynamic content.
    - request: Handles incoming request data (form inputs, file uploads).
    - flash: Displays temporary messages to the user.
    - Response: Returns streaming responses (used in webcam streaming).
    - session: Maintains user login sessions.
- **pandas**: Imported for data manipulation and analysis, but not used in the current code.
- **csv**: Imported for reading and writing CSV files, but not utilized in the current implementation.
- **re**: Regular expressions module; imported but not currently used in the code.
- **werkzeug.utils.secure_filename**: Ensures secure file names are used during file uploads.
- **ChildIdentification**: Custom module used for facial recognition.
- train: Trains the face recognition model using uploaded images.
- predict: Predicts matching faces from the database.
- **os**: Used for interacting with the file system (e.g., creating directories, saving files).
- **base64, io**: Used for image encoding/decoding during processing.
- **PIL (Python Imaging Library)**: Handles image conversion and manipulation.
- **random.randint**: Generates a random number for unique child ID (CID) naming.
- **numpy**: Provides support for numerical operations (especially in image handling).
- **cv2 (OpenCV)**: Captures real-time video from the webcam and handles image processing tasks.

4.2 Methodology Proposed For Solution Implementation.

- The system is developed using the Flask framework, ensuring modularity, scalability, and lightweight deployment.
- User and authority registration is handled through role-specific routes with fields like Name, UID, Password, Email, and Mobile Number.
- UID is validated to ensure uniqueness before registration is allowed in either the users or authority tables.
- After successful login, **role-based access control** directs users or authorities to their respective dashboards.
- **Image upload functionality** allows users/authorities to submit missing child details (Name, City, Landmark, Remarks) along with a photo.
- A unique **Child ID (CID)** is generated automatically, and image files are saved to a structured directory based on this ID.
- All uploaded metadata and images are stored in a **MySQL database**, with a default status of "Pending".
- The system uses **HOG (Histogram of Oriented Gradients)** for face feature extraction and **K-NN (K-Nearest Neighbors)** for face recognition.
- The train() function is used to train the model on uploaded images, and predict() is used to find a match from newly uploaded test images.
- If a match is found, the status is updated to "Resolved" in the database, and details of the matched child are displayed to the user.
- If no match is found, the system informs the user that **no results were found**.
- A **webcam interface** is provided using OpenCV, allowing users to capture and upload real-time images directly from their devices.
- The complete flow ensures **end-to-end interaction** from registration, data upload, facial recognition, to result display in a user-friendly and secure manner.

4.3 Metrics Used For Results Evaluation

There are 4 main matrixes here that will be used to evaluate the results of the hair identification system (especially face identification/discovery functionality):

Definition: Percentage of the faces identified correctly from the total number of test cases.

Formula:

Accuracy = (correct predictions / total number of total predictions) × 100

Objective:

To measure how many times the system recognizes the missing child correctly.

2. False positive rate (FPR)

Definition: The speed that the system incorrectly identifies a child (when it is not right, detects a match).

Formula: Fpr = incorrectly positive / (false positive + true negative)

Objective: To evaluate how often the system confuses different faces, which can lead to wrong matches.

3. False negative rate (fnr)

Definition: The speed that the system fails to identify a child who is actually present in the database.

Formula: Fnr = incorrectly negative / (false negative + true positive)

Objective: To assess how often the system misses the right struggles - very important in the landscapes of the missing child.

4. Treatment time / response time

Definition: It takes the average time for the system to process an image and return the result.

Objective: To measure system performance and responsibility, important when it is especially important.

4.5 Summary

The methodology involves building a web-based child identification system using the Flask framework in Python. Key components of Flask such as `render_template`, `request`, `flash`, `session`, and `Response` are utilized to handle user interactions, image uploads, and video streams. Although modules like `pandas`, `csv`, and `re` are imported, they are not actively used in the implementation. The core idea of the proposed solution is to enable users or authorities to upload or capture a child's photo, extract facial features using the Histogram of Oriented Gradients (HOG) technique, and identify missing children through the K-Nearest Neighbors (K-NN) algorithm by comparing with the existing dataset. The system is evaluated using four performance metrics: **Accuracy**, which measures the percentage of correctly identified faces; **False Positive Rate (FPR)**, which tracks incorrect matches; **False Negative Rate (FNR)**, which indicates missed identifications; and **Response Time**, which measures the average time taken by the system to return results. These metrics help assess both the reliability and efficiency of the system in real-time scenarios.

CHAPTER 5

TESTING AND RESULTS

5.1 UNIT TESTING

Test Case Number: 1 Type of Testing: Manual Component Being Tested: Login module

Date of Testing: 05/02/2025 Name of Tester: Medha Testing Phase: Unit Testing

Test No	Feature being tested	Expected Input	Expected Output	Actual Input	Actual Output	Result of Test (Pass/Fail)
1	Login (Valid User)	Correct user ID and password	Navigates to home page	uid: user1, pwd: user123	Redirects to userhome.html	Pass
2	Login (Invalid Pwd)	Correct user ID, wrong password	Shows error message “Invalid Credentials”	uid: user1, pwd: wrongpwd	Displays login page with error message	Pass
3	Login (Unknown User)	Non-existent user ID and password	Shows error message “Invalid Credentials”	uid: nouser, pwd: nopwd	Displays login page with error message	Pass
4	Registration	New valid user data	Registers user and redirects to login	name, uid, pwd, email, mno	Message: “Registered Successfully. .! Login Here.”	Pass
5	Registration	Existing UID	Message: “User Id already exists..!”	Same UID as existing	Message: “User Id already exists..!”	Pass
6	Upload Photo	Valid photo + child info	Photo uploaded successfully	Valid image & details	“Photo Uploaded Successfully. .!”	Pass
7	Upload Photo	No image selected	Exception handled / error message shown	Empty image field	Error / log shown on console	Pass
8	Face Search	Matching face input	Shows match	Known face image	Match result shown	Pass

			result and updates DB status			
9	Face Search	Unknown face input	Message: “No Results Found”	Unknown face	“No Results Found” message	Pass
10	Webcam Stream	Access /webcam route	Camera feed displayed	Route accessed	Live feed shown on browser	Pass

Table 5.1.1 Unit Testing

5.2 SYSTEM TESTING

Test Case Number: 2 Type of Testing: Manual Component Being Tested: Entire Application Workflow Date of Testing: 05/03/2025 Name of Tester: Akshara Testing Phase: System Testing

Test No	**Feature being tested**	**Expected Input**	**Expected Output**	**Actual Input**	**Actual Output**	**Result of Test (Pass/Fail)**
1	User Registration	Unique Name, UID, Pwd, Email, Mobile	User registered and redirected to login	Valid registration form input	Message: “Registered Successfully..! Login Here.”	Pass
2	User Registration (Dup)	Existing UID with other details	Message: “User Id already exists..!”	Same UID, different data	Message: “User Id already exists..!”	Pass
3	Login Success (User)	Valid UID and Pwd	Redirects to userhome.html	Correct user credentials	Redirected to user home	Pass
4	Login Failure (User)	Valid UID, wrong password	Shows error message “Invalid Credentials”	Correct UID, incorrect pwd	Error shown on same page	Pass
5	Upload Child Photo	Valid child info and image file	Saves photo to dataset and DB, shows success message	Valid child form + image	“Photo Uploaded Successfully..!”	Pass
6	Upload No File	Valid form fields, but no file selected	Error logged, handled gracefully	Valid form without file	Exception handled, printed in console	Pass

7	Search Known Face	Image of already uploaded child	Displays matched child info, updates DB	Matching test image	Result displayed with details	Pass
8	Search Unknown Face	Random image not in dataset	Displays “No Results Found”	Unknown person image	Message: “No Results Found”	Pass
9	Webcam Access	Route: /webcam	Renders camera.html with live webcam feed	Accessed /webcam route	Webcam feed started	Pass
10	Video Feed Route	Route: /video_feed	Returns MJPEG stream to browser	Accessed /video_feed	MJPEG video stream loads	Pass
11	Authority Login	Valid authority credentials	Navigates to authority dashboard	Valid authority ID & Pwd	Redirected to authorityhome.html	Pass
12	Search Resolution	System resolves a match and updates status in DB	Status updated to “Resolved” in DB	Matching image submitted	DB record status changed to "Resolved"	Pass

Table 5.2.1 System Testing

5.3 USER ACCEPTANCE TESTING

Test Case Number: 3 Type of Testing: Manual Component Being Tested: User Interface and Functional Modules Date of Testing:26/03/2025 Name of Tester: Akshitha Testing Phase: UAT Testing

Test No	**Feature being tested**	**Expected Input**	**Expected Output**	**Actual Input**	**Actual Output**	**Result of Test (Pass/Fail)**
1	User Registration	All valid details (Name, UID, Password, Email, Mobile)	User gets registered, redirected to login page	Valid registration form	Message: “Registered Successfully..! Login Here.”	Pass
2	Message: “Registered Successfully..!	Existing UID with valid other details	Error message: “User Id already exists..!”	Existing UID in form	Message displayed: “User Id already exists..!”	Pass

	Login Here.”					
3	Login Success (User)	Valid user ID and password	User redirected to user home page	Correct login credentials	Redirected to userhome.html	Pass
4	Login Failure (User)	Valid user ID and wrong password	Error message: “Invalid Credentials”	Wrong password for correct UID	Message shown: “Invalid Credentials”	Pass
5	Photo Upload by User	Valid child details and image file	Photo saved and success message shown	Valid child upload form with file	“Photo Uploaded Successfully..!”	Pass
6	Photo Upload without File	Valid form fields without uploading image	Exception handled gracefully (no crash)	Valid form without image	Console prints error, no crash, no success message	Pass
7	Face Match Found	Image of a known (already uploaded) child	Match found, result shown, database updated	Uploaded photo of known child	Result displayed with child info, status changed to "Resolved"	Pass
8	Face Match Not Found	Image of an unknown child	“No Results Found” message shown	Random child image	Message shown: “No Results Found”	Pass
9	Webcam Access Page	URL: /webcam	Camera feed page opens	Accessed via menu/button	Webcam feed starts streaming live	Pass
10	Live Feed Working	URL: /video_feed	Browser displays live MJPEG video stream	Webcam active	Continuous live video shown in browser	Pass
11	Authority Registration	All valid authority details	Authority registered successfully and	Valid registration form	Message: “Registered Successfully..! Login Here.”	Pass

			redirected to login			
12	Authority Login Success	Valid authority credentials	Redirected to authority home page	Correct credentials	Redirected to authorityhome.html	Pass
13	Prediction Status Update	Face matched successfully	Status in DB updated to “Resolved”	Known child image	DB updated, verified in database	Pass

Figure 5.3.1 User Acceptance Testing

5.4 RESULTS

Step 1: Run the python code on Sublime Text 3 software by clicking Ctrl+B. The code executes and it produces a URL. Copy The URL on to your web browser and then click enter.It outputs the figure shown below.

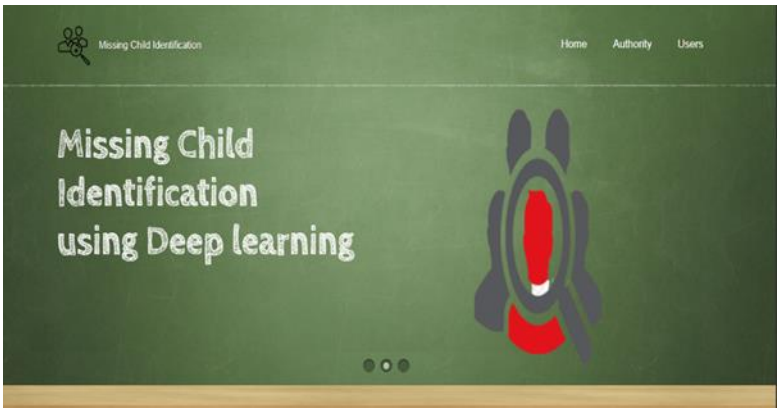

Figure 5.4.1 Application Interface

Step 2: The authority like police or any other officer’s login through the authority page and enter their credentials like User ID and password and then login into the website. If the authority is not registered, then they must register themselves by clicking on registerung button as shown in the figure below.

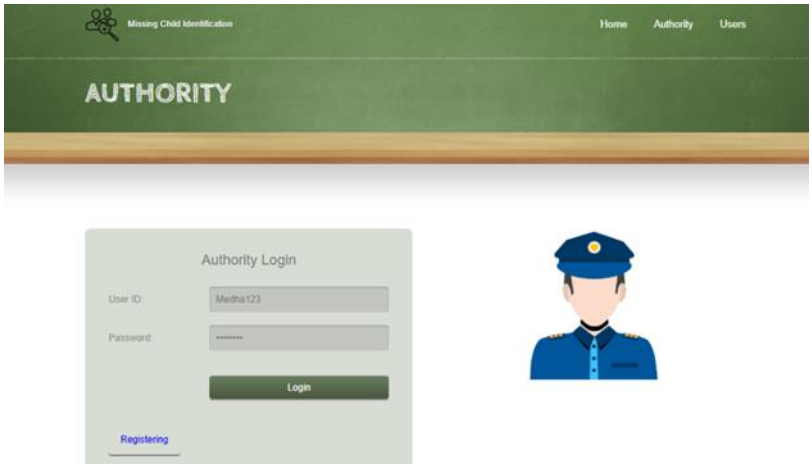

Figure 5.4.2 Authority login

Step 3: After the authority login into the website, it shows the next page with the welcome text for the authority to show that they have login successfully.

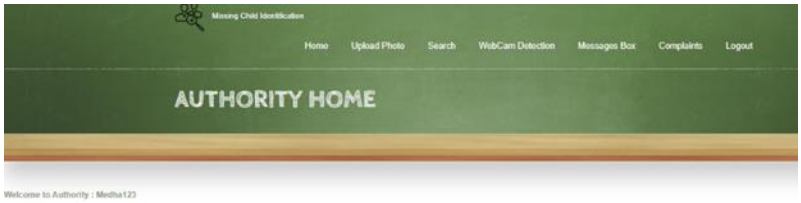

Figure 5.4.3 Authority Homepage

Step 4: The authorities will upload the missing children's information, including their name, location of the child found, remarks like any identification for the easy recognition of the child, profile photo, and other facts, like mobile number. All these data are stored in the complaint box for future reference for the authorities or users.

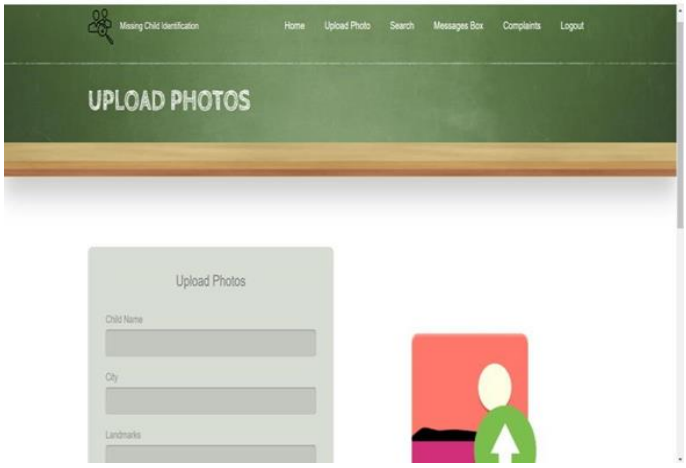

Figure 5.4.4 Upload Photos

Step 5: The authority will keep track of the number of missing child complaints and the status of each complaint, including whether it has been resolved or still pending.

Figure 5.4.5 Complaints box

Step 6: Users or authorities examine the search image, and upon clicking submit, the system executes the child identification process. If a match is found with the training features, it returns the details of the missing child along with profile pictures. Otherwise, it displays an alert message stating "No Results Found".

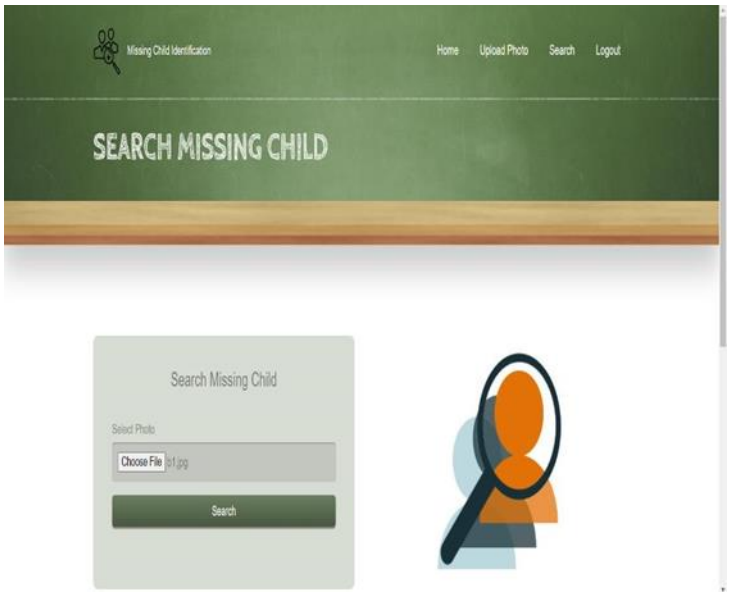

Figure 5.4.6 Search Missing Child

Step 7: The results will be produced upon clicking the search button whether the child's identity between the authority and the user are same or not. If the identities are same then the details of the matching child are given as shown in the figure below. Or else it will show "No Results Found" .

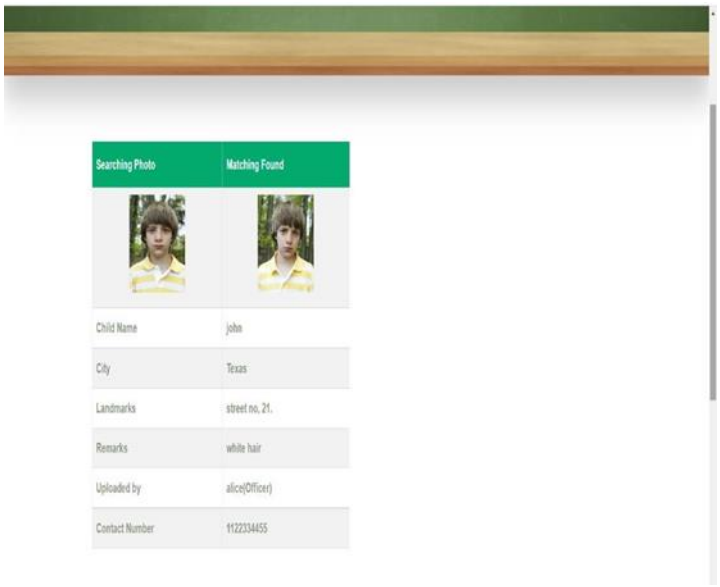

Figure 5.4.7 Result

Step 8: This system will present a list of alert messages. Upon the user's image search, if a match is identified, alarm notifications are automatically dispatched to the authorities.

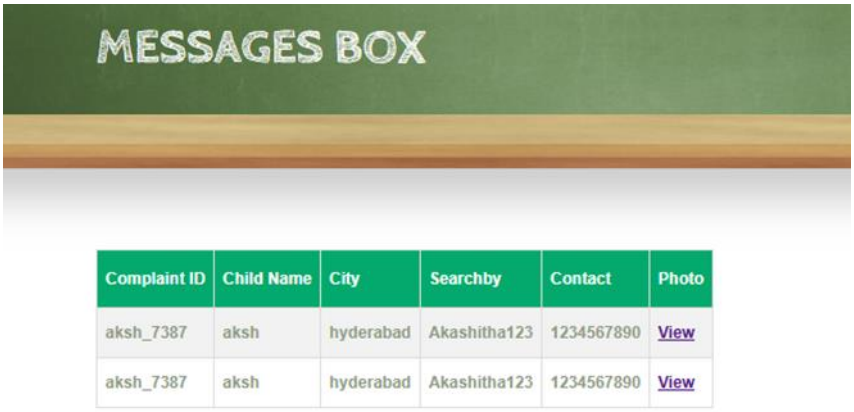

Figure 5.4.8 Messages Box

Step 9: This application will run the webcam and capture the image, which is forwarded to the trained model. Then, it will return the matched results if they are matched with the database; otherwise, it acknowledgment message.

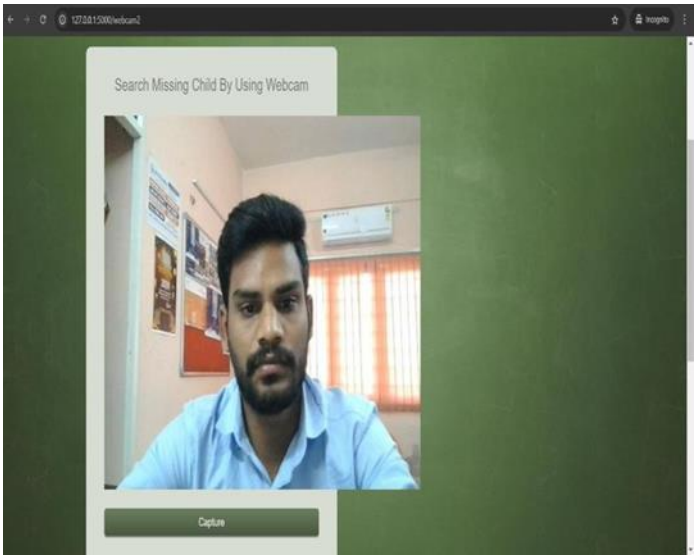

Figure 5.4.9 Webcam Detection

Step 10: The user like common people can also use this website for reporting the details of the missing child or to identify the details of the missing child. The user login through the users page and enter their credentials like User ID and password and then login into the website. If the user is not registered, then they must register themselves by clicking on registerung button as shown in the figure below.

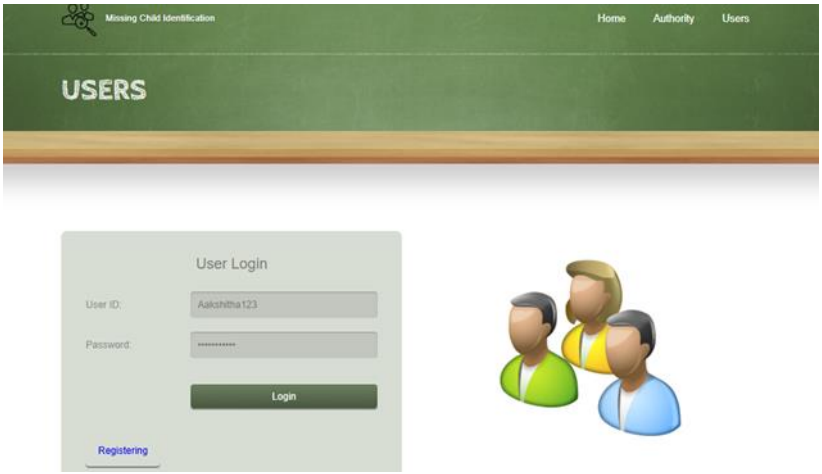

Figure 5.4.10 User Login

Step 11: After the user login into the website, it shows the next page with the welcome text for the user to show that they have login successfully.

Figure 5.4.11 User Homepage

Step 12: The user or the authority can upload the image of the child using the webcam and enter the details of the child.

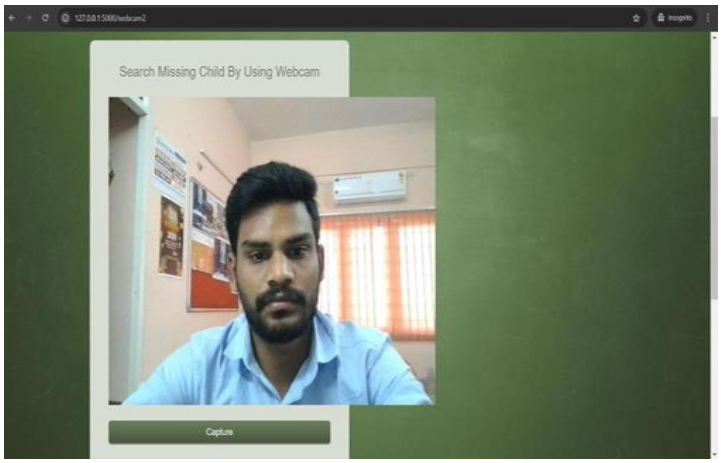

Figure 5.4.12 Search Using webcam

Step 13: The user or the authority may also search for the missing child by uploading the child's image.

Figure 5.4.13 Search using photo upload

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

The Missing Child Identification System is designed to recognize lost or found children based on facial recognition. It enables users and authorities to upload or take pictures, which are processed through HOG for feature extraction and classified by the K-Nearest Neighbors (KNN) algorithm. HOG assists in capturing facial structure effectively, and KNN compares features to recognize the nearest match. The application has been developed in the Flask framework with role-based login support and image as well as metadata uploads. An OpenCV-based webcam module facilitates live face detection. Modularization assures easy scalability as well as ease of maintenance. Images as well as user details are safely stored, and a foreign key relation-based structuring of the database is achieved. The system further supports surveillance networks integration, providing cost efficiency with large-scale deployments. It makes rapid identification with less human error. The lightweight algorithms enable the system to execute on low-grade hardware. It has an admin and public role-supporting interface. This system will greatly contribute to law enforcement and public safety.

6.2 Future Scope

The future horizon for the Missing Child Identification System encompasses several developments to maximize its effectiveness and reach. It can be integrated with CCTV surveillance networks to provide automatic scanning of live feeds to identify missing children in real-time. A real-time notification and alert system can be implemented so that officers and parents can get immediate updates when it comes to combat. Using the system as a mobile app can increase accessibility and promote widespread public participation. The expansion of other populations, such as elderly people, missing individuals, or smuggling victims, increases the extent of the system. Integration of increased face identification methods can also increase accuracy even with older or bad images. Finally, a step-based data will provide scalability, rapid access, and centralized data management for coordination against cloud-based data storage and processing.

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