International Journal of Engineering Trends and Technology
ISSN: 2231–5381 / https://doi.org/10.14445/22315381/IJETT-V72I7P107

Volume 72 Issue 7, 69-74, July 2024

Original Article

Proposal for the Implementation of a Facial Recognition Mobile Application to Search for Missing Persons Oriented Towards University Students

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Received: 21 February 2024 Revised: 11 May 2024 Accepted: 18 June 2024 Published: 26 July 2024

Abstract *- Currently, the issue of missing persons is a growing concern in our country. Every day, there are increasing reports of individuals, ranging from young children to the elderly, going missing. Unfortunately, many of these individuals are never found due to the significant challenges faced by authorities in conducting effective searches. This research aims to address this problem by implementing a mobile application leveraging facial recognition technology to assist in locating missing persons, specifically targeting university students. To develop this application, we utilized a flexible methodology designed to gather essential data, provide an introduction to face detection, and demonstrate the application's functionality. We created prototypes to simulate the application's operation, which were then tested by a selected group of university students. The feedback from these students was overwhelmingly positive, indicating the feasibility and potential success of this project.*

Keywords *- Disappearance of people, Facial recognition, Mobile app, Facial recognition, Missing persons.*

1. Introduction

The issue of missing persons has become a significant concern in our country, with numerous cases reported involving individuals of all ages, from very young children to the elderly. In the year 2020 alone, over 18,000 people were reported missing. Of these cases, 64% involved women, 36% involved men, and 57% involved children and adolescents [1]. Sadly, many of these individuals were never found, and some were discovered months or even years later, often deceased, causing immense distress to their families. Inés Martens, the Director of Democratic Security at Minister, highlighted the regions with the highest number of missing persons cases over the past two years: Lima, Cusco, Lambayeque, Junín, and Arequipa [2]. This research will focus specifically on the Lima region, where the Ombudsman's Office reported that in February alone, 450 girls, adolescents, and adult women were reported missing. This equates to an average of 16 reports per day and represents an increase from January, which saw 311 disappearances of girls and adolescents [3]. In Peru and worldwide, the disappearance or loss of people is a persistent problem addressed daily. Numerous projects have been proposed and implemented to help solve these cases. For instance, in our country, the Technological University of Peru (UTP) presented a facial recognition model system aimed at addressing human trafficking. This model processes images by extracting their characteristics through the OpenFace neural network and compares these results using the Euclidean distance with the characteristic vectors of the dataset images. Once a person is recognized, an alert is issued indicating "recognized" [4]. Similarly, in Bolivia, a project aimed at solving issues related to the disappearance of people, often linked to human trafficking and smuggling of people, organs, etc., was presented. This project combined augmented reality technology with a mobile application to provide users with an easy and accessible way to recognize and locate missing persons [5]. In Colombia, another initiative was introduced to combat the problem of missing persons, which averages 3,000 cases per year. This project proposed using a drone as the primary agent to monitor and capture images of various study areas. The drone operates in two modes: automatic and manual. It patrols areas and takes pictures, which are sent directly to a mobile application where an operator monitors the drone. The operator then selects images to be sent to the MTC, initiating the facial recognition process with previously uploaded database images. Upon completion, the operator receives a notification regarding the recognition accuracy [6]. The objective of this research is to develop a mobile application for searching for missing persons using face detection from an image or photograph. This application aims to assist in finding individuals who have been reported missing and may still be on the streets, potentially unable to remember or return home due to mental or physical issues, thereby endangering their lives.For this work, we will utilize Python, a programming language widely used today for

various software and applications due to its versatility and readability. Python is notable for being easy to use across different devices. This tool will be complemented with OpenCV, an open-source software library for computer vision and machine learning. OpenCV provides an infrastructure for machine vision applications, enabling functionalities such as object and face identification, classification of human actions in videos, object movement tracking, 3D model extraction, similar image finding, red-eye removal, eye movement tracking, and scene recognition. It is employed in applications like video intrusion detection, equipment monitoring, robot navigation assistance, and more.

2. Methodology

This section outlines the methodology employed in the research for developing the application, which consists of three phases.

2.1. Data Collection

Missing persons are those who are absent from their habitual residence for no known or apparent reason, causing concern for their safety and prompting a search based on family or social interest. The National Register of Information on Missing Persons (RENADE) centralizes and systematizes information to identify victims and the circumstances of their disappearance. This includes details about relatives, associated events, and presumed locations with human remains, among other aspects [7].For this work, statistical data on missing persons were analyzed, focusing on classification by age and sex. It was found that many cases involve children and young people, with women representing a higher percentage. In terms of age classification, a significant percentage of missing persons are young people aged 15 to 18, accounting for 62% of the cases. This is followed by children aged 11 to 14, who represent 32%. A smaller percentage includes young people over 18 years and children up to 10 years of age, representing 5% and 1%, respectively, as illustrated in Figure 1.

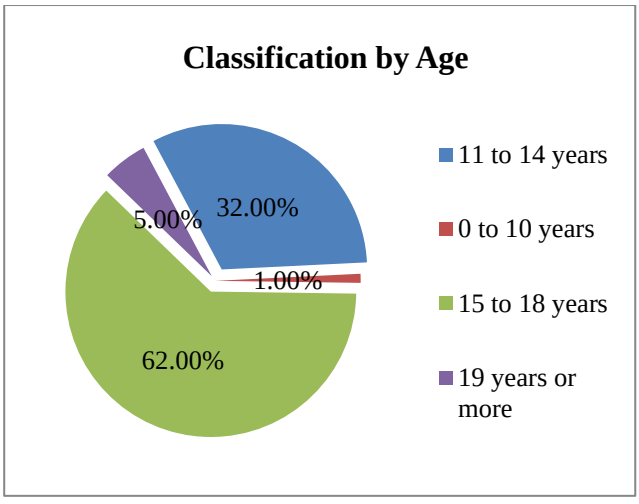

Fig. 1 Missing persons statistics by age

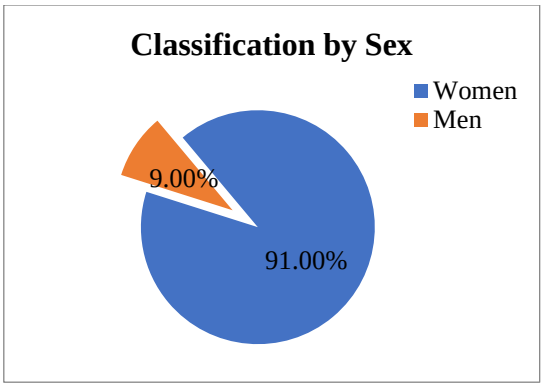

Fig. 2 Missing persons statistics by sex

In the classification of missing persons by sex, it is noted that men represent a lower percentage, accounting for only 9% of the total. Conversely, a large percentage of missing persons are women, representing 91%. This indicates that women are significantly more vulnerable to this issue, as illustrated in Figure 2.

2.2. Face Detection Method

Face detection is a fundamental step in facial recognition, and it is used in various applications such as facial expression recognition, face tracking for surveillance, digital tagging in social networks, and autofocusing in cameras or smartphone cameras [8]. The procedure involves successfully identifying a person's face through unique biometric data related to their facial features and expressions. This data can be obtained from a series of images and videos. Using the OpenCV library, the images are converted from BGR (color) format to grayscale to create a set of training images for different individuals. These images should ideally include various subsets for each person, featuring different postures, lighting conditions, and more. This process, known as the training stage, requires the images to be of the same size [9]. For the face detection process, it is essential to store a variety of images of the individuals to be recognized in the database. Although there is no exact number, it is recommended to have as many varied images as possible.

These images serve as a training method for the program and can be obtained through video captures or photos where individuals display different expressions such as surprise, happiness, sadness, etc. Once the images are stored in the database, the program records the biometric pattern of each person's face and then performs comparison and verification for identification. The process flow when running the application is illustrated in Figure 3. As shown in Figure 3, the process begins with an image of the person's face being entered into the database. The database contains a series of learning images that include the biometric pattern records of various faces.

The system then compares the input data with the stored biometric patterns. If similarities are found, the person's face is marked as recognized. If no similarities are detected, the detection fails.

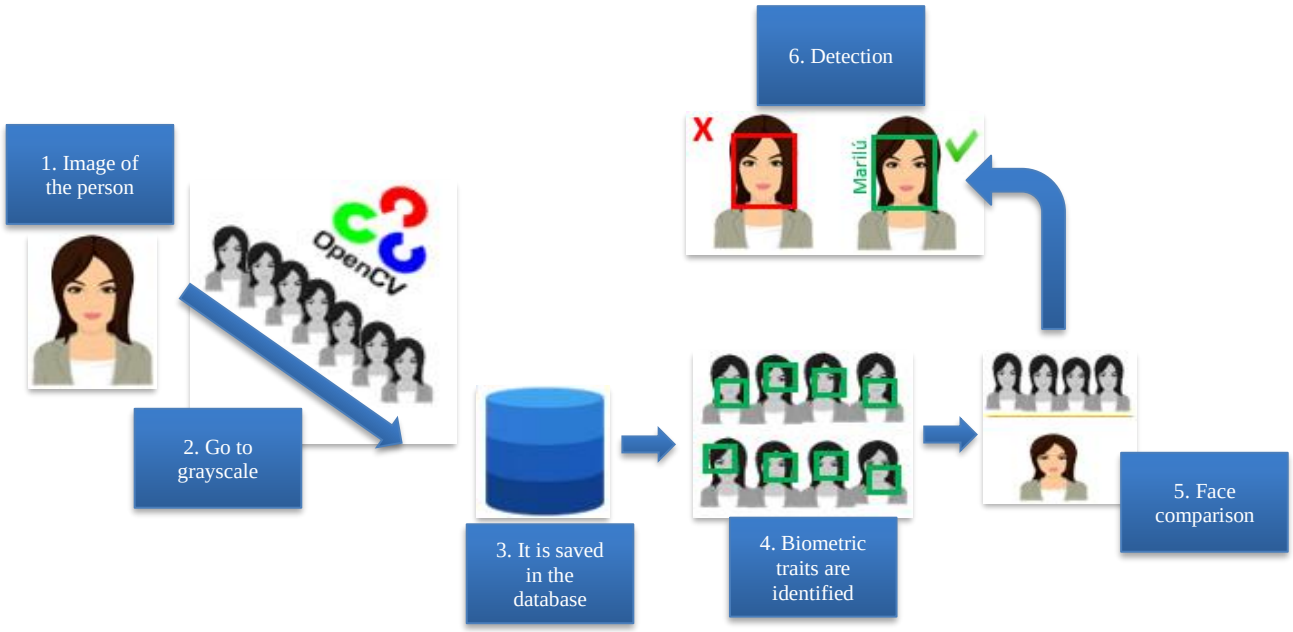

Fig. 3 Face detection method

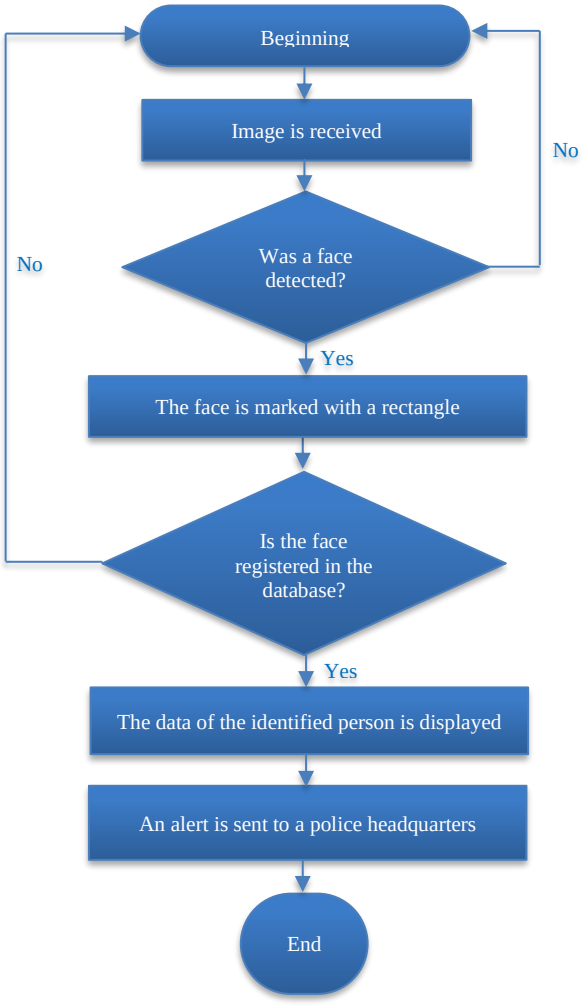

Fig. 4 Application flowchart

2.3. Operation of the Application

For this section, an analysis of the mobile application's operation was conducted and represented in a flowchart, as shown in Figure 4. This flowchart illustrates the process from entering the image of the person's face to the final identification of the person. The operation of the system begins when the image of the person's face is captured using the mobile camera.

The system then verifies whether this face is registered in the database of missing persons. A comparison is made to find similarities and identify the person. If the identification is successful, the individual's data is displayed, and a notification is sent to a police headquarters indicating that the person has been found, as illustrated in Figure 5.

3. Results

In this section, we present the results of the prototype development for the mobile application. The application includes features such as detecting faces and displaying data for individuals reported as missing, which will greatly aid in the search for missing persons.

3.1. Face Identification

In the detection window, the mobile camera is pointed at the person's face. Once the face is detected, the image is sent to the database, where it is compared against the biometric features of registered missing persons. Suppose the search is successful and the person is identified.

In that case, a green rectangle appears around the detected face, along with a message indicating the person has been found, as illustrated in Figure 6.

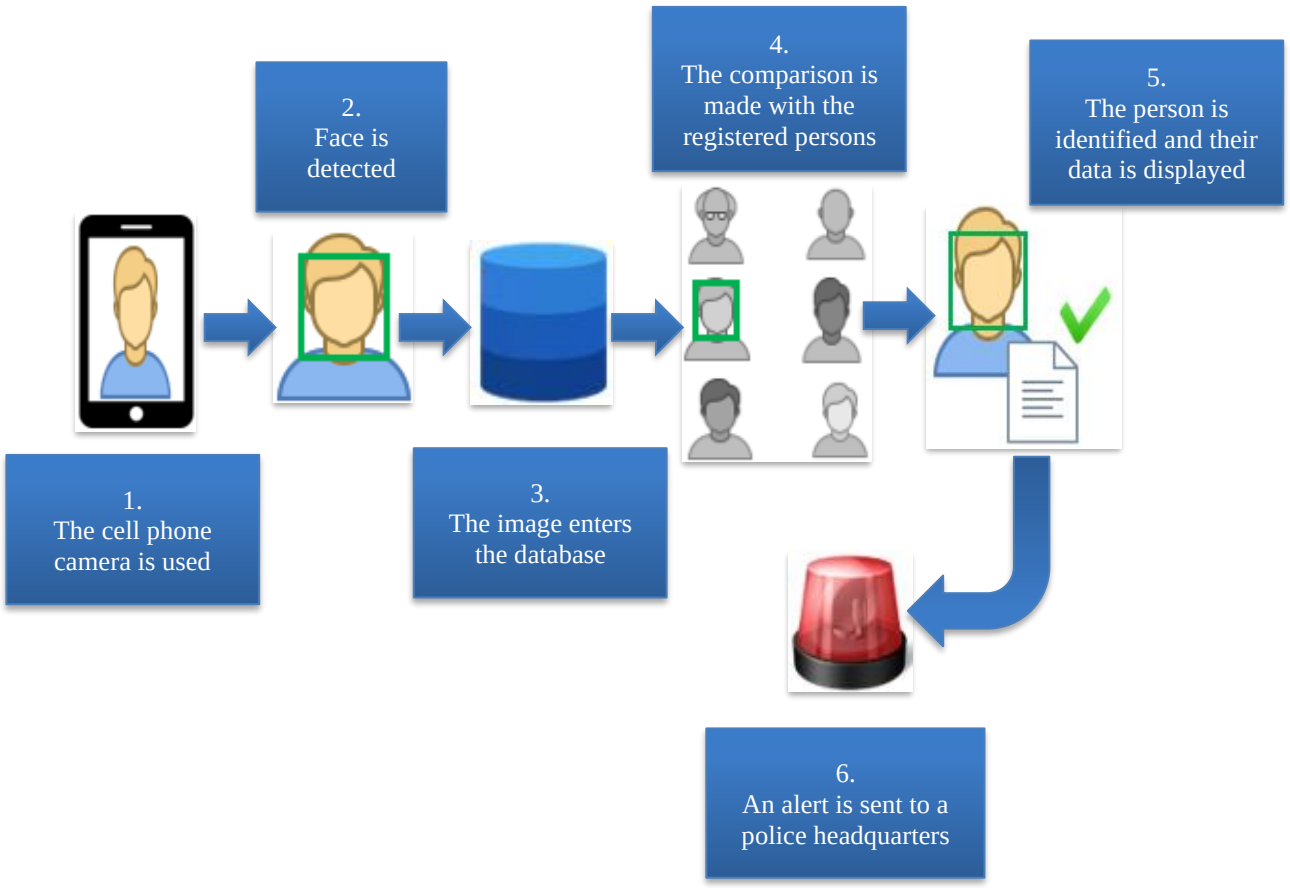

Fig. 5 Application operation

Fig. 6 Face detection

3.2. Show Data

If the person is detected in the missing person's database, as shown in the previous figure, the system will display the registered data of the identified individual. This allows the application to send an alert to a police headquarters indicating that the person has been found. After developing the prototypes, a survey was conducted using Google Forms. This survey targeted a group of 50 individuals who had experienced the issue of losing a family member or friend. The aim was to gather data on the feasibility of the research work and to identify potential improvements, as shown in Figure 7. Following the survey, the results were obtained and are presented in Figure 8. As shown in the image, 44 respondents, representing 88%, indicated that the application of facial recognition could indeed help in the search for missing persons. Conversely, a small group of 4 people, representing 12%, responded negatively, citing concerns about the reliability of facial recognition.

The suggestions for improvement provided by some respondents included:

- Adding the option to send an alert to family members as well.
- Enhancing face detection in areas with poor lighting.
- Not only displaying the contact number but also enabling calls directly from the application.

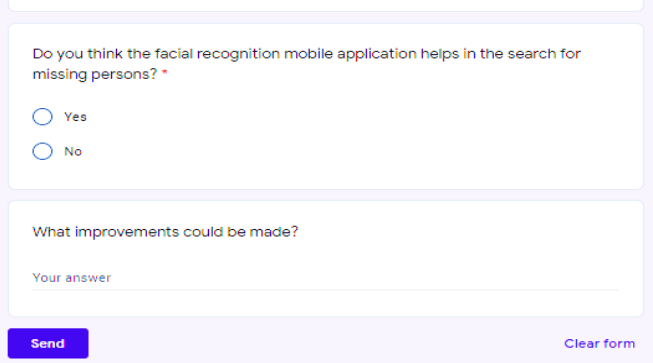

Fig. 7 Google forms survey

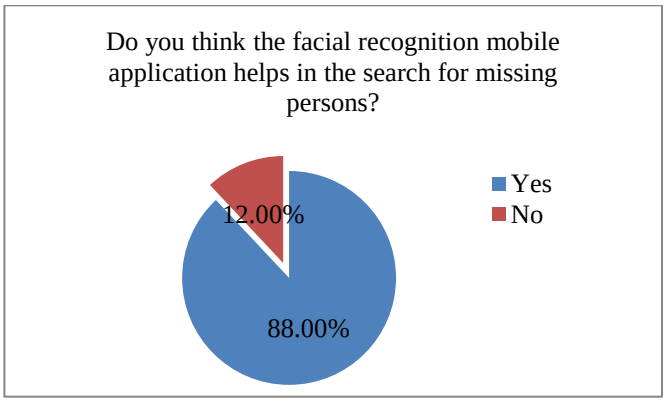

Fig. 8 Survey results

4. Discussions

This section analyzes various works associated with our research and evaluates the processes carried out within our application, comparing its impact with other similar works. Like previous research, this study aims to utilize facial recognition to address societal issues. The study [4] employs facial recognition to combat human trafficking, which is similar to our research focus. However, it does not indicate the degree of public acceptance of their project, a point that our work addresses through user surveys. Another study [6] describes the use of drones to capture images, which are then sent to a mobile application to initiate facial recognition. However, it does not detail the internal process for facial recognition, which our research does provide. These aspects highlight the innovative nature of our research by showcasing the facial recognition process and measuring public acceptance to determine feasibility. Our research uses facial recognition to identify individuals through images or videos, specifically aiding in the search for missing persons. The application can be used to detect the faces of people wandering the streets and determine if they are reported as missing. While our work focuses on the facial recognition aspect, it does not delve into the internal structure of the mobile application. Although we did not detail the internal workings, we provided an analysis of its functionality, which could be further explored in subsequent studies.

5. Conclusion

Finally, this research work successfully developed prototypes of a mobile application for the search of missing persons through facial recognition. Once implemented, this application could be of great benefit to society by assisting in locating missing family members or friends, particularly in cases of loss or kidnapping. These issues are increasingly prevalent in our country, with numerous reports of missing persons ranging from very young children to the elderly. The objective of our research is to help address this problem and reduce the percentage of such cases with the aid of our mobile application.

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