



PROTOTYPE OF DPO SEARCH INFORMATION SYSTEM (PEOPLE SEARCH LIST) ON CCTV CAMERAS USING FACE RECOGNITION

Tri Reski Anugraha^{1*}, Dedy Atmajaya², Lilis Nur Hayati³, Nurhajar Anugraha⁴
Universitas Muslim Indonesia, Makassar, Indonesia¹⁻³
Politeknik Negeri Sriwijaya, Palembang, Indonesia⁴
E-mail address: *anugrahatrireski@gmail.com*¹

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ABSTRACT

The efficiency aspect of the housing security sector is the main consideration in creating information technology in a CCTV security development, because so far CCTV has not guaranteed maximum housing security, because CCTV can only record not analyze. This makes CCTV only a recording device for the point of occurrence, so this activity is less effective considering CCTV cannot analyze the face of a person who has committed a DPO action. So on that basis, researchers are developing existing technologies with facial recognition systems using the face recognition method for housing security. This method works by detecting a person's facial features. The face recognition apps provide information to the authorities by notifying the notification on the user's smartphone (security guard). So face recognition apps have been applied to the Green Cakra Housing, to help security guards monitor the entrance and exit of guests in the housing. This system can recognize the face of DPOs by obtaining a percentage of the assessment as much as agreeing that the application is effective enough.

Keywords: CCTV, DPO, Face Recognition, Housing Area.

1. INTRODUCTION

The Prosecutor's Office of the Republic of Indonesia is a Government Institution that exercises state power in the field of prosecution based on Law Number 16 of 2014 (Undang-Undang Republik Indonesia Nomor 16 Tahun 2004 Tentang Kejaksaan Republik Indonesia, 2014). Referring to this authority, the Prosecutor's Office is given the responsibility to carry out investigations and examination processes at trials as well as to be the implementer of court decisions and decisions. The number of crimes or crimes in Indonesia has shown an increasing trend since 2014-2016. Based on the Central Statistics Agency (BPS), the crime rate in 2016 reached 357,197 cases, an increase of 1.2% from the previous year (Badan Pusat Statistik, 2019). However, since the emergence of the disease outbreak in Indonesia, criminal acts have reached 19.72% during the pandemic. In February it was 17,411% while in March it was 20,845% of cases according to the Police of the Republic of Indonesia (katadata.co.id, 2016).

South Sulawesi is one of the 10 regions with the most criminal acts. The number of crimes reported according to the 2019 South Sulawesi POLDA was 21,498 cases. Currently, the crime rate in society is increasing in the form of theft, robbery, murder and acts of terrorism (Katadata.co.id, 2019). As shown in figure 1.

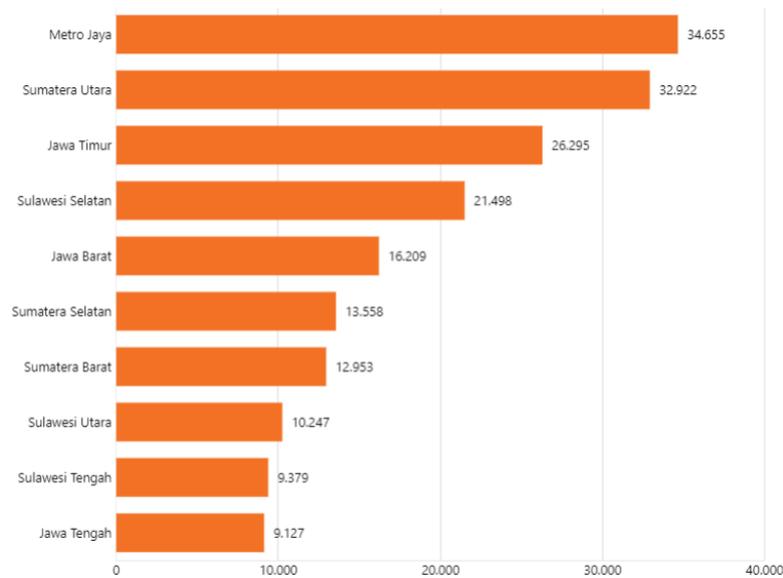


Figure 1. Most Crime Reports, (Katadata.co.id, 2019).

This causes the police as a law enforcement agency to be required to work extra hard to overcome and resolve criminal acts in society. Of the various kinds of criminal acts that occur, sometimes the police have difficulty catching criminals who run and hide somewhere or are often called DPO (People Wanted List). This is no exception to the South Sulawesi regional police with a large security area with a limited number of personnel, causing the police to need community participation in finding or providing information to the police if they find or see the perpetrator.

So far, the police have distributed DPO (People Wanted List) information in the form of regular leaflets to the public which are pasted and distributed in public places. The police are collaborating with the community and security guards throughout the Makassar area to search for a list of DPO people (People Wanted List) (Zinaida, 2013). The CCTV security system at the Green Cakra Housing Complex currently cannot guarantee maximum home security, because CCTV only records, does not analyze. This makes CCTV only a means of recording the scene of the incident. Proving that surveillance with CCTV is often carried out in several housing developments to anticipate crime. This activity is deemed less effective considering that CCTV cannot analyze a person's face to carry out arrests. In this action, the security guard must watch the suspect's face repeatedly so as not to arrest him incorrectly (Putra et al., 2011).

This problem is in research to create a facial recognition system using the Face Recognition method for home security. This method works by detecting a person's facial characteristics, and if the person's face is not in the database, the system will automatically send a notification in the form of a pop-up notification which will appear on the smartphone screen (Ghafoor et al., 2020; Khairuddin et al., 2021). So that security forces can find out the DPO detected on the camera. During the process of taking images from the camera, there are several things that must be considered, such as light conditions, variations in expression, and also image quality (Lumaban & Battung, 2020).

Therefore, based on the problems above, researchers took the initiative to create a Prototype of a DPO Search Information System (People Search List) on CCTV Cameras Using Face



Recognition. This tool will of course reduce resources from searching for people who are on the People Wanted List (DPO), because apart from recording events that occurred at that time, this tool also carries out the process of matching DPO data with data that has just been recorded using Face Recognition and sends a notification to the application installed on Android if there is data that matches the People Search List in the database (Lami et al., 2019).

The Green Cakra Housing Complex security system has been implemented by installing surveillance cameras (CCTV) in several vital locations. This system was initiated by the Security Guard who already has a Community Emergency Service System, one of the main components of which is the installation of CCTV cameras in 23 vital locations with its telecommunications network infrastructure. Then the RT/RW Head has done the same thing by monitoring 5 vital locations and has integrated it with the security guard camera system. So the Integrated Surveillance Camera System can monitor 25 vital locations.

One of the CCTV camera monitoring locations is Green Cakra Housing Block C2 no. 20 and the entrance and exit hall of the complex. At this location officers can monitor the situation in the complex area and also the activities of people there. However, if this camera monitoring is used to identify someone specifically (personally), for example a person who is the target of a police search (DPO - wanted list), officers will have difficulty because they have to continuously monitor the camera captures and also have to match them one by one. video seen with the DPO in question. In dealing with this matter, the authorities carry out intensive searches, but in this case the authorities still use manual methods in searching for people who are included in the DPO, so automatically a lot of resources will be needed to carry out the search.

2. THEORY

2.1. Image processing

Image processing is a general term for various techniques that exist to manipulate and modify images in various ways.

2.2. Face Recognition

1. Understanding Face Recognition

The face is a part of the human body that is the focus of attention in social interactions. The face plays a vital role by showing identity and emotions. Therefore, the face is used as an organ of the human body which is used as an interaction to recognize a person or face recognition. Face recognition is a biometric technology that is widely applied, especially in security systems.

2. Face Recognition Concept

This recognition can be divided into two parts, namely: recognized and not recognized, after a comparison with patterns previously stored in the database. This method must also be able to recognize non-face objects.

3. False Route Acceptance (FAR)

False acceptance route (FAR) is an error in recognizing the identity of an input image, whether it is an error in recognizing the identity of an input image from an individual outside the

database who is detected as an individual in the database, or an error in recognizing the identity of an input image from an individual in the database that is recognized by the individual. other.

4. False Route Rejection (FRR)

Face rejection routing (FRR) is an error in rejecting an input image. An image that should be recognizable (its identity is in the database) turns out to be unrecognizable.

2.3. CCTV (Closed Circuit Television)

CCTV is a recording device that uses one or more video cameras to produce video or audio data.

2.4. Python programming

Python is a multi-purpose interactive programming language with a design philosophy that focuses on code readability. Theoretical framework (Explain the theory that was used as foundation of the study, if any). The study of theory is important in a research because it becomes the basis or basis of research. A good theoretical study will determine the weight of a study. Theoretical studies must adopt at least one fundamental theory that is relevant to the research. Theoretical studies must be relevant theories to explain the variables found in the study. In addition, theoretical studies must also be able to answer hypotheses or temporary answers that have been prepared.

3. METHOD

3.1. Literature Study and Data Collection

At this stage, researchers and the community held a discussion forum with residents of Green Cakra Housing, Gowa Regency. In the discussion, the Heads of RT and RW shared their complaints and the dangers that the security level of the complex/housing was no longer safe. The authorities (security guards) only supervise the post 24 hours a day with alternating shifts, but sometimes guest security guards are careless while on duty. Even though there is CCTV in the complex, this is still less effective.

Primary data is needed from the police who have wanted list (DPO) data. Meanwhile, the secondary data needed to be able to resolve complex residents' complaints is to create a system that can assist security guards in monitoring CCTV so that it does not drain the security guard's energy. This data was obtained from the PDO data list from KOLDA Makassar, literature studies and data collection sources taken from library references, reading and note-taking. So, the results of this data collection can be used as material for creating application system designs and activity implementation flows.

3.2. Knowledge Representation

a. System Architecture Analysis

The prototype DPO search system called ATSS (Active Total Security System) is connected to CCTV. ATSS operates depending on the CCTV system but leaves no effect on the existing system.

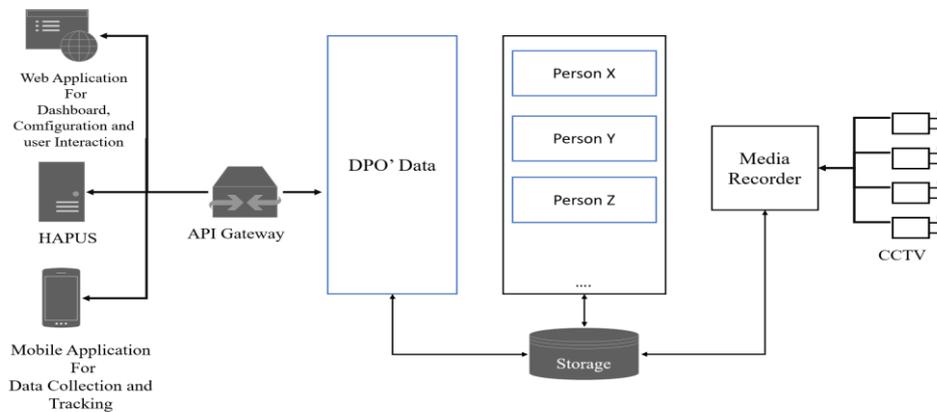


Figure 2. System Architecture.

- Media Recorder, plays a role in recording frames taken from CCTV for further processing.
- DPO's Data, provides, searches for and organizes worker tasks using data utilized from authorities' data.
- Storage, plays the role of processing data that will be processed and then stored in a central database which will be accessed by users for reporting and data manipulation via web applications.
- Central admin can allow the system to be more flexible in terms of processing.
- Person, acting as a research object, detects the DPO facial points that will be recognized. The DPO's face has been entered into the database.
- Web applications and mobile applications, act as application support systems.

b. Data

The data used in this research is a photo of the DPO's face and the DPO's identity which has been registered at the security center (Police), but in this research the data used is training data. The total of 18 DPO facial photos taken with different expressions from 10 DPOs. DPO's face photo is in *.jpg format and has original dimensions of 1080x1920. The identity of each DPO that will be output in the research consists of the DPO's Full Name and ID, but in this research we use training data to test that the Face Recognition Apps system can run as expected. Researchers group image frames archived with the appropriate DPO list into several job queues.

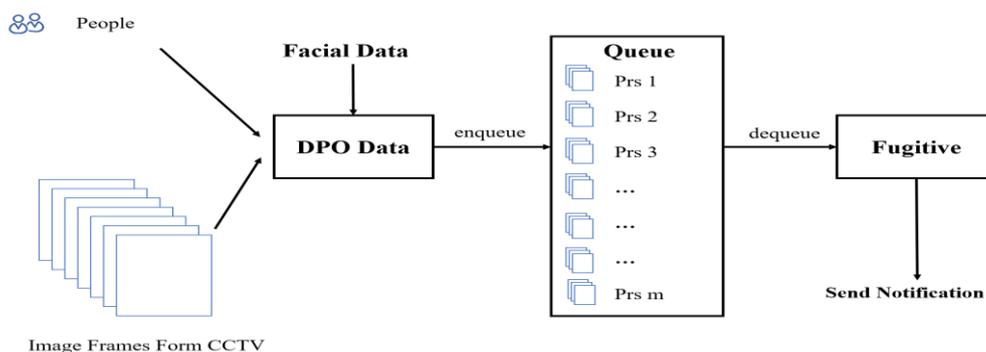


Figure 3. Data Flow Process.

- People, is someone who has registered as a DPO.
- Image Frames From CCTV, which are images of people and images of the DPO's face will be entered into the database.
- Facial Data
- Queue, which shows the process of dividing archived frames into tasks.
- Fugitive, is a workload balancer, which can control jobs between jobs to avoid bottlenecks and rice conditions.

c. Data Collection Analysis

The photo of DPO's face was taken from a CCTV camera which has a resolution of 13MP and produces an image with dimensions of 2304x4096. The DPO's face is taken with a distance between the CCTV camera and the object of around 4 meters max from the CCTV point. The DPO's facial expression is taken undetermined or free, but does not make much movement of the head. The sampling data will be processed, after cropping and changing image dimensions at the frame preprocessing stage, the image data will be divided into training data and testing data.

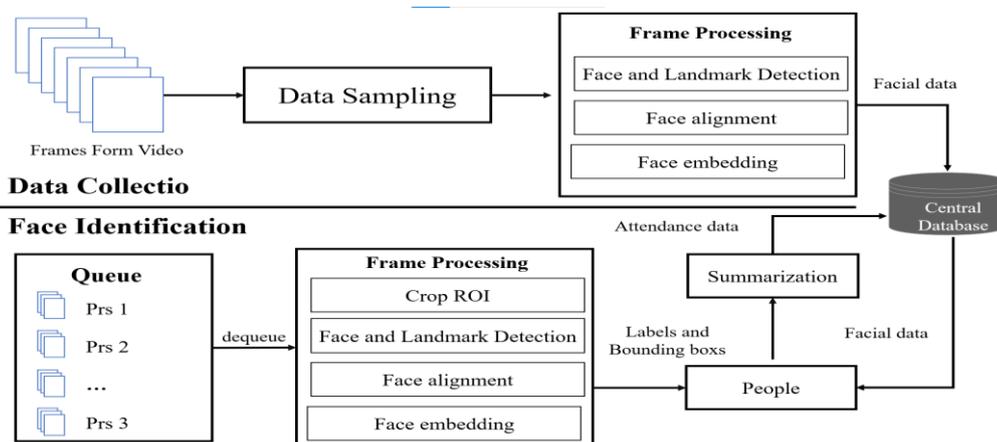


Figure 4. Data collection.

3.3. System planning

a. Use Case Diagram

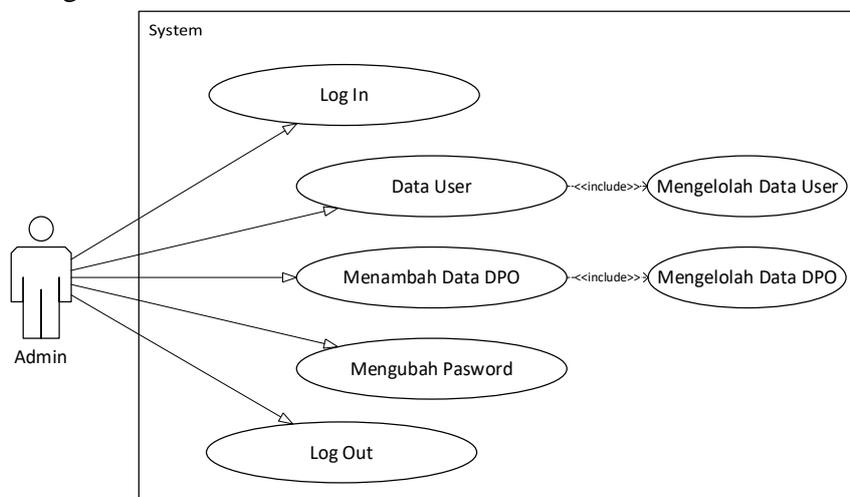


Figure 5. Use Case Diagram User.

- Admin Login, get access rights to manage DPO search application data.
- User data, view and manage user data. If an error occurs, such as a security guard forgetting the username and password, the admin can restart.
- Admin adds DPO data on the DPO table list page as well as detailed DPO history and can manage DPO data.
- The admin changes the password. By changing the password, you can adjust keywords that are easy for the admin to remember.
- Log Out means exiting the application.

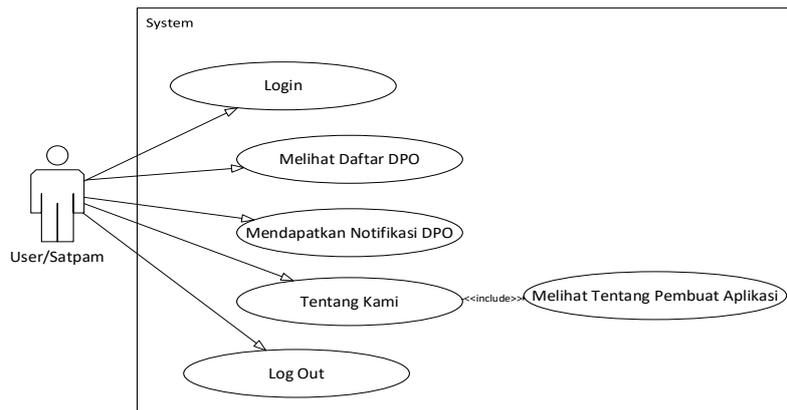


Figure 6. Use Case Diagram Admin.

- User Login, get access rights to manage DPO search application data.
- Users viewing the DPO List can find out DPO data information as well as detailed DPO data history.
- Users get notification of DPO information, if it is detected on CCTV surveillance cameras.
- About Us is about researchers or creators of facial recognition applications.
- Log Out, which means exiting the mobile face recognition apps.

b. Activity Diagram

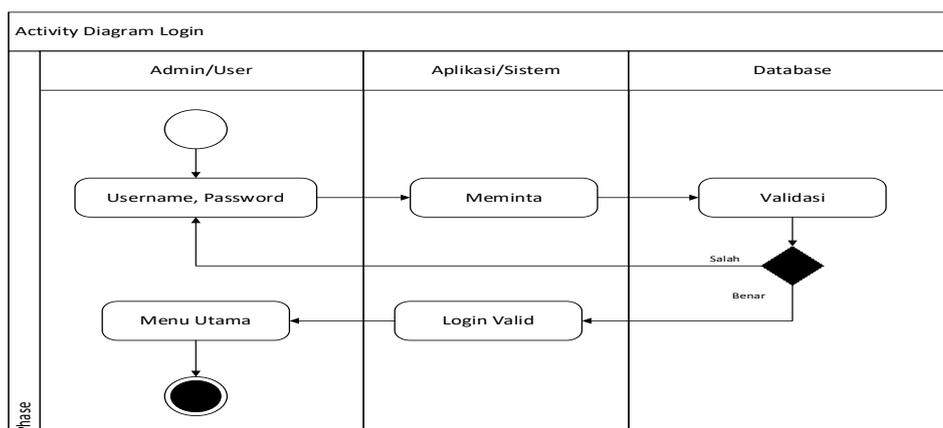


Figure 7. Activity Diagram Login.

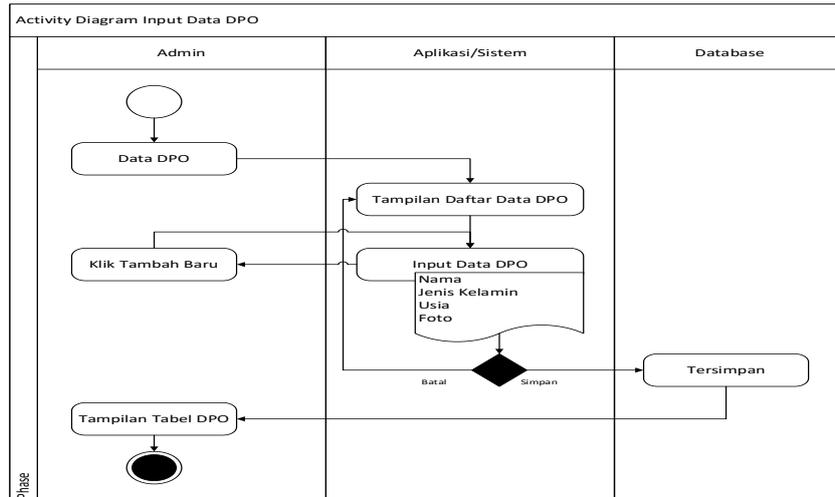


Figure 8. Activity Diagram DPO Data Input.

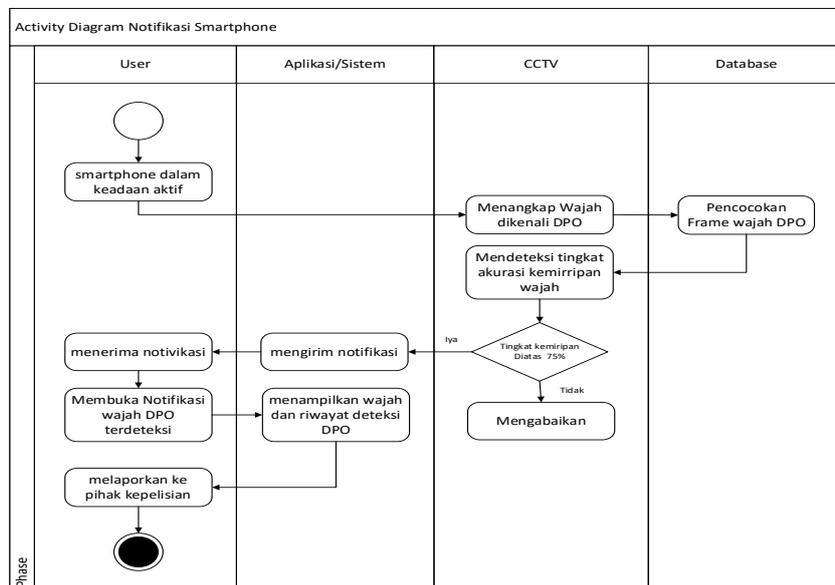


Figure 9. Activity Diagram Smartphone Notification.

c. Sequence Diagram

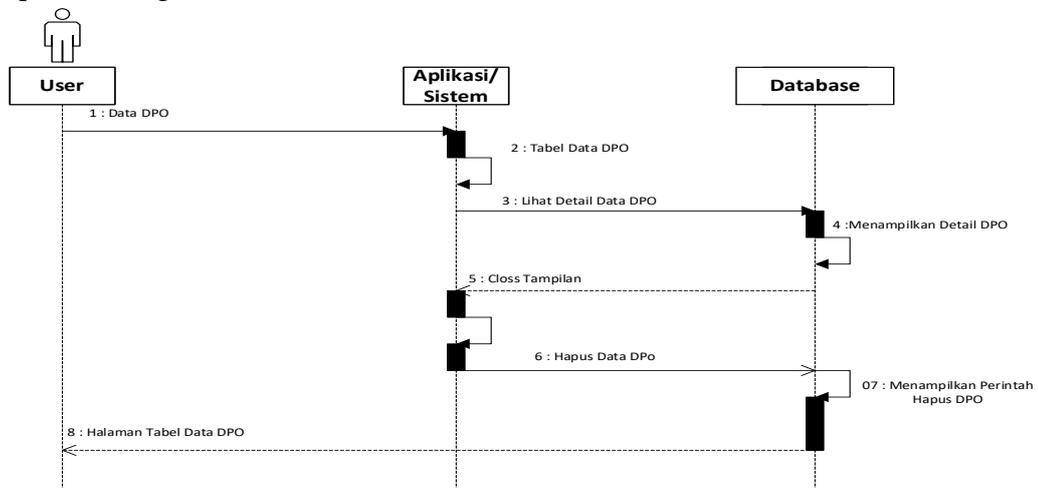


Figure 10. Sequence Diagram DPO's Table.



d. Class Diagram

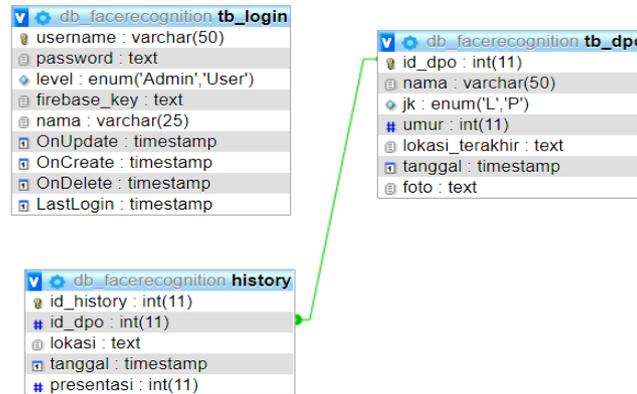


Figure 11. Class Diagram.

3.4. Interface Preparation and Creation

Create a sketch of an application that can monitor CCTV work so that security guards can only receive notifications. So, with smart CCTV, it will be easier for security guards to maintain the security of the complex so that 24-hour human supervision is not needed, but rather application monitoring. This Smart CCTV uses an application that can connect to an internet connection and has received an IP from a bot in the application, and the CCTV camera can take pictures.

Making a prototype in accordance with the concepts and designs that have been obtained previously, design: (i) CCTV (ii) CCTV monitor (iii) Computer. The results of creating the interface will be tested on the level of constraints and quality of image capture to operate the interface. This test is carried out to measure the quality of the image and the full-face image capture object so that it will be used as evaluation material for improvements.

3.5. Application Trial (Testing), System Implementation and Evaluation

At this trial stage, security guard complaints can be resolved properly. And we can find out the advantages and disadvantages of the application that has been created, so we can make further developments to reduce the burden on the authorities (security guards). Implementing an application at the Green Cakra Housing complex, Gowa district, a CCTV surveillance information system that can resolve resident complaints and concerns. Makes the work of security guards easier by producing an easy and safe system, independent of place, time, effective and fast. This introduction was carried out to help the community reduce security concerns about the complex. The test result data is then re-evaluated to be used as a reference in improving the application. The work is in the form of efficiency in the process of capturing CCTV images.

4. RESULTS AND DISCUSSION

4.1. MTCN (*Preprocessing*)

In the Preprocessing Stage as in Figure 12, there are three processes carried out, namely face detection, resizing and cropping using the help of the Multi-Task Cascaded Convolutional Natural (MTCNN) library. The image to be processed is given a bounding box so that it is cut

based on the boundary brain. After the facial image is obtained, it will be scaled (resized) to a size according to the model input used.

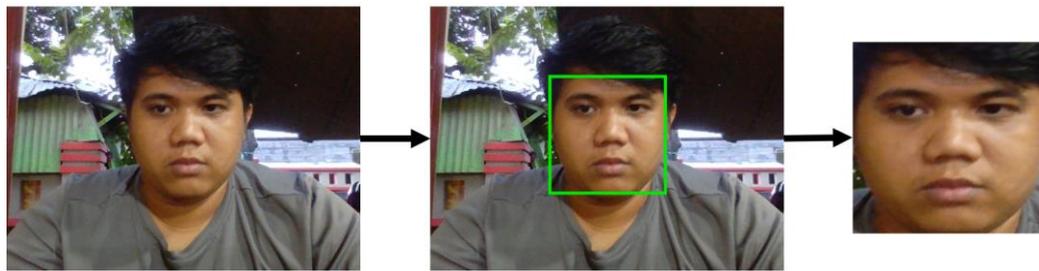


Figure 12. Preprocessing Stage.

4.2. Feature Extraction

Feature extraction is the creation of facial images and facial features (embedding) in 128 dimensions. The aim of feature extraction is to find information that is a special characteristic of each facial image. Retrieval of characteristics in the training database, while retrieval of characteristics in the test database only goes through the Evaluation and Testing stages.

4.3. Face Testing

System testing was carried out using a model that obtained high accuracy, namely faceNet. This is done in two conditions, namely all faces in the database (known faces) and faces that are not in the database (unknown faces).

Table 1. Distance Testing

No	Distance	Recognize Faces	
		Yes	No
1	30 cm	Yes	-
2	50 cm	Yes	-
3	100 cm	Yes	-
4	150 cm	Yes	-
5	200 cm	Yes	-
6	250 cm	Yes	-
7	300 cm	Yes	-
8	350 cm	-	No

Seen at a distance of 50-300 cm, it can recognize faces, at a distance of 350 cm it cannot recognize faces.

Table 2. Testing of Known and Unknown Faces

No	Criteria	Subject	Detected		Akuration
			Y	T	
1	Manusia <i>Full Face</i>	555	Y	-	95.6%
2	Kecamata	555	Y	-	92.8%
3	Masker	555	-	T	100%
4	Helm	555	-	T	100%
5	<i>Unknown</i>	555	Y	-	100%

The results of this test can be concluded that if a full face or face (eyes, nose and mouth) is detected then the system can be detected, but if only one of the eyes and mouth is not visible on CCTV it will not be detected. This application is only able to recognize human faces.

4.4. Admin Application View

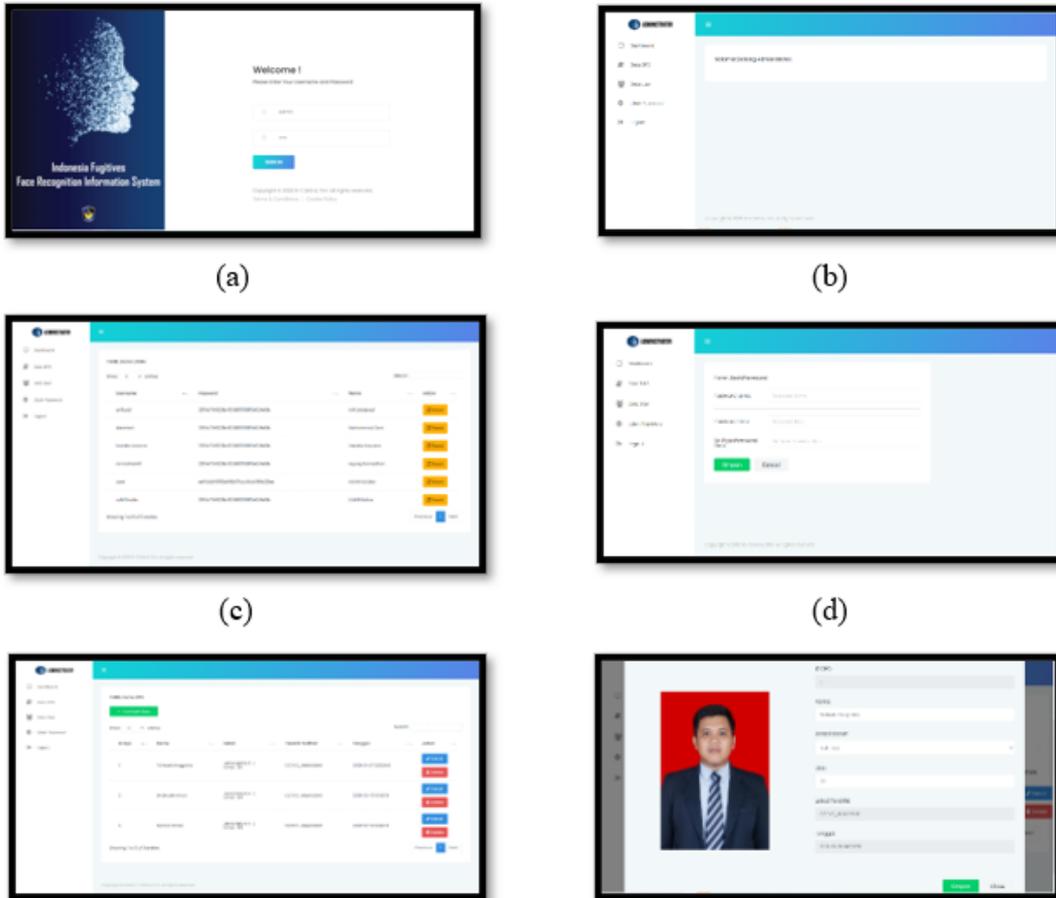


Figure 13. Admin Application View

In Figure 13 shows the application display page of the admin actor, this page can only be managed by the admin following are some features of the admin display, (a) login page, (b) dashboard page, (c) user data, (d) DPO form, (e) DPO data, (f) DPO details.

4.5. User Application View

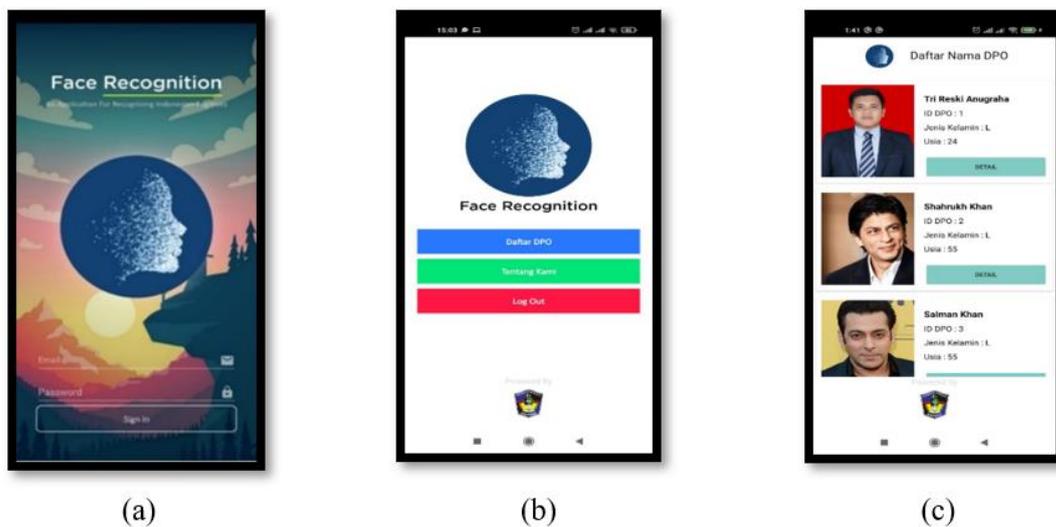


Figure 14. User Application View

Figure 14 shows the display page when users access the application (a) Login page, (b) Dashboard page, (c) DPO List page.

4.6. Notification Interface Display

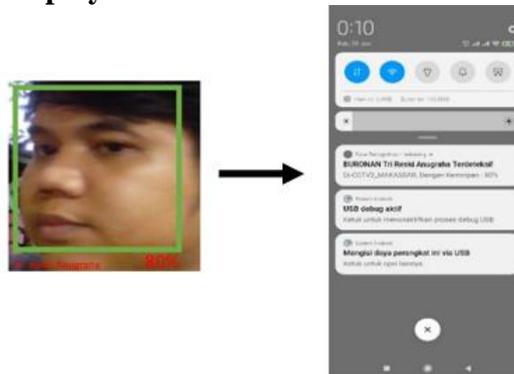


Figure 15. DPO Data Form page detected

Figure 15 illustrates that the DPO's face has been detected on CCTV2_Makassar with a similarity level of 80%, so the system will send a notification to the user's smartphone. This application can provide detailed information on detected human face objects and location points as follows.

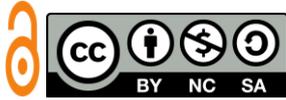
5. CONCLUSIONS AND SUGGESTIONS

Based on the test results of applying facial recognition to obtain the identity of the DPO's face, it can be concluded that:

1. Based on research using face recognition apps by filling out questionnaires, it can be concluded that 84% of the presentations agreed, based on beta testing.
2. The system is able to recognize faces well, displays the DPO's facial identity correctly, and produces the highest accuracy of 92.12%.
3. The greater the amount of facial image data used in facial recognition, the higher the resulting recognition accuracy. Because the amount of image data used in training is greater.
4. Face recognition produces high accuracy when a large amount of facial image data is used. The light when taking the picture is the same, the face captured by CCTV or does not produce too much head movement and the dimensions are correct.

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