# SMART PRESENCE SYSTEM BY USING MACHINE LEARNING

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# APPROVAL

This Project/internship titled **Smart Presence System by Using Machine Learning**, submitted by Mahmudur Rahman, Boby Nasrin Sultana and Md. Mahmudul Hasan Asif ID No: 181-15-11276, 181-15-11261 and 181-15-10649 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 4th January, 2022.

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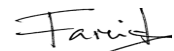Daffodil International University

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# DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Md. Sadekur Rahman, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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# ABSTRACT

If the task of ensuring the presence of an employee is completed by hand, it may be a significant load on the organization. An efficient and automatic presence system is being used to address this problem. However, with this system, verification is a critical topic to consider. In most cases, the Smart Presence System is implemented with the assistance of real-time facial detection and identification technology. The Haar Cascade Classifier method has been employed in the creation of this feature. Following face recognition, the system will create a spreadsheet for each day of the week in question. This real-time face detection and identification system are only available to firm personnel who have registered with the business. A QR code mechanism has been implemented for the benefit of those who have not registered. Some information about the user will be utilized in this system, but not all of it. This system will properly handle the presence of both registered and unregistered individuals.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

Each business must keep an eye on each employee's activities. That is why they use a system of presence. Present systems are classified into two kinds. Automated and manual. This may create problems with the Manual Presence system. However, an automated presence system will automatically detect an employee's presence, reducing management workload. Thus, a system for detecting faces and a way for recognizing them are suggested to ensure their presence. Not only does this save time, but it also eliminates the possibility of a fraudulent presence. As a result, it instills a sense of urgency in workers to go to work on time, as their presence will be tracked by an automated system.

Extensive study has been conducted in the area of facial recognition over the last several years since it is one of the most effective methods for determining a person's identification. In biometrics, face recognition from pictures is a hot area of study. Understanding picture analysis is one of the most advantageous uses of face recognition. Due to certain particular difficulties in face recognition, which have piqued the attention of not only computer vision experts but also psychologists and neuroscientists, since advancements in the area of face identification may offer insight into how the human brain functions. While there are many biometric techniques for human identification, such as fingerprint analysis and retinal scan, they all need human participation. Human identification via face pictures, on the other hand, does not need it. Thus, facial recognition is critical in determining a human being's identification since it does not need human collaboration, which is the method's distinct advantage over other biometric techniques.

Although many methods exist for detecting and recognizing faces in pictures. Numerous research projects are underway to identify more effective and accurate variables. In general, variables such as posture, occlusion, lighting, and so on affect efficiency and need a significant processing capacity for retrieval from a big picture collection. This may result in a greater emphasis on big picture datasets, as well as on novel methods that alleviate computational constraints and improve accuracy. The ultimate aim is to do efficient human face recognition from picture datasets. In the area of biometric face identification, researchers have attempted to identify individuals based on their facial characteristics from a photograph of a group of people. Face recognition has a broad

variety of applications and is extensively utilized in security and biometric systems. Face recognition systems, in general, are composed of three critical components: face detection, face training, and face recognition.

Face detection and identification techniques are available. However, we shall use the Viola-Jones method for face detection. And the primary purpose for adopting this method is to get superior results in a variety of lighting situations and to improve detection performance by merging several haar classifiers.

## 1.2 Motivation

We think that the Smart Presence System will be the quickest and most user-friendly system available to all workers. We're attempting to create a helpful environment in the real world-class. This mechanism enables us to safeguard or defend security. By providing workers with an online solution, it will be more efficient, engaging, and time-consuming. And the critical factor is the accuracy level at which the system produces accurate predictions.

## 1.3 Rationale of the Study

Real-time security environments are provided by the Smart Presence System. The goal of this system is to offer a more secure environment for employees inside the organization. By using real-time face detection and recognition for workers, we are able to capture any presence for every kind of person in the organization. The unauthorized individual, on the other hand, will get access by displaying a one-time QR code that will be sent to him. By using this approach, there will be no hassle associated with being present.

## 1.4 Research Questions

We have chosen a few questions as the basis for our study, which will be addressed in stages.

1. What's the point of doing research?
2. What is the best way to execute this technique?
3. What are the modules that are being used?
4. What was the dataset that was used in this study?

## 1.5 Expected Outcome

The primary result of this study is increased security for all businesses. Using facial detection, the administrator may register a person as an employee. Then, using facial recognition technology, workers may complete their attendance. On the other hand, an unregistered individual or an outsider may enter by presenting the admin with a QR code. The outcome of this study is to ensure security via appropriate documentation.

## 1.6 Project Management and Finance

Although the study is highly current and targeted, there is no financial backing or funding for this endeavor. We assumed all of the responsibility for manually collecting the data. The data had been processed and analyzed in the Jupyter Notebook. On the other hand, Daffodil International University has provided us with all of the assistance we needed to complete our studies.

## 1.7 Report Layout

**Chapter 1** Discuss about our thesis motivation, Rationale of the Study, Research Questions and Expected Outcome.

**Chapter 2** Introducing the background of our research. It gives us mainly the related works of this research, with comparative analysis. Challenges are also included.

**Chapter 3** Discusses about data collection procedure, proposed methodology and implementation requirements.

**Chapter 4** Discuss about the experimental results and analysis. Two algorithms are mainly implemented for getting the best result and analysis.

**Chapter 5** Discuss our research about the impact on society and environment.

**Chapter 6** Discuss about the future study of our research. The total summary of our research also included.

# CHAPTER 2

# BACKGROUND

## 2.1 Introduction

There is no real-time facial detection and identification technology integrated with a QR code system that enables an unregistered individual to take advantage of the person's presence. This chapter discusses the research that served as the foundation for this work.

## 2.2 Terminologies

Smart Presence System is mostly concerned with a company's security. It is mostly divided into two sections—detection and identification of faces. For face detection, any individual may register their face if they have just joined the business as a new employee. We may get a dataset throughout the face detection process in which we can store the face pictures that were utilized for face detection. Following the face detection procedure, the registered individual will be able to provide attendance through facial recognition. Following face detection, we will train the system using the pictures. However, for outsiders, we use a QR code method. Anyone may get a QR code via the QR code system by submitting certain information. One Time Password (OTP) was chosen because of its distinctiveness. The method creates two identical QR codes. One may get the outsider, while the administrator obtains another for verification reasons.

## 2.3 Related Works

Every business and organization must keep an eye on how its workers are participating. In the long run, it's pointless to calculate and store attendance. As a result, many studies on the subject are being conducted.

A. Riyanto et al [8] introduced an employee attendance system that can administer data collecting related to employee attendance effectively and efficiently, based on the deployment of a comparable system to the Smart Presence System. For the purpose of developing an effective and efficient attendance system, the approach used a narrative method, interviews, and documentary analysis pertaining to employee attendance. They only worked for those who were employed by the business. However, we also worked with outsiders who were able to get authorization via the use of QR codes.

Similarly, P. Kowsalya et al [4] suggested a monitoring system that is mostly based on a facial recognition algorithm as part of another implementation of a comparable system. Using this method, when a student walks into the classroom, the picture of that student is recorded by a camera at the door. After then, some further processing has taken place in order to do facial recognition. We, on the other hand, kept up with the times better than this system. In order to keep track of all the inputs, our system will create an excel file for you.

In a study conducted by S. Lukas et al. [18], researchers developed a face recognition technique for use in a student attendance system. They combined Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT) to extract the features of a student's face, which was then applied to Radial Basis Function (RBF) for classification of facial objects. The accuracy that they obtained after using this strategy was 82 percent. As compared to this strategy, we were able to maintain more precision.

Another work [11] describes developing an attendance system that identifies one or more faces in real-time incredibly quickly while attaining high detection rates with accurate and effective performance while maintaining high detection rates with correct and effective implementation. Even though they performed a lot of work for individuals who didn't have faces, it was time-consuming. An alternative is the one-time QR code approach, which is less time-consuming.

Researchers K.Sanath et al. [16] devised an attendance system that employs both RFID (Radio Frequency Identification) and facial recognition at the same time, allowing them to overcome the constraints of previous systems. It is quite expensive to proceed in this manner. As an alternative, we employed real-time facial detection and recognition to identify and track staff. In addition, we utilize a QR code system to identify visitors and unregistered staff.

## 2.4 Comparative Analysis and Summary

Like other attendance-based apps, the Smart Presence System works by monitoring your physical presence at a location. Facial detection and face recognition are both concepts that we're borrowing from while designing our system. A distinctive aspect of the Smart Presence System is its QR code system, which is used by visitors. We're certain that our solution will be beneficial to any company that uses it. It may help to increase the level of safety for the business.

## 2.5 Scope of the Problem

We believe that the Smart Presence Solution will be the quickest and simplest system for businesses to implement. However, our system's facial identification method necessitates that the administrator manually enters the user's id. Despite the fact that it's inconvenient for the administrator, it helps to maintain the system safer.

## 2.6 Challenges

With new platforms, model selection is not that simple. Manually generating datasets, on the other hand, is very time consuming. We were hoping for an accurate forecast. The application of the method, however, is a significant problem for this research. When someone who is just getting started in this area wants to brush up on their knowledge for future study.

# CHAPTER 3

# RESEARCH METHODOLOGY

## 3.1 Introduction

Fig 3.1 shows all stages for a registered individual. When a firm employee approaches the gate, they must face the camera for facial recognition. The door opens if a face is spotted. For an unregistered user, the QR code area is the place to go.
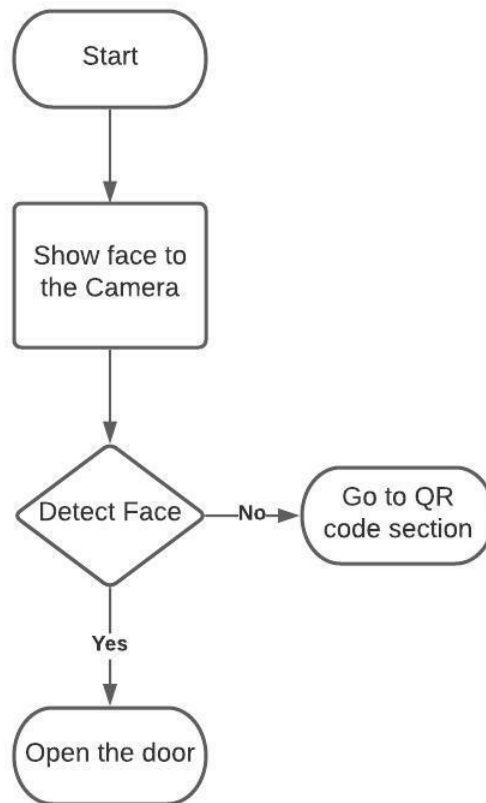


**Fig 3.1:** Diagram of registered person (employee) for Smart Presence System

Unregistered users will be able to get a QR code by giving basic information about themselves. In this case, some kind of verification mechanism will be employed.
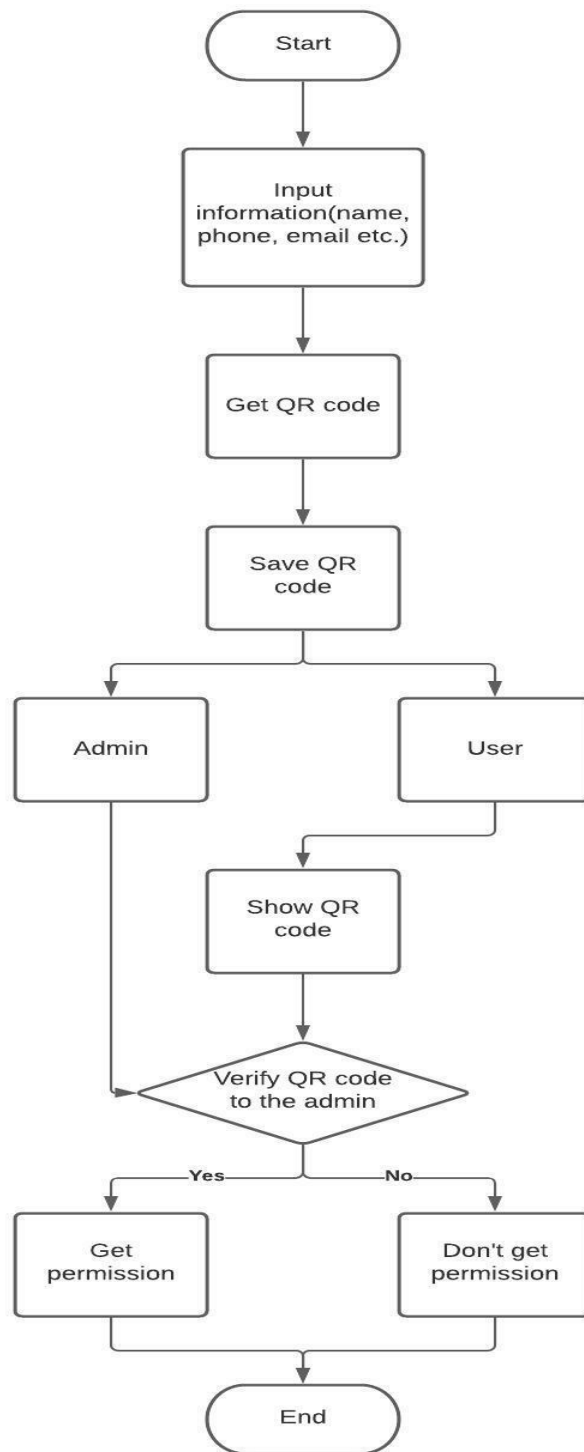
**Fig 3.2:** Diagram of unregistered person for Smart Presence System

## 3.2 Research Subject and Instrumentation

Our study aim may be one-of-a-kind in the world. It's very difficult to work on a system that will improve the overall security of the business. We have been used to the method of analyzing the previous system that has been released and developing a categorization model for future efforts.

### 3.2.1 Haar Cascade Classifier

The Haar Cascade Classifier is a technique for detecting objects that are used in computer vision. Paul Viola and Michael Jones were the ones that came up with the idea. There are four steps to it. It involves calculating Haar features, producing integral pictures, using Adaboost, and putting cascade classifiers into action, among other things.
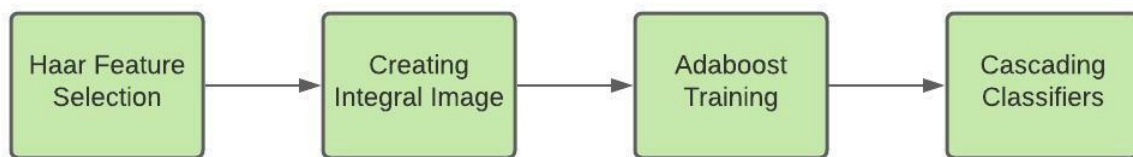


**Fig 3.3:** Stages of Haar Cascade Classifiers

A Haar feature is a computation made on neighboring rectangular sections in a detection window. The procedure includes adding up the pixel intensities in each area and subtracting them. Integral pictures, without delving into too much math, effectively speed up the computation of these Haar characteristics. As a result, Adaboost selects and trains the best features. To recognize the object, the method combines weak classifiers to build a "strong classifier." The cascade classifier has phases, each with a group of weak learners.



**Fig 3.4:** Feature detection by applying Haar features

### 3.2.2 Python Image Library

Python Image Library (PIL) is used to open and manipulate pictures, and it is also used to create new images. It is capable of doing somewhat complex image processing tasks.

### 3.2.3 Confusion Matrix

When it comes to describing the performance of classification algorithms, confusion matrix is the approach to use. If you have an unbalanced number of observations in each class or if you have more than two classes in your dataset, the accuracy of your classification alone might be deceiving. Making use of a confusion matrix will help you get a better understanding of what aspects of your classification model are correct and which sorts of mistakes it is making.

```
Confusion matrix :
 [[20  0]
 [ 0 20]]
```

**Fig 3.5:** Confusion Matrix after applying Haar Cascade Classifier

### 3.3 Data Collection Procedure

Every research work involves the gathering of data, which is a difficult job. You cannot consider your study good research if you do not include data collection and analysis.

Because we are dealing with real-time face detection and identification, we are using real-time facial pictures as datasets for our experiments. We have gathered a variety of data for our system in order to get better outcomes.

### 3.4 Statistical Analysis

In order to have a deeper knowledge of a study topic, statistical analysis is required. Two algorithms are shown in Fig. 1.1. Haar Cascade Classifier and Convolutional Neural Network (CNN) algorithms are examples of machine learning algorithms. In the graph below, we can observe that the performance accuracy of the Haar Cascade Classifier method is higher than that of the CNN algorithm.
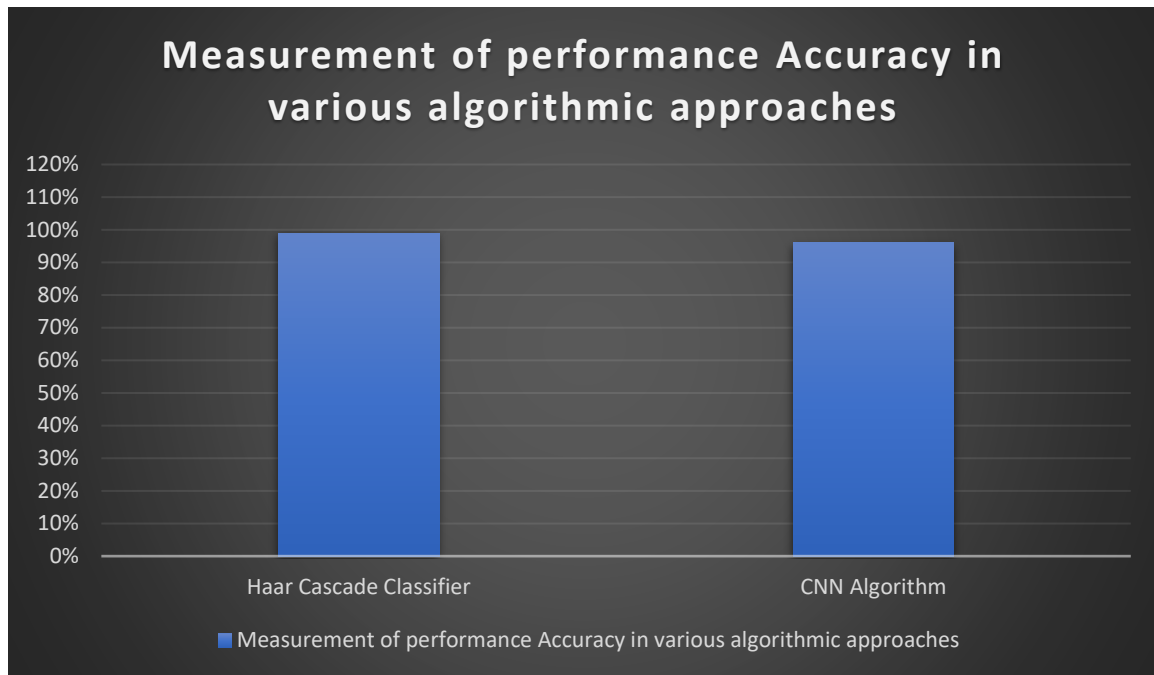
**Fig 3.6:** Performance accuracy graph

## 3.5 Proposed Methodology

We have completed a number of stages in order to complete our research work. Those are all linked together. This technique includes each and every step that must be taken along the journey. Fig 1.2 shows the methodology diagram.
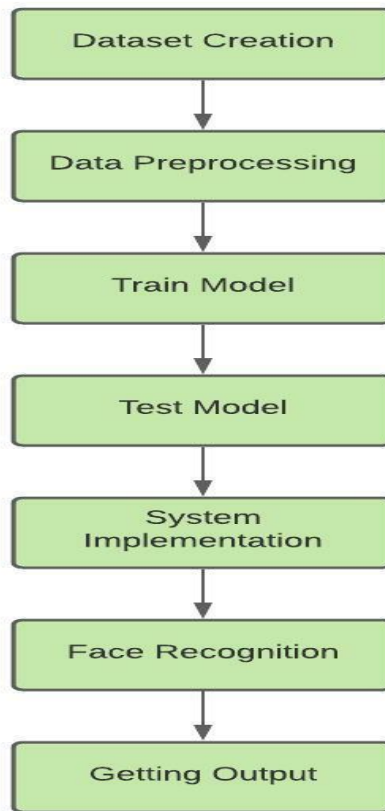
**Fig 3.7**: Methodology Diagram for Smart Presence System

### 3.6 Implementation Requirement

We loaded several libraries into the Smart Presence System, and Machine Learning was used to finish all of the operations in the system. For the purpose of creating a dataset, we made use of the OpenCV libraries. It is a computer vision library that operates in real-time. By collecting the footage, we were able to generate fifty pictures of people's faces. The Haar Cascade Classifier is used as a real-time face detector in this application. It is a machine learning object detection software that detects and identifies things in both still and moving images.

When it came to training the datasets, we mostly relied on the Python Imaging Library (PIL). It extends the capabilities of the Python interpreters to include image processing. Following the loading of the pictures for training, we transform the images to a grayscale representation.
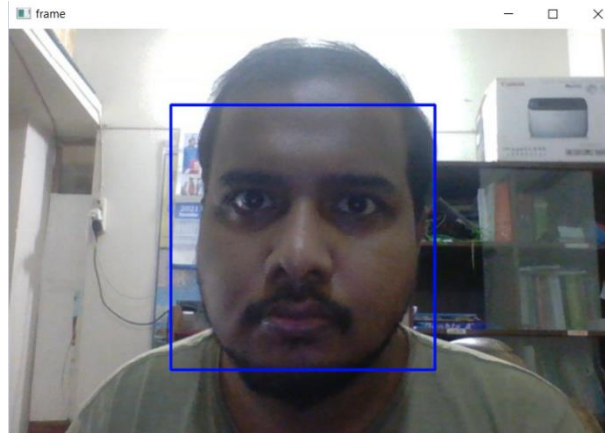
**Fig 3.8**: Face detection using Python OpenCV

After that, transform the pictures into a NumPy array. During this procedure, we were able to extract the ID from the pictures. As soon as we extract the face from the training picture sample, we add that image to ID's database. After all of the procedures have been completed, the face recognizer will generate a trainer file.

The face recognition procedure begins by reading that trainer file and matching the id with the id of our dataset. In this case, an excel file will be generated automatically to record the attendance information. It will generate a new document once each day.

We utilize a QR system to communicate with those who are not part of our organization. During this procedure, the user is required to submit certain information. A total of two copies of the QR code were created. One is for the user, while the other is for the administrator. We utilized the One Type Password (OTP) method to ensure that each password was unique.

# CHAPTER 4

# EXPERIMENTAL RESULTS & ANALYSIS

## 4.1 Experimental Setup

To achieve a successful outcome, our research endeavor is dependent on the selection of relevant data and the development of a flawless model. Finding the appropriate outcome is quite important while developing a system.

## 4.2 Experimental Results & Analysis

We have utilized two separate categorization algorithms in order to obtain the anticipated result. The haar cascade classifier algorithm provides us with the highest accuracy, which is 99 percent in this case. Table 4.2.1 shows the accuracy of all algorithms in comparison to one another.

**Table 4.1** – Measurement of performance Accuracy in various algorithmic approaches

| Algorithms | Results |
|---|---|
| Haar Cascade Classifier Algorithm | 99 % |
| Convolutional Neural Network Algorithm | 96% |

There are 850 photos in total in our databases. We utilized 850 photos for training and 340 images for testing in total.
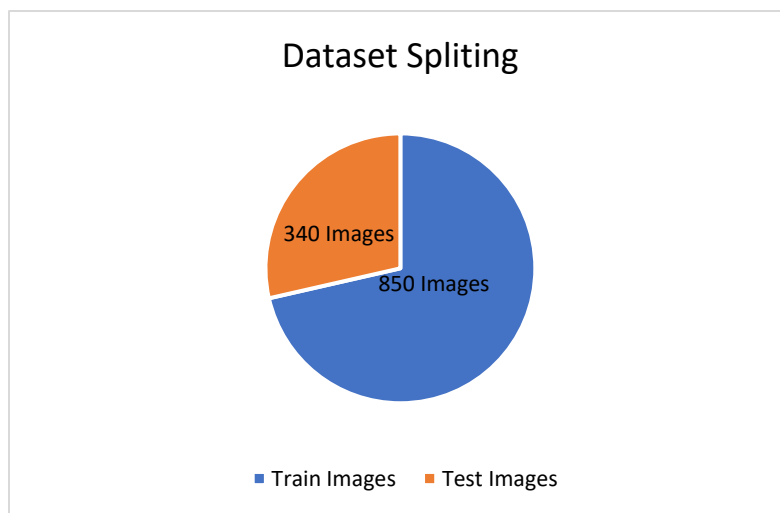


**Fig 4.2:** Pie Chart of Dataset

When we looked at the Confusion Matrix, we saw that the True Positive (TP) value was 20, the False Positive (FP) value was zero, the False Negative (FN) value was zero, and the True Negative (TN) value was 20.
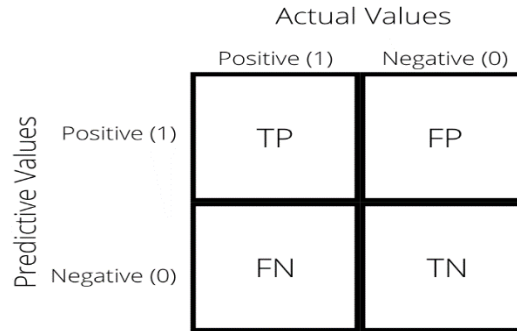
|  | Actual Values | |
|---|---|---|
|  | Positive (1) | Negative (0) |
| Positive (1) | TP | FP |
| Negative (0) | FN | TN |

**Fig 4.3:** Confusion Matrix

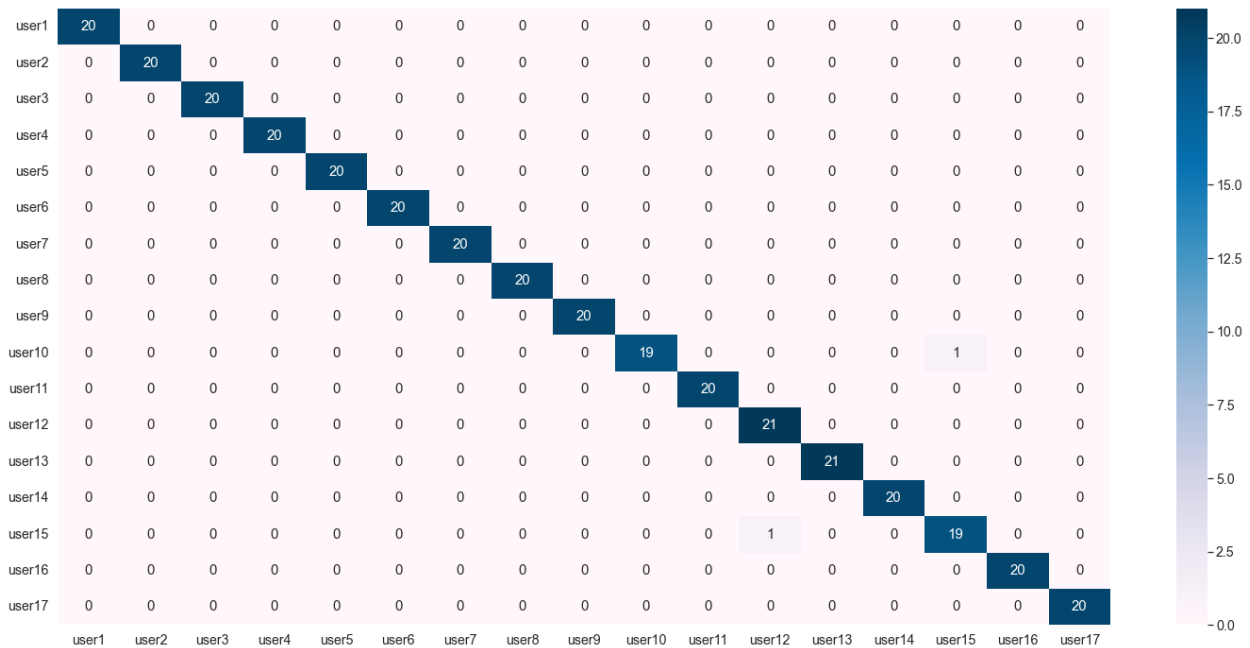| | user1 | user2 | user3 | user4 | user5 | user6 | user7 | user8 | user9 | user10 | user11 | user12 | user13 | user14 | user15 | user16 | user17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| user1 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user2 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user3 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user4 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user5 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user6 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user7 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| user10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| user11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| user12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 |
| user13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 |
| user14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 |
| user15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 19 | 0 | 0 |
| user16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| user17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |

**Fig 4.4:** Heatmap Correlation

## 4.3 Discussion

Following the receipt of the accuracy result, the Haar Cascade Classifier produces the majority of the elevated outcomes. We must set up the dataset correctly in order to get a higher degree of accuracy.

# CHAPTER 5

# IMPACT ON SOCIETY AND ENVIRONMENT

## 5.1 Impact on Society

The Smart Presence System has the potential to have a positive impact on society. By using this technology, we will be able to provide greater security for every business. We have no issues with utilizing the expensive biometric technology that is in place here. The most important feature is that it is simple to use and maintain. We have also implemented a QR code system, which eliminates the requirement for an outside guard for an organization. It lowers costs and makes it simple to get QR codes by giving useful information.

## 5.2 Impact on Environment

The Smart Presence System has no negative impact on the environment anywhere. It is entirely environmentally friendly. Our digital system will be used in the Internet of Things. As a result, there isn't much to contaminate. Furthermore, there are no radiation concerns.

## 5.3 Ethical Aspects

Every research project should include certain ethical considerations. Our study has the potential to make a significant contribution in this area. It may be used to provide sufficient security in a straightforward manner. Many security-related issues will be avoided, which will benefit the organization.

## 5.4 Sustainability Plan

As a result of our study, we have some long-term sustainability strategies. Efforts will be made to improve upon the prior performance while also including some new features.

# CHAPTER 6

# SUMMARY AND CONCLUSION

## 6.1 Summary of the Study

In order to complete our research job, we needed to first learn about Machine Learning and the methods that are used in it. Machine Learning procedures may be divided into two categories. There are two types of machine learning: supervised machine learning and unsupervised machine learning. However, we used Supervised Machine Learning for our own study project.

In order to do so, we must also get familiar with the Classification Model and Algorithms. In addition, we made use of several Python libraries. We used the OpenCV and PIL libraries to improve the performance of the program.

## 6.2 Conclusion

Machine Learning is an excellent research tool for facial detection and identification. We want to create a model that would provide companies with security while also saving them time. We worked to improve the system's efficiency and productivity. There is, however, a restriction to this investigation. Face recognition requires the manual use of id. Our system will work well, but it can be made much better if necessary.

## 6.3 Implication for Further Study

It is impossible to finish all of the research. Future improvements will have to be made gradually. We believe that this study has the potential to become even more effective in the future as a result of our findings. The previous version will be improved in terms of features, functions, and security.

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