A Project Report on

Machine Learning-Based Student Activity Monitoring System For An Educational Institution

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

Bachelor of Engineering

in

Information Technology

by

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Approval Sheet

This Project Report entitled ***"Machine Learning-Based Student Activity Monitoring System for An Educational Institution"*** Submitted by ***"Janhavi Kulkarni"(19104062), "Simran Choudhary"(19104023), "Loveritu Itnare"(19104028),*** is approved for the partial fulfillment of the requirement for the award of the degree of ***Bachelor of Engineering*** in ***Information Technology*** from ***University of Mumbai***.

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This is to certify that the project entitled ***"Machine Learning-based Student Activity Monitoring System For An Educational Institution"*** submitted by ***"Janhavi Kulkarni" (19104062), "Simran Choudhary" (19104023),"Loveritu Itnare" (19104028),*** for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering*** in ***Information Technology***,to the University of Mumbai,is a bonafide work carried out during academic year 2022-2023.

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Acknowledgement

We have great pleasure in presenting the report on **Machine Learning-based Student Activity Monitoring System for an Educational Institution** We take this opportunity to express our sincere thanks towards our guide and HOD **Dr.Kiran Deshpande** & Co-Guide **Prof. Jayshree Jha** for providing the technical guidelines and suggestions regarding the line of work. We would like to express our gratitude for his constant encouragement, support, and guidance throughout the development of the project.

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented, fabricated, or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

In this world of advanced information systems, one of the major issues is authentication. Several techniques have been employed to solve this problem. Face recognition is considered one of the most reliable solutions. A type of biometric software called facial recognition creates a mathematical map of a person's facial features and stores the information as a faceprint. The process of project uses deep learning algorithms to compare a live capture or digital image to the recorded faceprint in order to verify a person's identification. Deep learning and cloud computing are emerging technologies, which are used for the efficient processing of huge amounts of data with distinct accuracy. The report thus introduces the related work of face recognition from different perspectives. Talking about Humans, have always been identified by visual methods and obtain observable facts through our eyes. These statistics are diagnosed by our mind as ground rules. Face recognition was primarily used to combat the numerous unethical practices that exist in educational institutions. The institute's norms and regulations are frequently broken or ignored by students. To avoid such violation of rules we are building the Activity Monitoring System which will ameliorate the pace by which these can be limited to an extent. The process will start as the respected authority or professors will click the picture of the student who is caught doing any kind of mischief. This information will be uploaded to the portal. Once the specifications are imported into the application developed, the face will be collated and recognized by the database. The portal will display basic information about the respective student using face recognition which will be sent to the respective HODs via E-mail for further decisions. We intend to integrate the use of face recognition in student data modules to detect student identity. Thus this system will act as a disciplinary tool for maintaining discipline in college.

Index Terms—Machine learning, Image recognition, Face detection, Activity Monitoring System

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List of Abbreviations

ML:	Machine Learning
DL:	Deep Learning
MSE:	Mean Square Error
CNN:	Convolution Neural Network
DNN:	Deep Neural Network
KNN:	K-Nearest Neighbour
LDA:	Linear Discriminant Analysis
PCA:	Principal Component Analysis
SVM:	Support Vector Machine
LFR:	Learning Fair Representations
KFDA:	Kernel Fisher Discriminant Analysis

Chapter 1

Introduction

Image Processing is a method to convert an image into digital form and perform some operations on it, to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which the input is images, like video frames or photographs and the output may be images or characteristics associated with that image. Usually, an image processing system includes treating images as two-dimensional signals while applying already set signal processing methods to them Convolution neural network is a feed operational network with a deep structure composed of many layers which can separate required data from a huge data set. The use of Face recognition makes the work easygoing and firm in several fields like identification, verification, security services, retail shops, surveillance structures, leisure enterprises, etc. The acknowledgment of a human face is a functioning problem for validation purposes explicitly.

Students are not wearing identity cards and are practicing mischievous activities on the college campus. Students skip lectures and roam in the hallways which leads to disturbance and inconvenience. Students are out of discipline and ignorant towards the rules of the college and surrounding premises which are not beneficial for one's personal growth and personality development. Developing improvements have made numerous upgrades within the evolving scene of technology wherein identification verification may be done by the usage of face recognition method to avoid mischievous and ignorant behavior of students towards college rules and guidelines.

Automatic face recognition has been widely used in applications from social media to advanced authentication systems. Similarly, Automatic face recognition will be used in applications for advanced authentication.

To overcome this, we have proposed a system in which we will add images of individuals so that it will be easy to find the student and revert their details to authorities quickly. For those who are out of discipline and ignorant of the rules of the college and surrounding premises these techniques can be beneficial. This image will collate with the images in the database and the result will be displayed after scanning on the web page. The proposed system will use the image of students to identify the students and to retrieve detail of students and accordingly notify the concerned department. This system will act as a disciplinary tool for maintaining discipline in college.

Chapter 2

Literature Review

This shall normally form Chapter 2 and shall present a critical appraisal of the previous work published in the literature pertaining to the topic of the investigation. emphasis of the chapter shall depend on the nature of the investigation. In this section, we have covered a gist of ideas from the various technologies used by the authors. Few of them are summarized below.

- In paper [1], Coşkun, Musab Uçar, Ayşegül Yildirim, Özal Demir, Yakup. suggest a face detection and recognition algorithm based on convolution neural networks (CNN), which outperforms more conventional methods. With a single shot of 40 kids, the algorithm can distinguish 30 of the faces and detects about 35 faces. Moreover, edge computing is used in an IoT-based architecture to compute and transfer data that has been generated by smart classrooms. Because of its non-contact procedure, face recognition technology has a modest advantage over other biometric systems like fingerprints, palm prints, and iris. According to a performance comparison, its architecture outperforms other systems in terms of data latency and real-time response.

- In paper [2], Ankit Rajpal, Khushwant Sehra, corresponding author Rashika Bagri, and Pooja Sikka have put forth numerous deep learning (DL) strategies for a variety of applications, but face recognition (FR) in particular has advanced significantly thanks to these methods. A thorough examination of several FR systems that make use of various DL approaches is provided in this work. They have talked about publications that deal with various algorithms, architectures, loss functions, activation functions, datasets, problems, suggestions for improvement, and present and potential developments in DL- based FR systems. The paper also summarises the usage of several datasets for FR tasks and discusses difficulties with illumination, expression, position changes, and occlusion.

- In paper[3], Wirdiani, Ayu Hridayami, Praba Widiari, Ayu Rismawan, Diva Candradinata, Putu Jayantha address face recognition's early algorithms, synthetic features, classifiers, and related technologies, such as deep learning. The K-Nearest-Neighbor (KNN) the technique is used to combine PCA with face recognition in their straightforward feature extraction approach. LDA wants the variance within the same category of data groups after projection to be as minimal as feasible, while PCA requires the data variance after dimensionality reduction to be as large as possible so

that the data can be divided as broadly as possible.

- In paper[4], Zhi-yang Wang, Stanley Ebhohimhen Abhadiomhen, Zhi-feng Liu, Xiangjun Shen, Wen-yun Gao, Shu-ying Li authors suggested a brand-new multiview low-rank representation technique. The approach uses a consistent structure and diversity regularisation to learn the intrinsic and distinctive representation of each view. It is based on hierarchical Bayesian approaches. Whereas the specific re- presentation reveals the diversity of information across views, the intrinsic representation preserves the information that is consistent across several points of view. To learn both the relationship in the data and the clustering structure, thier model integrates the clustering structure and low-rank local manifold. Additionally, by adaptively modifying the clustering structure during optimization, their method can improve face recognition and clustering performance at the same time. Numerous tests using face datasets and state-of-the-art algorithms demonstrate the usefulness of our approach. They will attempt to expand this approach to deal with incomplete data in the future.

- In paper [5], Rehmat Ullah,Hassan Hayat,Afsah Abid Siddiqui,Uzma Abid Siddiqui, Jebran Khan,Farman Ullah, Shoaib Hassan, Laiq Hasan, Waleed Albattah, Muhammad Islam,5and Ghulam Mohammad Karam are Examining a Real-Time Framework for Recognizing and Detecting Human Faces in CCTV Images. Using several machine-learning methods, the author of this study has created a framework for automatic face identification based on CCTV photos. Collecting more than 40,000 face pho- tographs with the goal of comparing algorithm performance to get the greatest recognition accuracy is one of the goals of this effort. They have used many algorithms to achieve great accuracy for CNN. Compared to PCA with DT, RF, and KNN, CNN is substantially more trustworthy.KNN is a sluggish method that checks every instance in the dataset for prediction, whereas CNN quickly recognizes from its model. The other reason is that, in contrast to CNN, which utilized ten classes and thirty images per class and had good accuracy in comparison to PCA, PCA used 41,320 images for 90 classes. There were almost 41,320 photos total that were gathered. Making the system fully security system will improve it. The next step for this may be to identify numerous faces in a live-streaming video if we can distinguish one face from the photograph.

- In paper [6], Md. Tahmid Hasan Fuad, Awal Ahmed Fime, Delowar Sikder, Md. Akil Raihan Iftee, Jakaria Rabbi, Mabrook S. Al-Rakhami, Member IEEE Abdu Gumae, Ovishakesen, Mohtasim Fuad, Md. Nazrul IslamThey have presented the most recent developments in deep learning-based face recognition systems, which are mainly concerned with algorithms, architecture, loss functions, activation functions, datasets, and various types of occlusion, including pose-invariant, illusion, facial expression, age, and different ethnic variations, etc. The majority of face recognition systems were created using deep learning, and the architecture may alter in response to different datasets and problems with performance enhancement. In recent decades, deep learning architecture has demonstrated exceptional performance in face recognition systems. Their research presents many dataset types in summary forms, including still image-based, heterogeneous face image-based, video-based, and occlusion-based datasets. According

to their study, LFR, IJB, YTF, and Ms-celeb-1M performed nearly flawlessly on all FR tasks. In the FR task, occlusion-based problems are still present. The FR systems' performance is hampered by this condition. Occlusion-based issues could be minimized with more datasets and innovative techniques. These systems have considerably advanced in recent years, notwithstanding some tasks' limitations and difficulties.

- In the paper [7], Yang, Xiaoying Liang, Nannan Zhou, Wei Lu, Hongmei.They have reached several findings. In comparison to the conventional AdaBoost approach and the skin color + AdaBoost method, the method employed in this paper has generally improved. The prior experiment's introduction and analysis of skin color attributes can more effectively remove the non-complex face's background. Ada- Boost detection is carried out as opposed to employing grays- cale photos directly, which lowers the likelihood of erroneous detection. 2. There is a high detection rate in the test due to the self- constructed face training sample's addition of the face that was collected by the laboratory itself. In the experiment, the skin color method, the AdaBoost method, and the experimental out- comes of the skin color + AdaBoost approach are contrasted. In terms of detection rate and false detection rate, it is evident that the method is superior to the AdaBoost method. It is also discovered that by including skin color features, it is now able to exclude faces that AdaBoost spotted owing to lighting, etc., and that the AdaBoost approach uses a new sparse feature for identifying the face of additional gesture types. 3. The essential capability of the nuclear learning approach is that all operations in the KPCA and KFDA algorithms are carried out by the inner product kernel function defined in the original space, with no specific nonlinear mapping function involved. The effects of illumination are eliminated by zero- space-based KFDA, which is also resistant to changes in expression and attitude. By locating the most useful discriminant analysis data that is present in the interclass dispersion matrix's zero space, the zero-space method can solve the small sample problem in discriminant analysis.

- In paper [8], Mahdi, Fahad Habib, Md Moslehuddin, A.S.M. Vasant, Pandian Mckeever, Susan Ahad, Md Atiqur Rahman according to their study, they have suggested and created a system that focuses on face detection and face identification from a video camera. In this research, we have proposed and constructed a system that does just that. A system that focuses on face detection and recognition via a camera can be created. The physical labor can be cut down with face detection. The system serves security objectives well. Students and employees in various fields utilize this technique to track attendance. The police can use this approach to help them find the thief.

- In paper [9], Shahbaz Rezaei, Zubair Shafiq, Xin Liu they have suggested an analysis network that identifies channels vital for face image visualization but not essential for maintaining a high FR accuracy through an interpretable privacy-accuracy trade-off analysis. An analytically established accuracy-privacy trade-off in deep ensemble scheme was created based on a trade-off study between accuracy and privacy. Results from experiments confirmed that the suggested technique achieves an accuracy that is

comparable to employing direct original face photos and a quick inference of time.

- In paper [10], Nurhopipah, Ade and Harjoko, Agus. focus on a CCTV video, motion detection, and facial recognition are designed and tested as part of this study. The success rate for motion detection using the ADI approach is 92.655 percent. The motion detection technique requires an average decision-making time of 1.115 seconds. A success percentage of 76 percent is achieved when utilizing the Haar Cascade Classifier for facial detection. Training data using the CPN method results in 0.0455 MSE with a 94.286 percent success rate. A 60 percent success rate for face identification using training data value, pattern extraction using SURF, and PCA. While in this study it takes 0.202 seconds, the ideal processing time is less than 0.1 seconds per frame. It can be concluded that the research results in a sizable time delay. The testing outcome, which includes both accuracy and time that results in a delay, demonstrates that this research still needs to be improved.

- In Paper [11], Min-Chuan Huang, I-Ping Chen, Hsiang-Lin Huang, Shih-Fu Sung, and Ai-Guo Wang state about the "Design and Implementation of Face Recognition, Fever Detection, and Attendance Record Based on Sensing Technology" by Min-Chuan Huang et al. proposes a system that integrates facial recognition, fever detection, and attendance recording using sensing technology. The paper provides a detailed explanation of the system's architecture, hardware components, and software modules. It also describes the algorithms used for facial recognition and fever detection. The authors conducted experiments to test the system's performance, including its accuracy and response time. Overall, the paper presents a comprehensive approach to combining different sensing technologies to develop a system that can be used in various settings, such as schools, hospitals, and workplaces. The system can help to improve security and streamline attendance recording processes. However, the authors do not discuss any potential ethical or privacy concerns that may arise from using such technology.

- In Paper [12], Shuang, Li Ning, Xin Yu, Lina Liping, Zhang Li, Dong Shi, Yuan He, Wei focus on the "Multi-angle Head Pose Classification when Wearing the Mask for Face Recognition under the COVID-19 Coronavirus Epidemic" by Shuang Li et al. addresses the challenges of face recognition technology during the COVID-19 pandemic, when people are required to wear masks. The authors propose a method to classify head poses based on multi-angle images, which can improve the accuracy of face recognition when wearing a mask. The paper provides a detailed description of the proposed method, including the data collection process, the feature extraction techniques, and the classification algorithm used. The authors also conducted experiments to evaluate the effectiveness of the proposed method, and the results show that the proposed method outperforms existing methods for head pose classification when wearing a mask. This research paper provides valuable insights into the use of machine learning techniques to address real-world problems, such as the challenges posed by the COVID-19 pandemic. The paper also highlights the importance of collaboration between different institutions, as the research was conducted by a joint laboratory. The findings of this research have practical applications in improving the accuracy of face

recognition technology, which has become increasingly important in various domains, including security, healthcare, and education.

- In Paper [13], Ji, Jiazhen Wang, Huan Huang, Yuge Wu, Jiaxiang Xu, Xingkun Ding, Shouhong Zhang, Shengchuan Cao, Liujuan Ji, Rongrong analyzed the "Privacy-Preserving Face Recognition in the Frequency Domain" by Jiazhen Wang et al. addresses the issue of privacy in face recognition technology. The paper proposes a method that can perform face recognition in the frequency domain, which can preserve the privacy of individuals' facial features. The paper provides a detailed explanation of the proposed method, including the use of the Fourier transform to convert facial images into frequency domain representations. The authors also describe the use of homomorphic encryption to protect individuals' facial features, ensuring that they cannot be reverse-engineered or reconstructed from the frequency domain representation. This research paper provides valuable insights into the use of advanced techniques, such as homomorphic encryption and Fourier transforms, to address privacy concerns in face recognition technology. The paper highlights the importance of developing privacy-preserving algorithms that can protect individuals' data while still providing accurate results. The proposed method has practical applications in various domains, including security and healthcare, where privacy is a significant concern. Overall, this research paper presents an innovative approach to privacy-preserving face recognition that can contribute to the development of more secure and privacy-conscious face recognition systems.

- In Paper[14], Wang, Zhi-yang Abhadiomhen, Stanley Liu, Zhi-feng Shen, Xiang-jun Gao, Wen-yun Li, Shu-ying. explore the use of "Multi-view intrinsic low-rank representation for robust face recognition and clustering" by Zhi-yang Wang et al. address the challenges of face recognition when dealing with variations in pose and illumination. The paper proposes a novel method that can effectively represent facial images using a multi-view intrinsic low-rank representation, which can enhance the robustness of face recognition systems. The paper provides a detailed description of the proposed method, including the use of multiple views to capture variations in pose and illumination, and the use of low-rank representation to reduce noise and enhance the discriminative power of the representation. The authors also conducted experiments to evaluate the effectiveness of the proposed method, and the results show that the proposed method outperforms existing methods for face recognition and clustering. This research paper provides valuable insights into the use of advanced techniques, such as low-rank representation and multi-view analysis, to address the challenges of face recognition. The paper highlights the importance of developing robust algorithms that can handle variations in pose and illumination, which are common in real-world scenarios. The proposed method has practical applications in various domains, including security and healthcare, where face recognition is becoming increasingly important. Overall, this research paper presents an innovative approach to face recognition that can contribute to the development of more accurate and robust face recognition systems.

2.1 OBJECTIVES

We intend to do this project implementation to meet the following objectives:

- To design and develop a comprehensive cross-platform application for monitoring and identifying students involved in notorious activities.

- To orchestrate the use of Machine Learning in the application developed for tracking students' notorious activities.

- To orchestrate the use of Cloud Computing for providing scalability to a comprehensive student monitoring system developed.

Chapter 3

Project Design

The project's key features, structure, criteria for success and major deliverables are all planned out in this step. The aim is to develop a design in a way that can differ from the existing system that can be used to achieve the desired project goals.

3.1 Existing System

- It becomes difficult for the security guard to identify the students who do not carry their Id cards.
- Faculty sometimes see students misbehaving and roaming but the faculty cannot identify the respective department. Then sometimes these students lie about the department to be spared from punishment and go unidentified.
- They need to grab students on the spot and then go to higher authorities to get them punished instantly. This process wastes a lot of valuable time for the faculty as they cannot proceed to their lecture or labs without getting through with the students.

Proposed System Architecture/Design Prototype

3.2 DNN (Deep Neural Network)

- Deep Neural Networks (DNNs) are a type of artificial neural network (ANN) that use multiple layers of interconnected nodes or neurons to learn and extract meaningful features from raw input data. This hierarchical process of feature extraction and abstraction enables DNNs to automatically learn and represent complex patterns in data.
- DNNs typically consist of an input layer, one or more hidden layers, and an output layer. Each layer is composed of multiple nodes or neurons that perform nonlinear transformations on the input data using activation functions. The output of one layer is passed as input to the next layer, with each layer progressively learning and refining the representations of the input data.
- Training a DNN involves feeding it with labeled training data and adjusting the weights and biases of the neurons through a process called backpropagation. Backpropagation is an optimization algorithm that adjusts the weights and biases of the neurons based on the difference between the predicted output and the actual output.
- The "Preprocess" activity involves capturing a face image and preparing it for input to a DNN model. The process starts with capturing a face image (1), then preprocessing it (2) to enhance its quality and prepare it for input to the DNN model.
- The "Recognize" activity involves running the preprocessed image through a DNN model and retrieving the top matches. The process starts with running the DNN model on the preprocessed image (2), then retrieving the top matches (3) from the DNN output. If there is a match, the system returns "The Preliminary Information Of Student" (4) to the faculty (5)the Email notification is sent to the respective branch HOD. If there is no match,(6) the system returns Unknown.

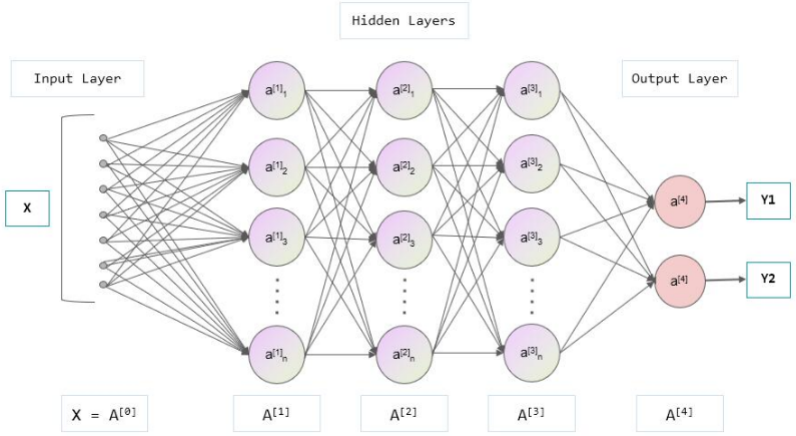


Figure 3.1: Use Case Diagram For Student Monitoring System

Architecture of Facial Recognition System:- The architecture of the System consists of three modules, namely:

1. Enrolment Module:-
   The enrollment module records student details and clicks 20 images of the student and updates it to the database. Our project will enroll the students with their basic details such as Name, Branch, Academic Year, Mobile Number, Moodle Id, E-mail Id . on the website Which will help in enrolling the students for further recognition by the higher authority.

2. Database:-
   The student activity monitoring system uses MySQL for the storage of the students as well as the faculty data and their Login Credentials. It consists of three tables namely 1. Email data which stores the Email Ids of the HODs from various Branches. 2. Teach Register stores details of the faculties who can enroll the students. 3. Register which contains student data.

3. Identification Module:-
   The Activity monitoring system application is connected to the modules Matplotlib, Pickle, Numpy, and utils for image processing functions like rotating, etc. Opencv, cmake, face-recognition, and pillow are mainly used for face recognition and identification in the project. Deep Neural Networks are used for the efficient processing of huge amounts of data with distinct accuracy. The Facial Recognition packages and Python both use the Dlib library for the front end. The System receives an image of a face from the faculty and uses DNN algorithms to identify the student's face. The front end consists of HTML, CSS, JavaScript for the development of the website Interface for the Activity Monitoring with the database inbuilt.

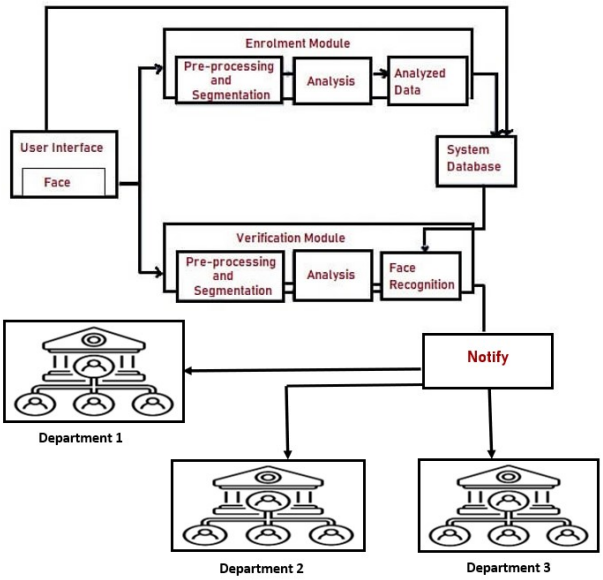


Figure 3.2: Architecture of Activity Monitoring System

1. Face detection using deep neural networks (DNN) is a technique that involves using artificial neural networks to detect and locate human faces in images. DNN-based face detection algorithms have significantly improved the accuracy and speed of face detection, making them widely used in various applications, such as security systems, social media, and digital cameras.

2. Face extraction using deep neural networks (DNN) is a process of isolating the facial regions from images using artificial neural networks. DNN-based face extraction algorithms have significantly improved the accuracy and efficiency of face extraction, making it a widely used technique in various applications, such as facial recognition, emotion analysis, and video surveillance.

3. Face recognition using deep neural networks (DNN) is a technique that involves using artificial neural networks to recognize and verify human faces in images. DNN-based face recognition algorithms have significantly improved the accuracy and speed of face recognition, making them widely used in various applications, such as security systems, social media, and mobile devices.

3.2.1 Proposed System Overview

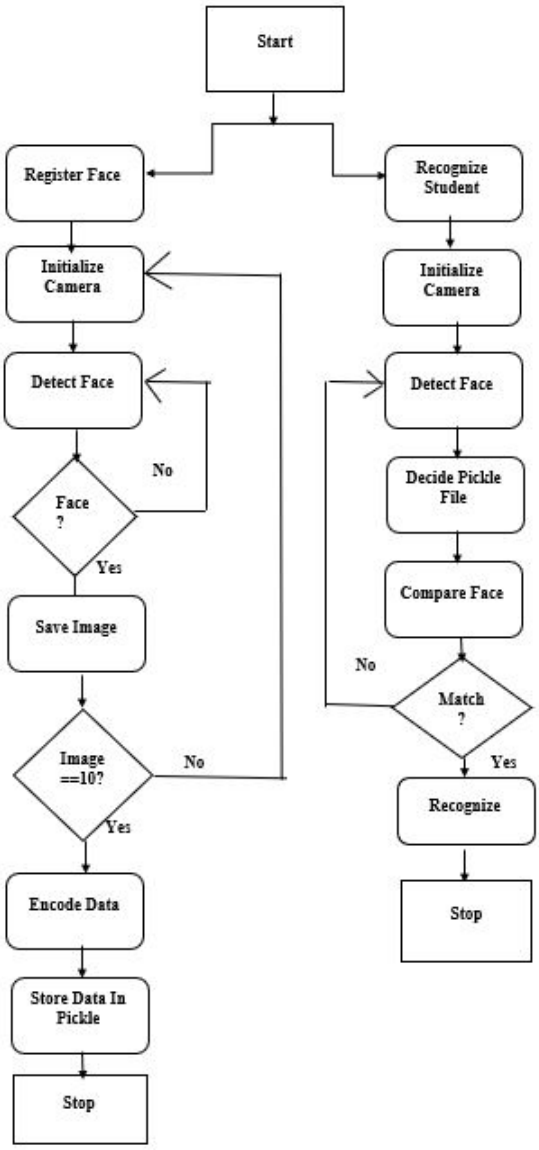


Figure 3.3: Method flow

The Above figure illustrates the flow of the project where the system first registers the faces of the students which is done by the faculty. The system takes 10 images of each student as a database and uses them to train the model for identification. The data is stored in Pickle. For the recognition of the students, the mobile applications camera is initiated and the required student's face is captured or uploaded by the faculty for monitoring purposes. If the student is registered, the application will detect using the required pickle file and the system will recognize the student by providing Basic details of the student, or else it will show the message as unknown.

3.2.2 System Diagram

Activity Diagram
An activity diagram is a type of UML diagram that visualizes the flow of activities or processes in a system. It depicts the steps, actions, and decisions that are involved in carrying out a particular task or business process.
The face recognition system activity diagram represents the behavior of the project in terms of its activities. It contains important details on the activities and constraints done in the project. This diagram shows the flow of interaction between the system and Admin-User(HODs and Faculty). This is done by helping them visualize the system's functionality in various degrees of detail.

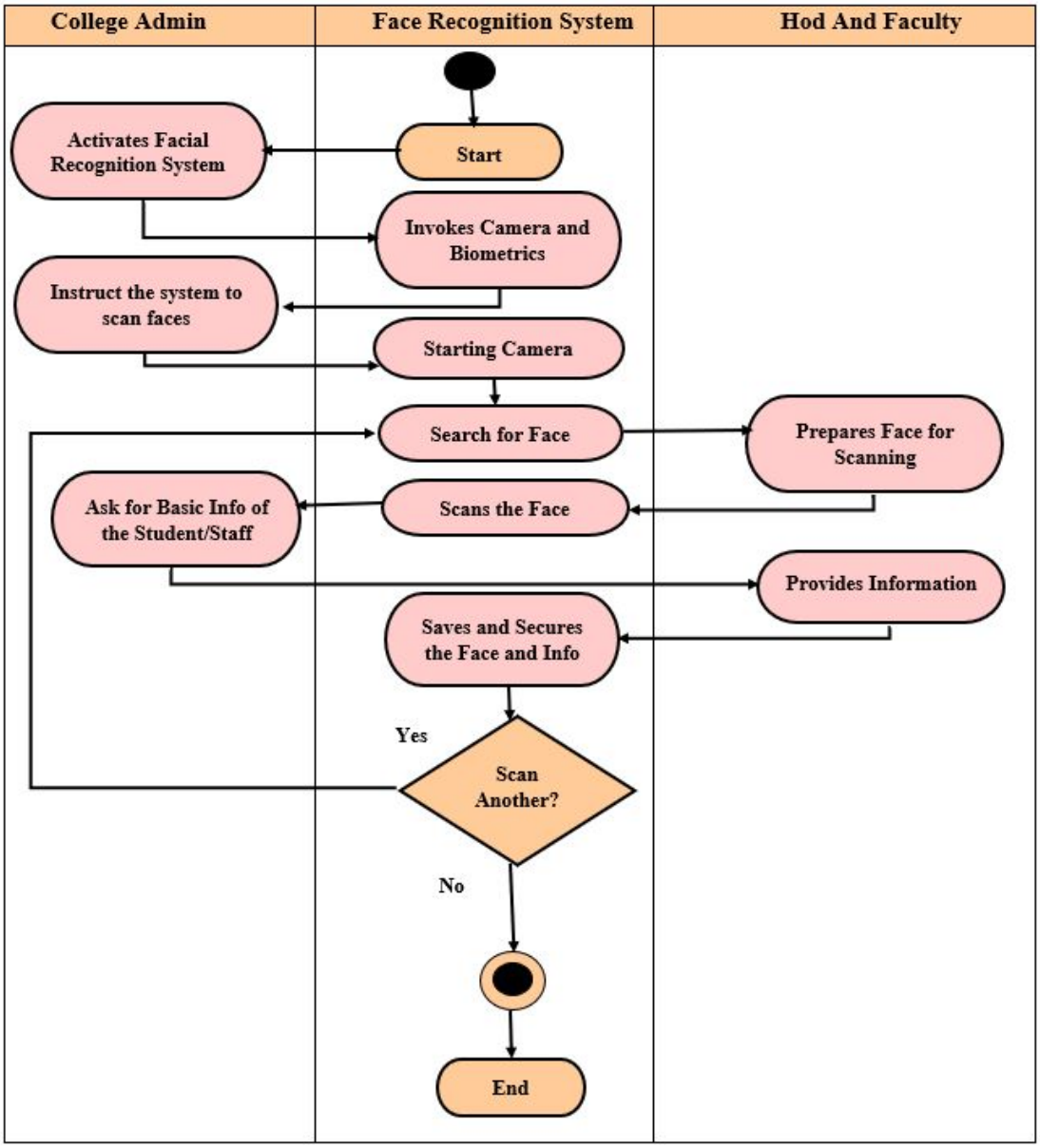


Figure 3.4: Activity Diagram For Student Monitoring System

3.2.3 Use Case Diagram

A use case diagram is a type of UML (Unified Modeling Language) diagram that represents the various ways that users interact with a system. The use case diagram would provide an overview of the system's functionality and help to identify areas for improvement.

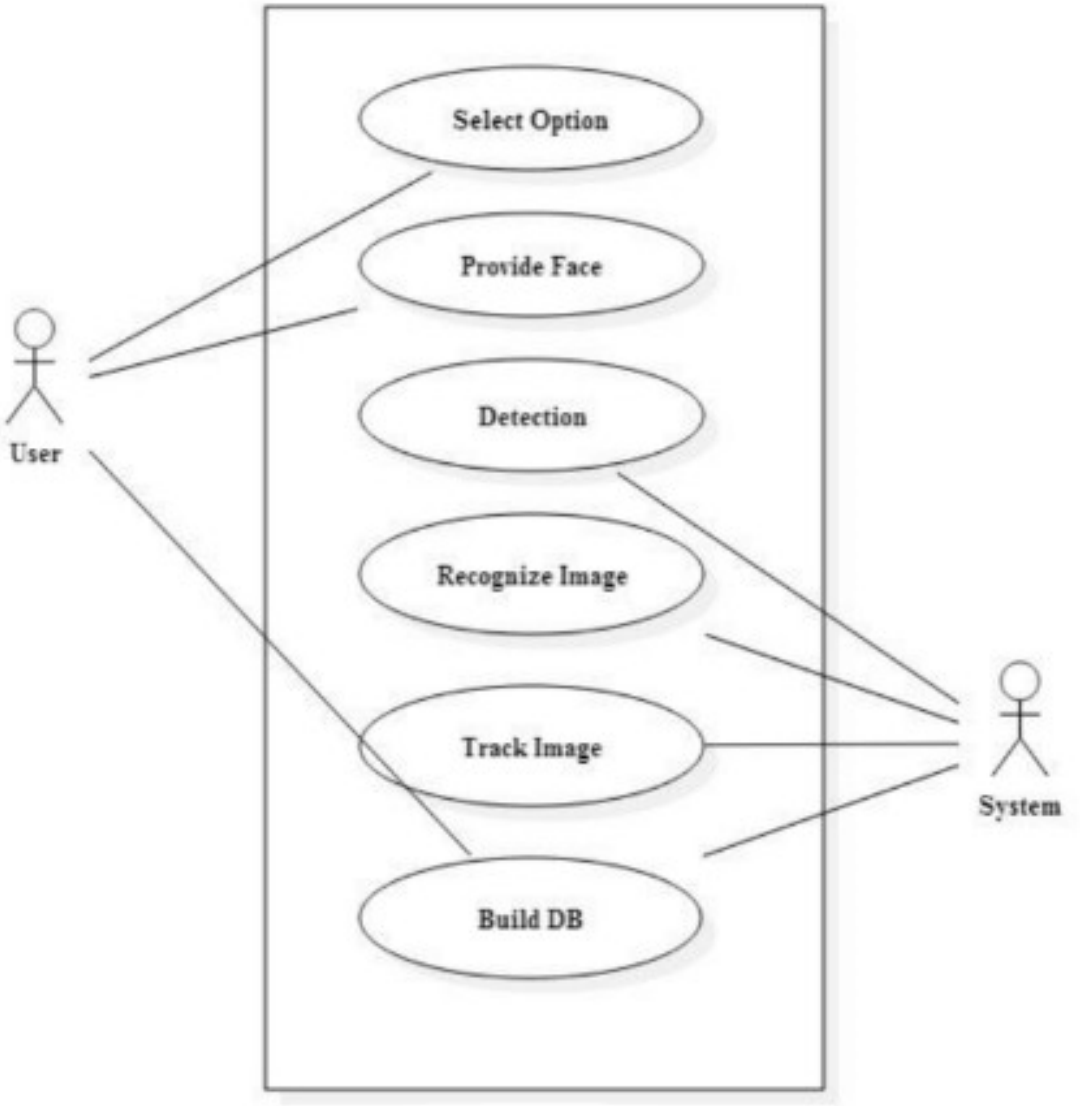


Figure 3.5: Use Case Diagram For Student Monitoring System

A use case diagram for face recognition includes actors such as users and administrators and use cases such as registering a face, recognizing a face, managing users, and managing system settings. The diagram provides a visual representation of how users interact with the system and how the system operates. The use case diagram helps to identify the key features of the system and how they work together to provide the desired functionality. This enables developers and designers to create a system that meets the needs of the users and is easy to manage and maintain.

3.2.4 Sequence Diagram

A sequence diagram is a type of UML diagram that illustrates the interactions and messages exchanged between objects or components in a system. It depicts the order in which the objects communicate with each other and the specific messages that are sent and received.

In this sequence diagram, the user initiates the face recognition process by requesting that the system recognize their face. The system prompts the user to provide an image of their face, which the user then provides. The system retrieves a list of stored face images from the database and uses an algorithm to compare the input image to the stored images. The algorithm applies additional filters to the list of potential matches, such as a confidence threshold, and returns a list of final matches to the system. Finally, the system displays the match results to the user.

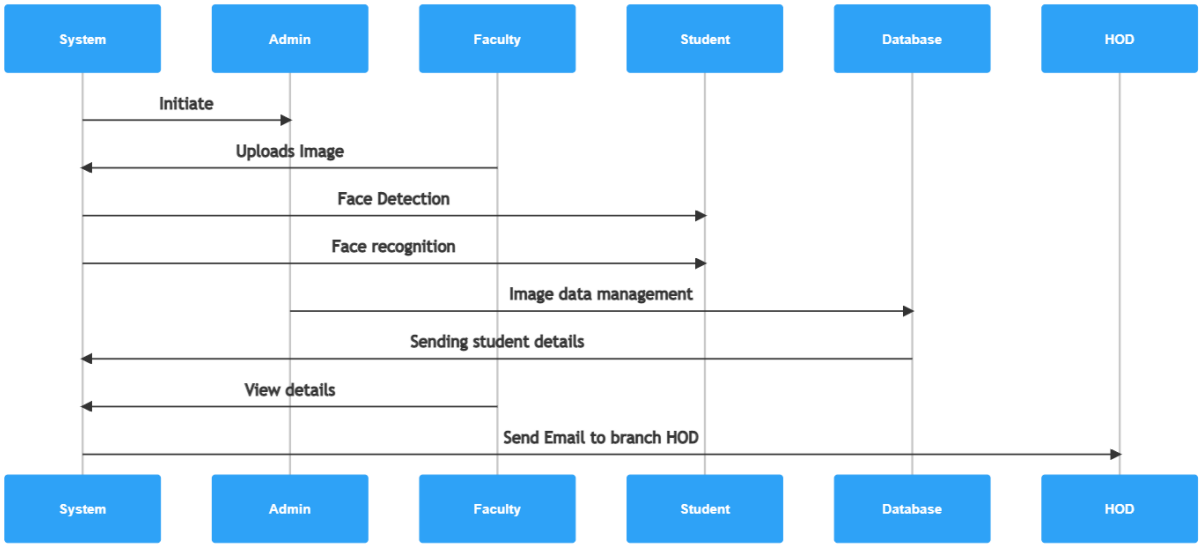


Figure 3.6: Sequence Diagram For Student Monitoring System

In a face recognition system that uses a DNN algorithm, the sequence diagram would involve several steps. First, the user would provide an image of their face to the system. The image would be preprocessed to remove noise and enhance key features, such as the shape of the eyes, nose, and mouth. The preprocessed image would then be fed into the DNN algorithm, which would produce a set of features that represent the face. The features would be compared to the features of the faces in the database to find the closest match. The system would then display the match results to the user. The DNN algorithm would be trained on a large dataset of face images to learn to recognize faces in a wide range of conditions. This would enable the system to accurately recognize faces in real-time, making it well-suited for security systems, attendance tracking, and other applications that require fast and accurate face recognition.

Chapter 4

Project Implementation

Project implementation consists of visions and plans with which we are supposed to build the end product. This includes the logical conclusion, after evaluating, deciding, visioning, planning and finding the other resources for the project. Technical implementation is one of the major aspects of executing a project.

Fig 4.1 portrays the database, the E-mail, and the connection of these two used for sending the notification of the student information to the Email from the database.

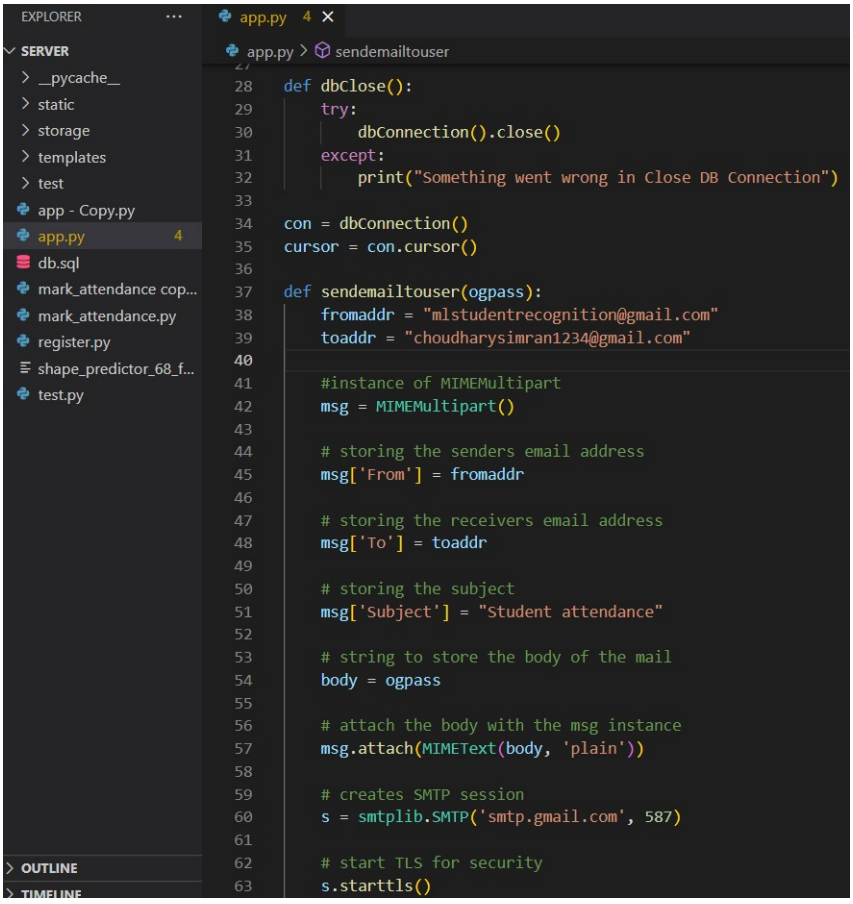


Figure 4.1: Database Connect And E-Mail

Fig 4.2 shows the Faculty registration and Login in the activity monitoring system application where they will further register the students in the application for future reference. This is the first turning point of the project.

```python
@app.route('/teacherRegister', methods=['GET', 'POST'])
def teacherRegister():
    if request.method == 'POST':
        print("GET")

        username = request.form.get("username")
        email = request.form.get("email")
        mobile = request.form.get("mobile")
        passw = request.form.get("password")

        cursor.execute('SELECT * FROM teacherregister WHERE username = %s', (username))
        count = cursor.rowcount
        if count > 0:
            return "fail"
        else:
            sql1 = "INSERT INTO teacherregister(username, email,mobile, password) VALUES (%s, %s, %s, %s);"
            val1 = (username, email, mobile, passw)
            cursor.execute(sql1,val1)
            con.commit()
            return "success"

@app.route('/teacherLogin', methods=['GET', 'POST'])
def teacherLogin():
    if request.method == 'POST':
        print("GET")

        username = request.form.get("username")
        passw = request.form.get("password")
        print("INPUTS")
        print("username",username)

        cursor.execute('SELECT * FROM teacherregister WHERE username = %s AND password = %s', (username, passw))
        count = cursor.rowcount
        if count > 0:
            return "success"
```

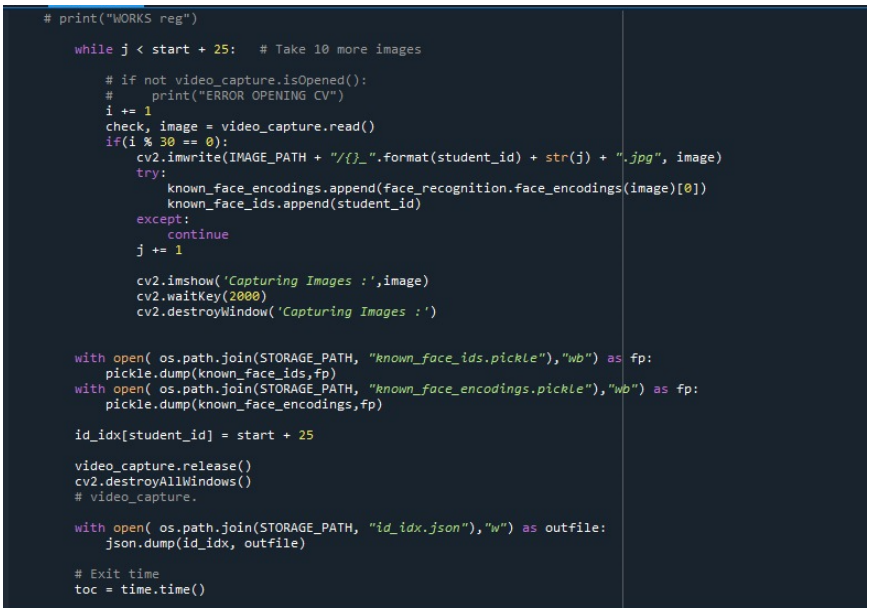
Figure 4.2: Faculty Register And Login

Fig 4.3 helps in understanding the process of inputting the student faces in the model and the database for recognition by the mobile application of Student Recognition.

```python
def main():
    return render_template('Main.html')

@app.route('/addStudent', methods=['GET', 'POST'])
def addStudent():
    if request.method == 'POST':
        print("POST")

        rollno = request.form.get("rollno")
        name = request.form.get("name")
        email = request.form.get("email")
        mobile = request.form.get("mobile")
        classname = request.form.get("classname")
        division = request.form.get("division")
        password = request.form.get("password")

        cursor.execute('SELECT * FROM register WHERE rollno = %s', (int(rollno)))
        count = cursor.rowcount
        if count > 0:
            return "exist"
        else:
            status = register_yourself(rollno+"_"+name)
            if status == 'Success':
                sql1 = "INSERT INTO register(rollno, name,email, mobile,classname,division,password) VALUES (%s, %s
                val1 = (int(rollno),name, email,mobile,classname,division,password)
                cursor.execute(sql1,val1)
                con.commit()
                return "success"
            else:
                return "Fail"
    return render_template('addStudent.html')

@app.route('/logout')
def logout():
    return render_template('index.html')
```

Figure 4.3: Adding Students Face Data In Model And In Database

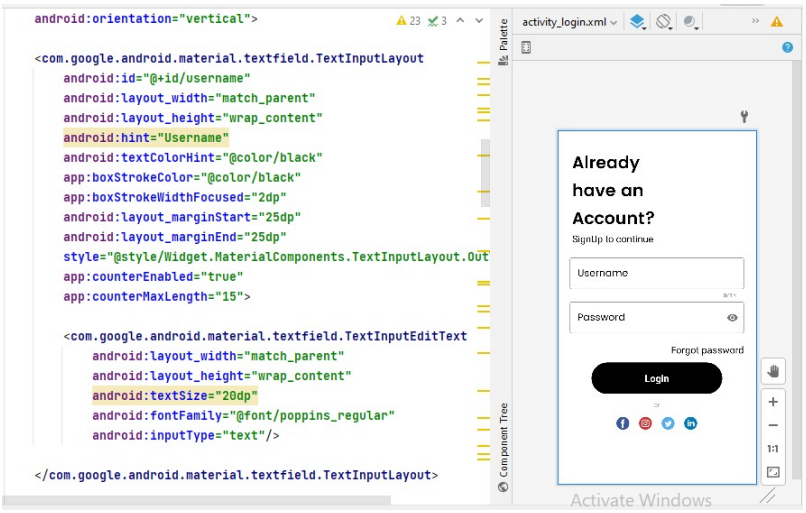
Fig 4.4 is the most important part of the code as here the 20 images are captured and trained by using the DNN model which is the second most important turning point of the project.



```
# print("WORKS reg")

    while j < start + 25:   # Take 10 more images

        # if not video_capture.isOpened():
        #     print("ERROR OPENING CV")
        i += 1
        check, image = video_capture.read()
        if(i % 30 == 0):
            cv2.imwrite(IMAGE_PATH + "/{}_".format(student_id) + str(j) + ".jpg", image)
            try:
                known_face_encodings.append(face_recognition.face_encodings(image)[0])
                known_face_ids.append(student_id)
            except:
                continue
            j += 1

            cv2.imshow('Capturing Images :',image)
            cv2.waitKey(2000)
            cv2.destroyWindow('Capturing Images :')


    with open( os.path.join(STORAGE_PATH, "known_face_ids.pickle"),"wb") as fp:
        pickle.dump(known_face_ids,fp)
    with open( os.path.join(STORAGE_PATH, "known_face_encodings.pickle"),"wb") as fp:
        pickle.dump(known_face_encodings,fp)

    id_idx[student_id] = start + 25

    video_capture.release()
    cv2.destroyAllWindows()
    # video_capture.

    with open( os.path.join(STORAGE_PATH, "id_idx.json"),"w") as outfile:
        json.dump(id_idx, outfile)

    # Exit time
    toc = time.time()
```

Figure 4.4: Capturing 20 Images and Training Model for the Images using DNN

Fig 4.5 displays the code where the Faculty(Teaching Staff and HOD's) will Login through the Mobile Application created in Android Studio.



```
android:orientation="vertical">

<com.google.android.material.textfield.TextInputLayout
    android:id="@+id/username"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:hint="Username"
    android:textColorHint="@color/black"
    app:boxStrokeColor="@color/black"
    app:boxStrokeWidthFocused="2dp"
    android:layout_marginStart="25dp"
    android:layout_marginEnd="25dp"
    style="@style/Widget.MaterialComponents.TextInputLayout.Out
    app:counterEnabled="true"
    app:counterMaxLength="15">

    <com.google.android.material.textfield.TextInputEditText
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:textSize="20dp"
        android:fontFamily="@font/poppins_regular"
        android:inputType="text"/>

</com.google.android.material.textfield.TextInputLayout>
```


Figure 4.5: Faculty Login On App

Fig 4.6 is the Final step before the result is declared and it is the cross-checking of the presence of Face images in the model. This helps in detecting the student details with accuracy irrespective of the angle and background.

```
    face_locations = face_recognition.face_locations(rgb_small_frame)
    face_encodings = face_recognition.face_encodings(rgb_small_frame, face_locations)

    face_names = []
    for face_encoding in face_encodings:
        # See if the face is a match for the known face(s)
        matches = face_recognition.compare_faces(known_face_encodings, face_encoding, tolerance = 0.35)
        name = "Unknown"

        # # If a match was found in known_face_encodings, just use the first one.
        # if True in matches:
        #     first_match_index = matches.index(True)
        #     name = known_face_ids[first_match_index]

        # Or instead, use the known face with the smallest distance to the new face
        face_distances = face_recognition.face_distance(known_face_encodings, face_encoding)
        # print(face_distances)
        try:
            best_match_index = np.argmin(face_distances)
        except:
            # print("No students have been marked")

            marked = False
            return marked
        if matches[best_match_index]:
            name = known_face_ids[best_match_index]

        face_names.append(name)

print(str(sanity_count)+"  "+str(unknown_count))
if(name == "Unknown"):
    unknown_count += 1
else:
    unknown_count = 0
```

Figure 4.6: Checking If Face Is Present In Model Or Not

Fig 4.7 Here we run the server code and after compiling we can enroll students on the localhost website.

```
PS C:\Users\Simran\OneDrive\Desktop\Project\Final\FinalCode\Server> & C:/Users/Simran/anaconda3/envs/project/python.exe c:/Users/Simran/OneDrive/Desktop/Project/Final/FinalCode/
Server/app.py
C:\Users\Simran\anaconda3\envs\project\lib\site-packages\numpy\_distributor_init.py:30: UserWarning: loaded more than 1 DLL from .libs:
C:\Users\Simran\anaconda3\envs\project\lib\site-packages\numpy\.libs\libopenblas.GK7GX5KEQ4F6UYO3P26ULGBQYHGQO7J4.gfortran-win_amd64.dll
C:\Users\Simran\anaconda3\envs\project\lib\site-packages\numpy\.libs\libopenblas64__v0.3.21-gcc_10_3_0.dll
  warnings.warn("loaded more than 1 DLL from .libs:"
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on all addresses (0.0.0.0)
 * Running on http://127.0.0.1:5000
 * Running on http://192.168.82.194:5000
Press CTRL+C to quit
192.168.82.11 - - [26/Apr/2023 17:39:09] "POST /uploadfile HTTP/1.1" 200 -
0  0

['07_Simran ']

1  0

['07_Simran ']

2  0
```

Figure 4.7: Uploaded Image In Recognition Process

Fig 4.8 In this Snippet we get to see the activity on the application when student image is uploaded it shows the details in the terminal and on the application.

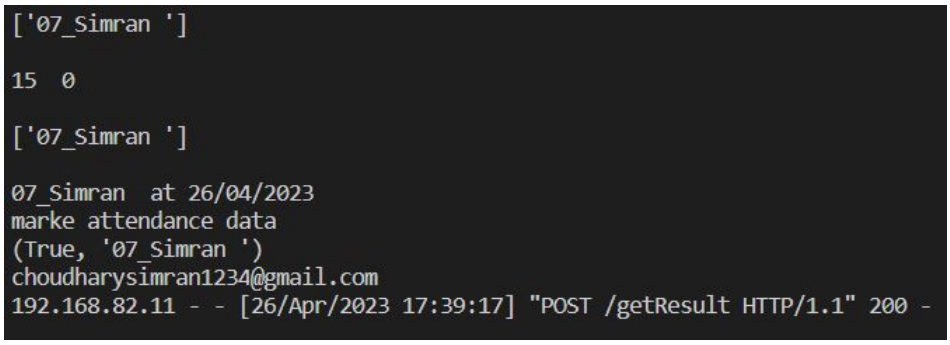


Figure 4.8: Positive Output Of Student Detected And Identified

Chapter 5

Testing

Testing is an organized summary of testing objectives, activities, and results. It is created and used to help stakeholders (product manager, analysts, testing team, and developers) understand product quality and decide whether a product, feature, or a defect resolution is on track for release. Test documentation includes all files that contain information on the testing team's strategy, progress, metrics, and achieved results. The combination of all available data serves to measure the testing effort, control test coverage, and track future project requirements.

5.1 Functional Testing

5.1.1 Unit Testing

Unit testing is the first level of testing, which is typically performed by the developers themselves. It helped us understand the desired output of each module, which we had broken down into separate units and in classifying the cry categories on the basis of algorithm that we have used.

5.1.2 Various Testcases

Test Condition	Test Steps/Procedure	Test Data	Expected Result	Actual Result	Pass/Fail
Login/Register	Pass all inputs	Check validation	Properly validate	Validation successful	Pass
Registering Face Data	Capturing 10 images	Checking if the face is detected	Train model on Face data	Create a Folder of that user and store 10 images and train models	Pass
Predicting data from face	Pass captured image from mobile	Checking the image is clear as much as its face value is detected.	Predicting username from face data.	Prediction of user successful.	Pass

Table 5.1: Testcases

Chapter 6

Result

When the System is executed the application is accessible to the Users, they could be any faculty in need of student information. When they upload an image on the application after login they receive the student details and if it is not present in the database then on the application screen it shows "Unknown".

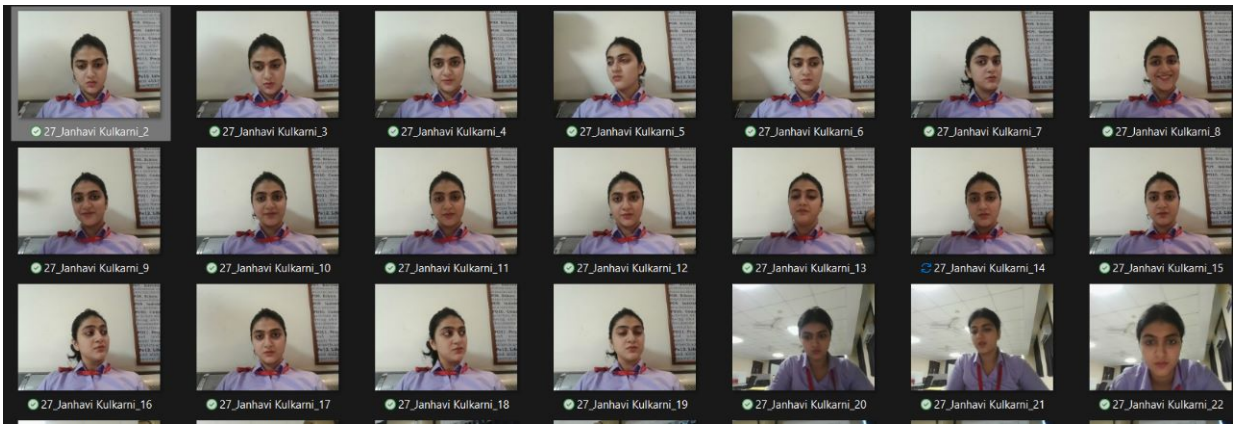


Figure 6.1: Backend Reflecting Student Images Contributing to Datasets.

Fig 6.2 as the Face is recognized the Notification Email is sent to the respective HOD.

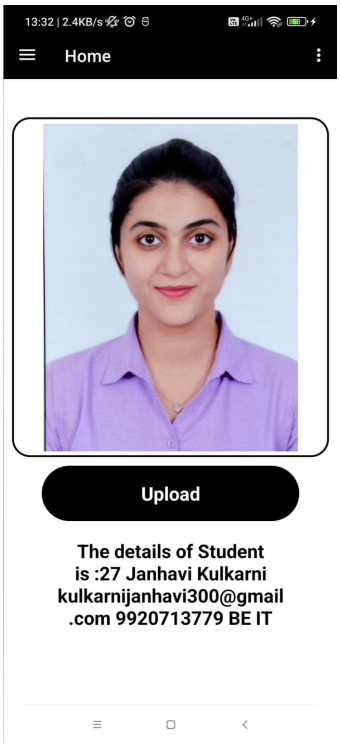


Figure 6.2: Student 1 Recognized With The Basic Details For Identification

The following images are the output of our system, the student database figure Fig 6.1, 6.3, 6.5 is the folder of images added to the database while enrolling the students.

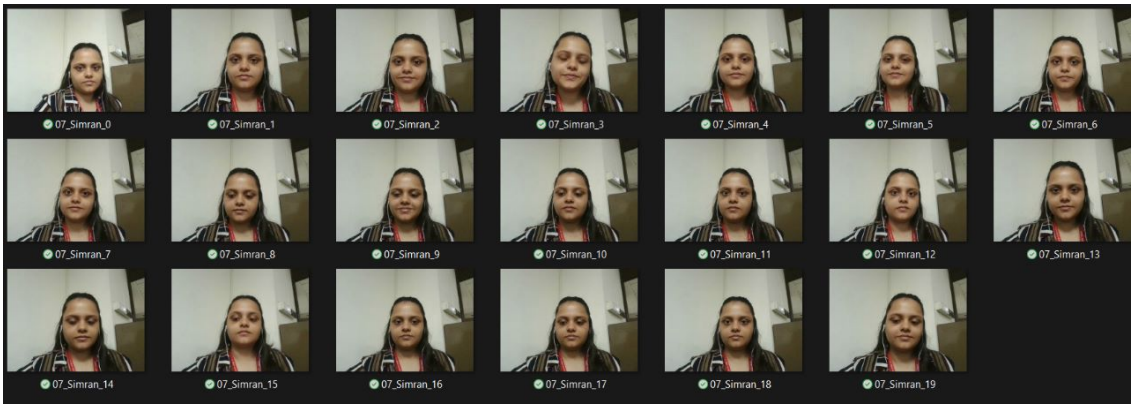


Figure 6.3: Backend Reflecting Student Images Contributing to Datasets.

Fig 6.4 as the Face is recognized the Notification Email is sent to the respective HOD.

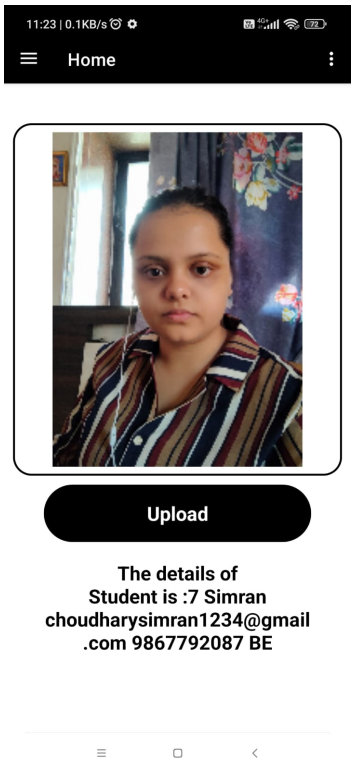


Figure 6.4: Student 2 Recognized With The Basic Details For Identification

The output in Fig 6.2, 6.4, and 6.6 shows how the application screen loads data and provides basic details to our users.

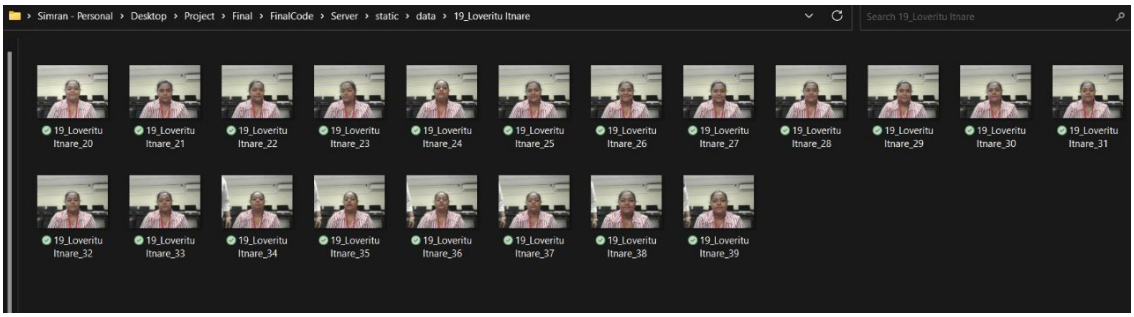


Figure 6.5: Backend Reflecting Student Images Contributing to Datasets.

In addition to that, it also sends an E-mail notification to the respective branch HOD which is represented in Fig 6.7, 6.8, 6.9.

Fig 6.6 as the Face is recognized the Notification Email is sent to the respective HOD.

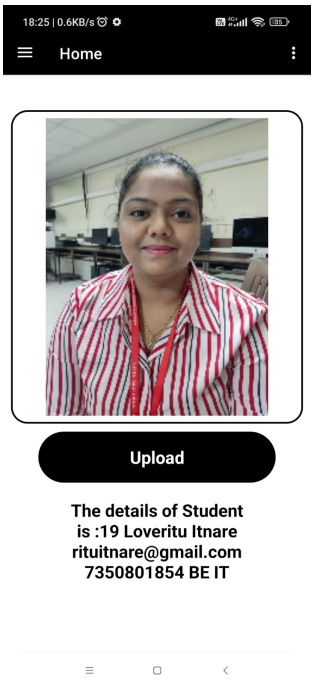


Figure 6.6: Student 3 Recognized With The Basic Details For Identification

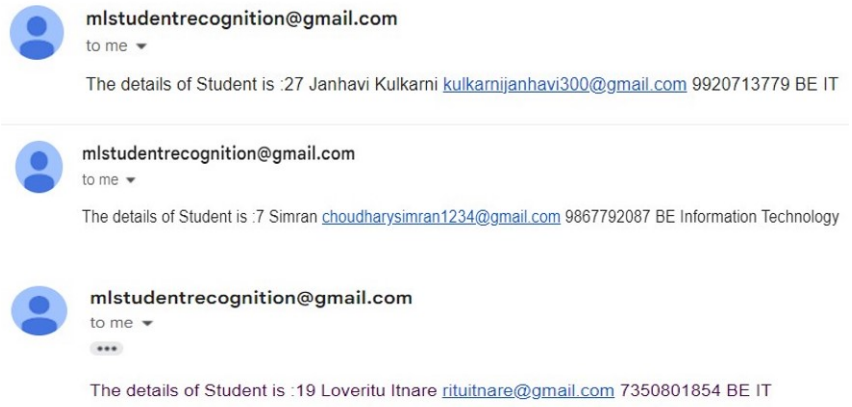


Figure 6.7: E-mail Notification to HOD

Chapter 7

Conclusions and Future Scope

An efficient and proprietary Activity Monitoring system was designed with the help of Machine Learning and Face Recognition. The application targets mainly Educational Institutions ameliorating the safety and discipline in the respective institutions. Such monitoring system turns out much more beneficial for educational Institutes. It will make it easier for the respective faculty to keep a check on the student activities. It plays a vital role in maintaining the discipline of the institute as it is quite flexible. On a large scale, this approach can be implemented in corporate offices, Businesses, and retail industries.

The Student Activity Monitoring System will be updated with the addition of the notification which is sent to the respective student as a warning.

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Appendices

Appendix-I: Installation Of Libraries

1. **cd Desktop**
2. **cd Project**
3. **cd Final**
4. **cd FinalCode**
5. **cd Server**
6. **pip install virtualenv**
7. **pip install virtualenv**
8. **myenv/Scripts/activate**
9. **pip install flask**
10. **pip insall pymysql**
11. **pip install cmake**
12. **pip install pillow**
13. **conda install -c conda-forge dlib**
14. **pip install face-recognition**
15. **pip install opencv-python**
16. **pip install secure-filename**
17. **pip install smtplib**
18. **pip install numpy**
19. **pip install dlib**
20. **pip install pickle**
21. **pip install matplotlib**
22. **pip install imutils**

Publications

Paper entitled **"Machine Learning-Based Student Activity Monitoring System for an Educational Institution"** is Submitted -ICSCSS Conference; **"In process of publication"** by **"Janhavi Kulkarni, Simran Choudhary, Loveritu Itnare".**