Attendance automation using face recognition

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

CSE1901-Technical Answers for Real world Problems(TARP)

A project report submitted by

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in partial fulfillment for the award of the degree

Bachelor of Technology
in
Computer Science and Engineering

VIT®
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November - 2023

Introduction:-

Attendance automation with image recognition integrates advanced computer vision technologies to revolutionize traditional attendance tracking methods. Utilizing algorithms, the system analyzes images or video feeds to identify and register individuals present in each space. This innovative approach minimizes manual efforts and human errors associated with traditional methods, offering seamless and accurate attendance management. Applied across educational institutions and workplaces, it enhances efficiency, reduces administrative burden, and provides real-time insights. The technology showcases the potential to transform various sectors, offering a reliable, automated solution for tracking attendance while promoting a more streamlined and digitally advanced environment.

Objectives:-

- Develop a user-friendly attendance automation system using image processing techniques.
- Design an intuitive interface for administrators to manage and monitor attendance records.
- Capture high-quality images of attendees using cameras or mobile devices.
- Implement face detection and recognition algorithms to extract faces and identify individuals.
- Create a secure database to store attendance records and associate them with identities.
- Enable real-time attendance processing and updates.

Sustainable Development Goals:-

Quality Education :This goal focuses on ensuring inclusive and equitable quality education for all. Automating attendance using image processing can contribute to this goal by:

- ➢ Improving attendance tracking accuracy, which leads to better student engagement and learning outcomes.
- ➢ Enhancing administrative efficiency, allowing educators to focus more on teaching and students' individual needs.
- ➢ Providing a fair and transparent system that promotes inclusivity and equal access to education.

List of modules:-

1. User authentication
2. Camera access
3. Attendance taking
4. Data storage

Detailed explanation of the modules:-

1. **User authentication:**

The web page serves as a secure login gateway where users inputted their credentials. Server-side validation ensures only authorized users access the system. Users are assigned roles (admin/teacher), dictating their privileges. This controlled access prevents unauthorized actions. By combining secure validation and role-based access, the system safeguards data and functionality.

2. **Camera access:**

Our classroom attendance system employs advanced image recognition, offering camera access through live capturing or picture uploading. Users have the flexibility to adjust and rotate the camera for optimal coverage. The system accurately identifies individuals, generating an Excel sheet with student names, time, and date. Whether through live feeds or uploaded images, it ensures reliable recognition. The user-friendly interface allows easy camera adjustments, adapting to various classroom layouts. Real-time processing updates the Excel sheet instantly, streamlining attendance tracking for educators. This innovative system simplifies administrative tasks, providing a precise and efficient approach to classroom management.

3. **Attendance taking:**

1. Button Design: Add a "Take Attendance" button near the classroom selection dropdown on the website's interface.

2. Camera Activation: When the button is clicked, initiate the camera feed for the selected classroom .

3. Face Detection: Utilize face detection algorithms to identify students in the camera feed.

4. Attendance Marking: Analyze detection results to mark students as "Present" or "Absent" based on their presence in the camera feed.

5. Database Update: Update the attendance records in the database or an Excel sheet with the marked attendance information.

Explanation:

The "Take Attendance" button provides a user-friendly method to initiate attendance tracking. When clicked, it activates the camera feed for the

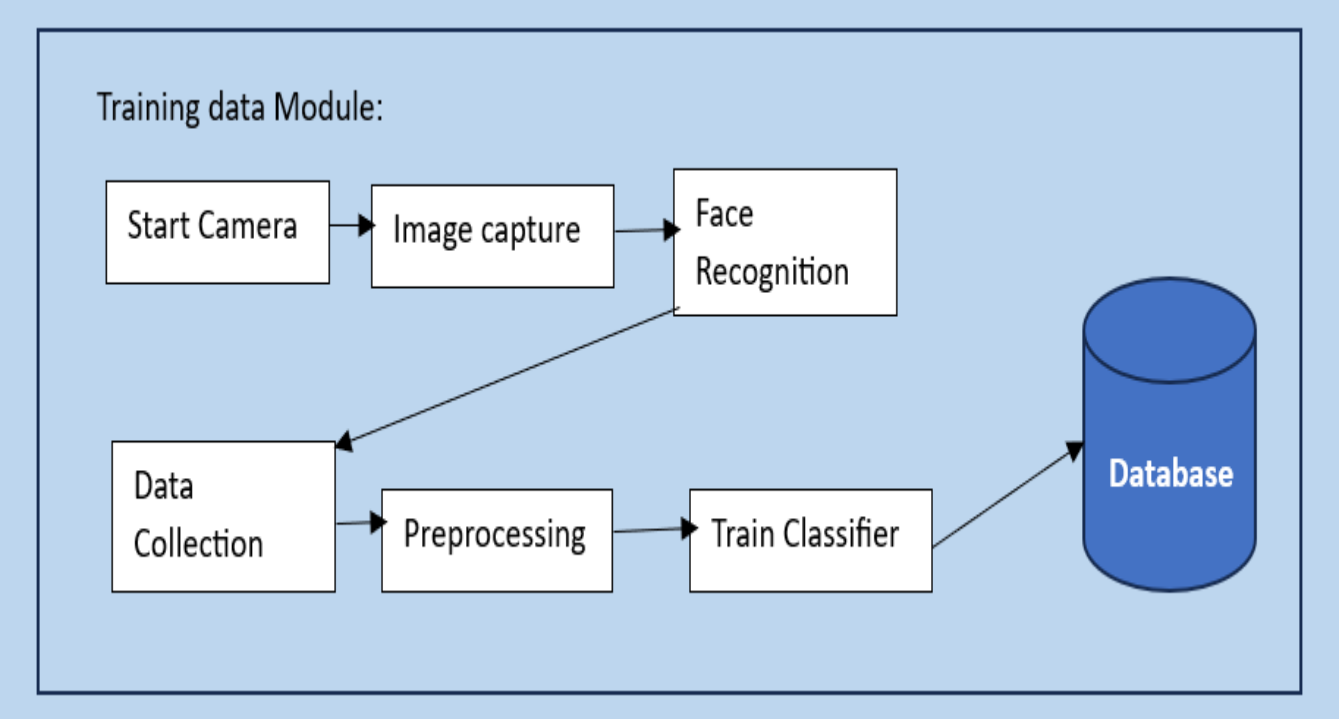
chosen classroom . Our face detection technology system identifies students present in the camera feed. Based on this detection, the system automatically marks students as "Present" or "Absent." Or the faculties can upload a picture of the classroom with students, the system will recognize it and generate an excel sheet.

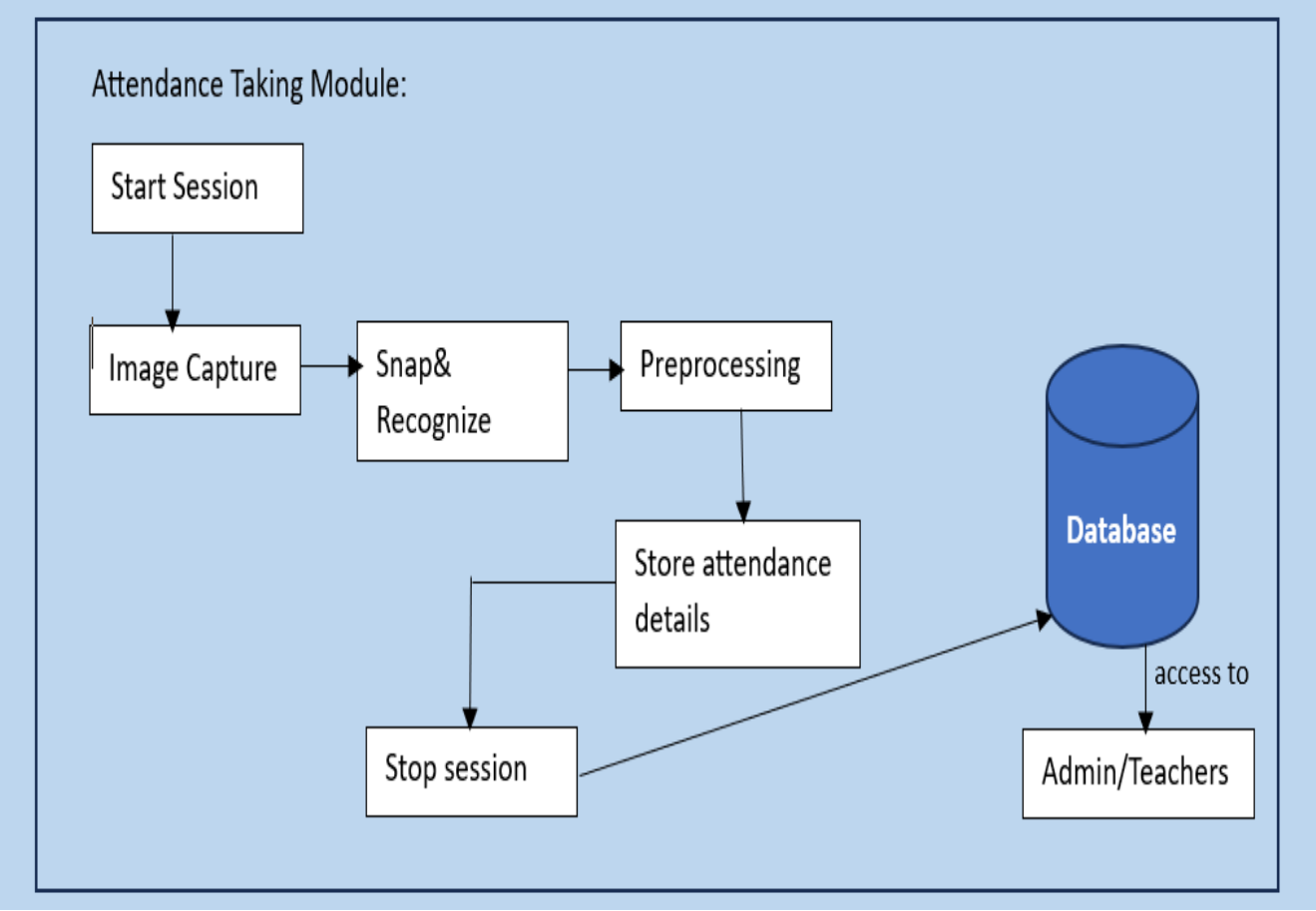
This automated process streamlines attendance management and reduces manual effort. The attendance data is then updated in Excel sheet, ensuring accurate record-keeping and the faculties can use this Excel sheet in VTOP for marking attendance thereby reducing the time for taking attendance.

4. **Data storage:**

Our classroom attendance system currently relies on local storage in the form of Excel sheets. In the future, we plan to integrate and link these storage files seamlessly with cloud storage solutions. This transition aims to enhance data accessibility, security, and remote retrieval for educators. By leveraging cloud storage, we ensure scalability and reliable backup redundancy, aligning with modern data management practices. This strategic shift optimizes our approach to classroom attendance tracking.

Architecture:





Individual Contribution:

Database connection and integration, backend: Ganesh V

Preprocessing, Model building: Santhoshkumar

Visualization, Technical Report writing: Harini S

Presentation Preparation, Camera: Mahir

Website Building: Santhoshkumar, Arvind Narayanan

Hardware requirements:-

- A camera: This is the main sensor that will be used to capture images of the faces of the people being attended. The camera should have a resolution of at least 720p to capture clear images.
- A computer: The computer will be used to run the software that processes the images captured by the camera and identifies the faces. The computer should have a processor that is fast enough to handle the image processing tasks.
- Storage: The computer will need to store the images captured by the camera, as well as the data about the people being attended. The amount of storage required will depend on the number of people being attended and the frequency of attendance taking.
- Internet connectivity: The computer will need to be connected to the internet to download the software and update the database of faces.

Software requirements:

➔ Operating System:

- ◆ Windows 7 or higher, Linux, or macOS .

➔ Programming Language for website building and terminal usage:

- ◆ Python 3.9

➔ Face Recognition Libraries:

- ◆ OpenCV: A library for computer vision tasks.
- ◆ Face detection : YOLO 5
- ◆ Face recognition: Resnet

➔ Database Management System:

- Local Storage
- AWS S3 (Cloud)

➔ Frontend and Backend:

- HTML
- CSS
- JavaScript
- Django

Field Study:-

Field : CTS
Location : VIT Chennai
Proof
(Audio reference link) :
https://drive.google.com/file/d/1x8QR6jYMNXHcmhx3YlbZa90ZzXV1II16/view?usp=sharing

Suggestions and
Discoveries : Our project team conducted a thorough field study, including a visit to Cyber Technical Solutions (CTS), a reputable provider of security solutions. Following insightful discussions with CTS experts, we gained valuable recommendations for our attendance automation system.

CTS emphasized the paramount importance of security and advised against compromising on this aspect. They recommended wired cameras over wireless solutions to ensure robust and consistent connectivity, minimizing potential vulnerabilities. In line with their security-oriented approach, CTS emphasized the need for a camera with a

minimum resolution of 5 megapixels. This resolution ensures that captured images retain exceptional clarity, vital for accurate recognition. Furthermore, CTS recommended a camera equipped with three lenses, a feature that enhances the system's ability to capture diverse angles and optimize facial recognition accuracy. By integrating these expert suggestions, we aim to develop a dependable attendance automation system that prioritizes security, clarity, and precise recognition, meeting the highest standards set forth by industry leaders like CTS.

Field : Camera(selection)
Location : Kolathur
Number :9840455322
Proof :
https://drive.google.com/drive/u/0/folders/1L4dLl5bpDFh7j6fKAhvr7mpIUm0uOrv8
Suggestions and
Discoveries : A 5-megapixel camera can offer exceptional benefits within its scope, especially when considering a wide range of applications and quality demands. While the megapixel count is just one factor contributing to image quality, a 5MP camera can strike a balance between resolution and image size. For certain uses like surveillance systems, industrial applications, or specific scientific imaging where precision and clarity matter more than large file sizes, a 5MP camera can deliver excellent quality without generating excessively large image files. The balance it strikes between resolution and manageable file sizes makes it suitable for various purposes, including detailed imaging for microscopes, efficient monitoring in security setups, or even high-quality snapshots for everyday use. Furthermore, the advancements in sensor technology and image processing capabilities ensure that a 5MP camera of today can provide remarkable clarity and detail, sometimes surpassing cameras with higher megapixel counts due to improved sensor quality and optimized image processing algorithms. Therefore, when considering a camera's versatility, capacity to deliver quality within a manageable file size, and advancements in image sensor technology, a well-equipped 5MP camera can often stand out as an excellent choice compared to higher megapixel cameras for specific use cases.

Algorithm used:-

Import Libraries:

- ➔ Import necessary libraries, including PyTorch, OpenCV, and others.
- ➔ Load Models:

- ➔ Load YOLOv5 face detection model (model) and InsightFace face recognition model (model_emb).
- ➔ Choose the appropriate models based on the specified cases.
- ➔ Preprocessing Functions:

- ➔ Define functions for resizing images (resize_image), scaling coordinates (scale_coords_landmarks), and creating a CSV file (create_csv_file).
- ➔ Face Detection:

- ➔ Define a function get_face that takes an input image, resizes it, uses YOLOv5 for face detection, and returns bounding boxes (bboxs) and landmarks.
- ➔ Face Recognition:

- ➔ Define a function get_feature to extract facial features using the InsightFace model.
- ➔ Define a function recognition to match detected faces with stored face features and save recognized faces to a CSV file.
- ➔ Main Function:

- ➔ Initialize variables and constants.

- ➔ Create a CSV file if it does not exist.
- ➔ Check if a test image folder exists and recognize faces from images, or recognize faces from the camera feed.
- ➔ Save the camera feed frames into a video file.
- ➔ Execution:

- ➔ Run the main function.

Output Screenshots:

Method 1:

Live capturing (Video drive link) :

https://drive.google.com/file/d/1xsliffqDswu_kQAwsnYj2bJrhkdHBFQP/view?usp=sharing

Output:

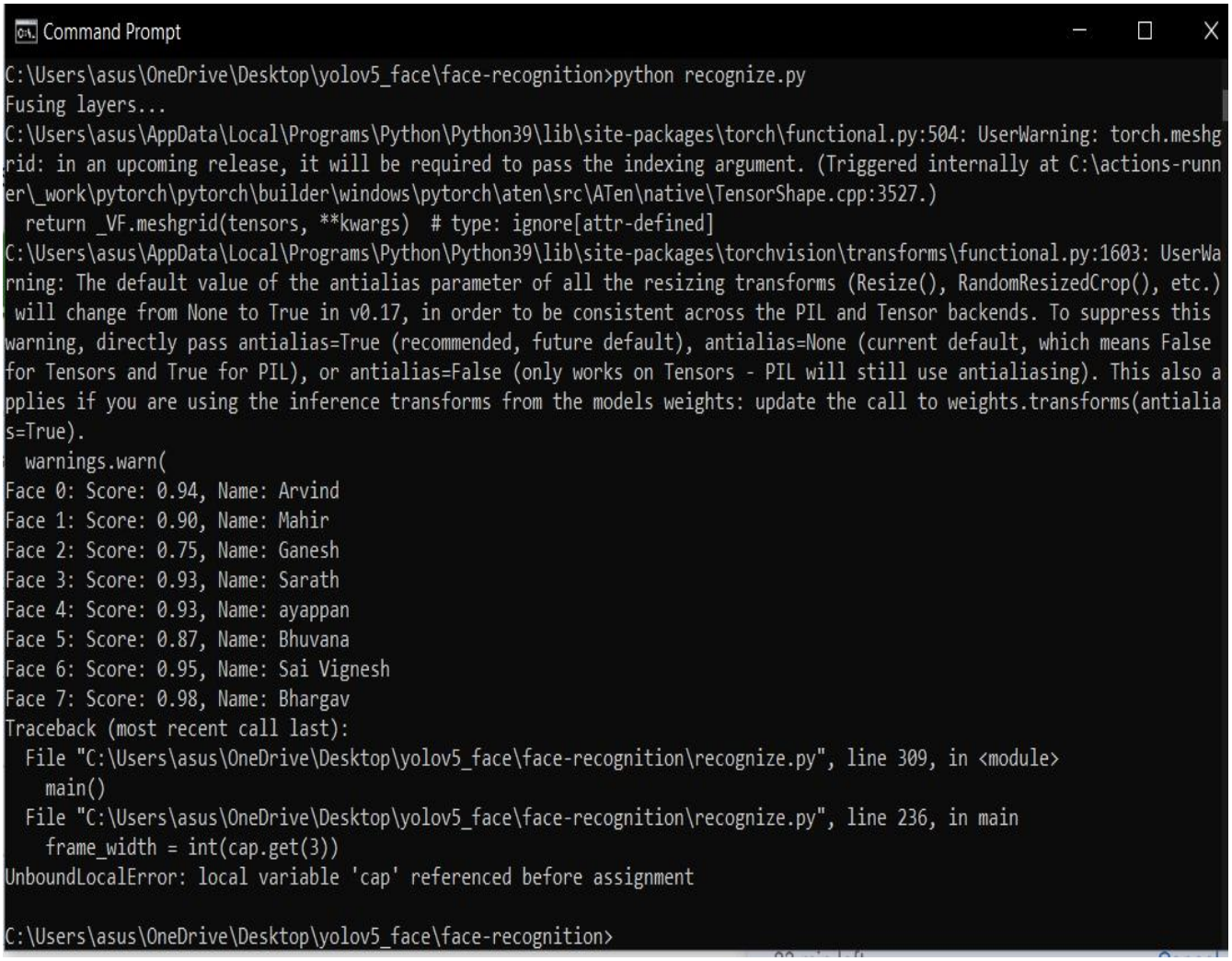
	A	B	C
1	Name	Date	Time
2	Arvind	#########	12:58:51
3	Unknown	#########	12:58:57
4	Unknown	#########	12:59:02
5	Bhargav	#########	12:59:12
6	Roshan	#########	12:59:20
7	SanthoshK	#########	12:59:53
8	Unknown	#########	01:00:02
9			
10			

Method 2:

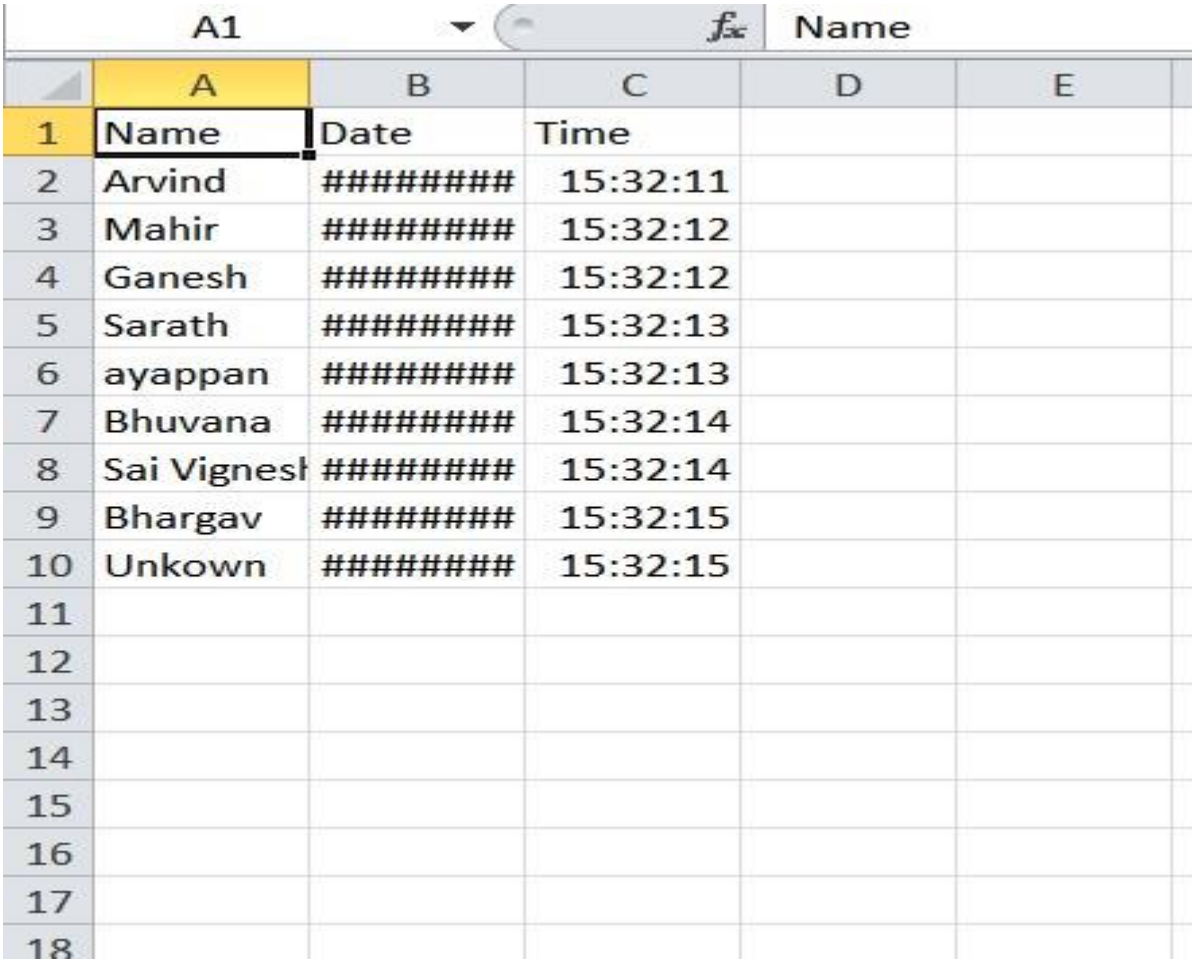
Using image as input:

Output:

Terminal->



Final Excel sheet outcome:



	A	B	C	D	E
1	Name	Date	Time		
2	Arvind	#########	15:32:11		
3	Mahir	#########	15:32:12		
4	Ganesh	#########	15:32:12		
5	Sarath	#########	15:32:13		
6	ayappan	#########	15:32:13		
7	Bhuvana	#########	15:32:14		
8	Sai Vignesh	#########	15:32:14		
9	Bhargav	#########	15:32:15		
10	Unkown	#########	15:32:15		
11					
12					
13					
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16					
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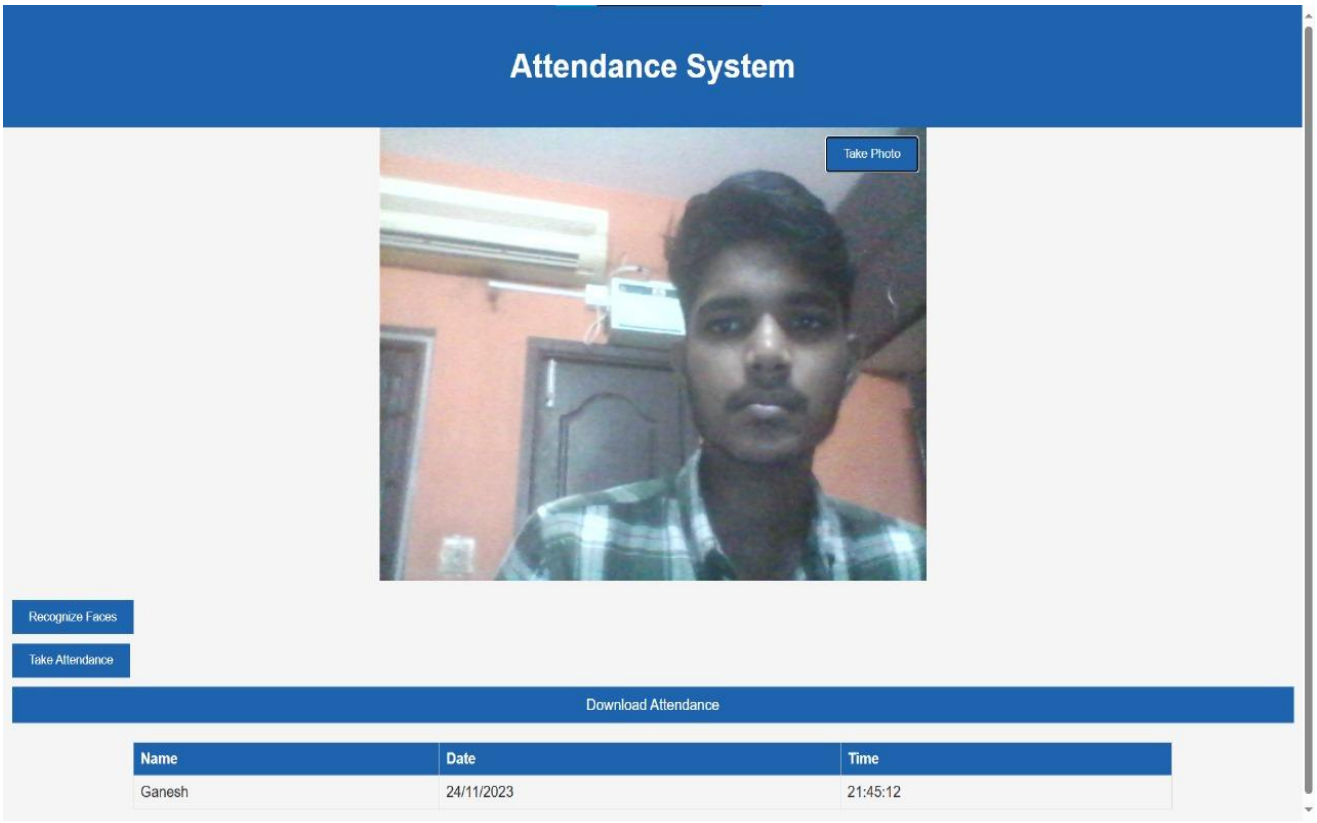
18					

Website screenshot:-



Project code:-

https://drive.google.com/drive/folders/1xrFr-dA_BxRlljRgLfU9Qy61Wgvf9SZZ

Camera suggestions:-

https://drive.google.com/file/d/1m9G7qAjC4mMwt6OnXfIXEr0J7dKZklYY/view?usp=sharing

Limitations and Challenges:

- Accuracy and Reliability
- Privacy Concerns
- Real-time Processing
- Integration and Compatibility
- Ethical Considerations
- Adaptability to Environmental Changes
- Balancing Speed and Accuracy
- Variable Environmental Conditions
- Complexity of Facial Variations

References:

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