

AI-Based Face Recognition Attendance System for Automated and Contactless Attendance Management

Sakhi Deopraakash Dubey

Department of Science and Technology, G.H.Raisoni Skill Tech University, Nagpur, India

ABSTRACT

Face Recognition Attendance Systems are ways to track attendance in places like schools, offices and workplaces. Old methods like using registers RFID cards or fingerprint scanners have problems. For example people can ask others to mark them it takes a lot of time and there are hygiene issues.

The Face Recognition Attendance System uses Artificial Intelligence and machine learning to recognize people by their faces. A camera captures the faces and the system checks them against stored data to see who is present. This happens in time.

Using this system makes attendance tracking more accurate. It reduces mistakes prevents people from marking others present and lets managers monitor attendance in time. Also it is a contactless process, which's more efficient and cleaner than old methods. The Face Recognition Attendance System helps organizations to track attendance in a way. Face Recognition Attendance Systems are useful, for places.

Keywords: Face Recognition, Biometric Authentication, Attendance Management System, Artificial Intelligence, Machine Learning, Computer Vision, Facial Embedding, Automation.



This is an open-access article under the [CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/) license

I. Introduction

Attendance management is really important for organizations, schools and workplaces. We still use methods like signing our names in a book or using a fingerprint scanner. These methods have a lot of problems. Signing our names in a book takes a time and people can make mistakes. Fingerprint scanners need us to touch them. Sometimes they do not work because of technical issues.

Face recognition is a way to solve this problem. It uses a computer to look at our faces and figure out who we are. This computer uses tools to find our faces look at the unique features and match them with the pictures it has stored. The Face Recognition Attendance System uses a camera to take our picture. Then it uses a special computer program to figure out who we are. When it knows who we are it writes down that we are present in a computer database along with the time and date. This way is faster and more accurate and safe, than the methods. The Face Recognition Attendance System is an idea because it saves time and it is harder to cheat the system. The Face Recognition Attendance System is also easy to use because all we have to do is stand in front of the camera and the Face Recognition Attendance System does the rest. Face recognition is a way to solve this problem. It uses a computer to look at our faces and figure out who we are. This computer uses tools to find our faces look at the unique features and match them with the pictures it has stored. The Face Recognition Attendance System uses a camera to take our picture. Then it uses a special computer program to

figure out who we are. When it knows who we are it writes down that we are present in a computer database along with the time and date. This way is faster and more accurate and safe, than the methods. The Face Recognition Attendance System is an idea because it saves time and it is harder to cheat the system. The Face Recognition Attendance System is also easy to use because all we have to do is stand in front of the camera and the Face Recognition Attendance System does the rest.

Proposed AI-Based Solution

The new attendance system will use intelligence to work. It will have computer vision and deep learning. These will help it recognize peoples faces. The system will take pictures with a camera. Then it will use algorithms to find faces in the pictures. The intelligence model will look at each picture. It finds parts of a persons face. These parts get turned into numbers. Computers can understand these numbers. We call these numbers embeddings. The system compares these embeddings to ones in its database. If it finds a match it marks the person as present. The database gets updated with information. The attendance system has a part for administrators. They manage peoples information. Administrators can see who was present. They can make reports, about attendance. The attendance system is really an intelligence attendance system. It makes things easier. The intelligence attendance system helps with managing attendance. It uses intelligence to make attendance tracking easy. The system helps administrators with attendance reports. It keeps track of peoples attendance. The attendance system is helpful.

Motivation

The reason we made the Face Recognition Attendance System is because the old ways of tracking attendance are not good enough. The old systems where people have to mark their attendance are not efficient and people can easily cheat. The systems that use fingerprints are also not good because they need machines and people have to touch them.

Now that we have technology, like artificial intelligence and computer vision we can use Face Recognition to track attendance. This way is better because it is fast, accurate and people cannot cheat by sending someone in their place. The Face Recognition Attendance System also helps companies keep attendance records that're safe and honest.

II. Related Work

Face recognition is really helpful for attendance systems. Some people like Kamencay and his team checked into face recognition back in 2018. They found out that it works well for managing attendance. Thats a big help. Face recognition makes things easier for attendance systems. People have also tried using algorithms like Convolutional Neural Networks and FaceNet to make face recognition work better.

For example Kumar and his team came up with a system in 2020 that uses these algorithms to find and recognize faces accurately. This helps face recognition to work properly. Thats a good thing for face recognition.

Nowadays face recognition has gotten much better because of improvements in machine learning and artificial intelligence. This means that face recognition can be used for things like attendance management and access control systems and it is really good for these kinds of things. Face recognition is very useful not for attendance systems but for other things too. I think face recognition is useful, for things, including attendance systems because it is helpful. Face recognition technology is really good. It helps a lot with face recognition.

III. Research Methodology

The way we do research for the proposed system has a lot of steps. We have to collect data get it ready find the parts and recognize faces.

First we take pictures of peoples faces using a camera. Then the system looks at these pictures to find the faces. It uses algorithms to do this. After it finds the faces it uses learning models to get the important features from the faces. We turn these features into something called embeddings. We store these embeddings in a database, with the persons details. When we mark attendance the system takes a picture and compares the features from this picture with the embeddings we stored. This helps us figure out who the person is. The system uses face recognition to do this. It is an important part of how the proposed system works. We use face recognition to identify people.

Phases of Face Recognition Attendance System Project Development

1. Face Detection

The system starts by finding and locating faces from the camera or video. It uses tools like Haar Cascade or Convolutional Neural Networks to find faces in real time. Face detection is an important step. The system has to detect faces to move on to the step.

2. Face Preprocessing

Now the system gets the face images ready for recognition. It makes the images a little smaller fixes the brightness gets rid of things and makes sure the faces are straight. This helps the recognition tool work correctly. Face preprocessing is necessary for face recognition.

3. Feature Extraction

The system looks at the face. Finds important things like how far apart the eyes are, the shape of the nose and the face shape. It turns these things into numbers that're like a special code for each person. These codes are called embeddings. Facial embeddings are used to tell people

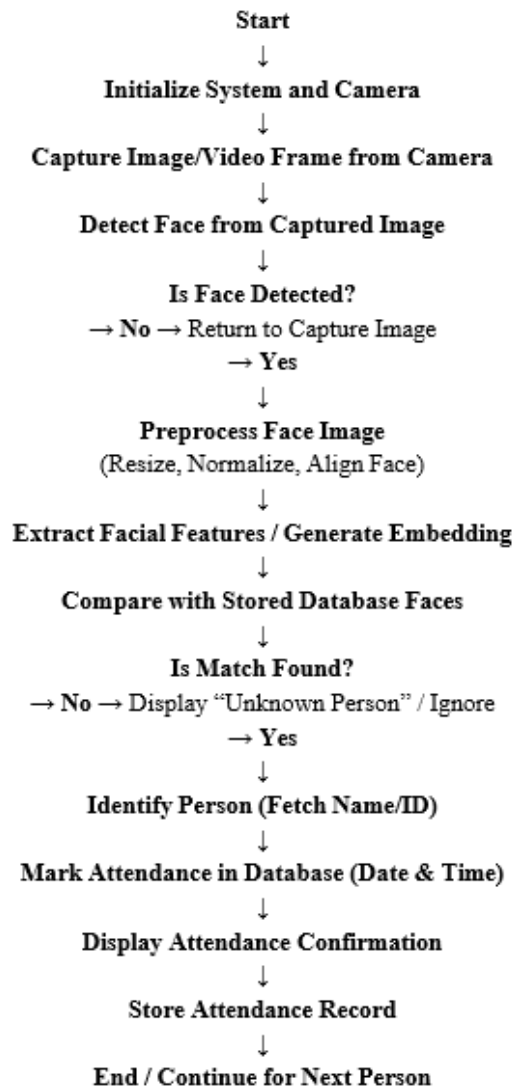
4. Face Recognition

The system compares the features with the codes it already has in the database. If it finds a match it knows who the person is. Face recognition is when the system uses the embeddings to identify someone.

5. Attendance Recording

When the system knows who the person is it marks them as present. Saves their name, date and time in the database. This helps with making reports. The system records attendance, for each person. Attendance recording is the step.

□ **Flowchart of Face Recognition Attendance System (Text Form)**



Data Preprocessing and Analysis

1. **Collecting Information :** We take pictures of people with a camera when they sign up. These pictures help teach the recognition model to identify them.
2. **Data Cleaning :** We review the collected pictures. Remove any that are not good. We get rid of unclear images so the recognition model can work properly.
3. **Data Transformation:** We convert the pictures into a format that computers can understand.
 - **Text Processing :** Although we mainly work with pictures we also look at information like names and IDs. This helps us store them in a database.
 - **Normalization:** We make all pictures consistent by resizing them adjusting brightness and aligning faces.
4. **Data Analysis**
 - **Descriptive Analysis:** We examine attendance to see things like daily attendance numbers and who is frequently absent.
 - **Correlation Analysis:** We try to find out if there's a link, between peoples attendance patterns and the time of day.

- **Feature Selection** : We use models to identify features of people's faces. This helps the recognition model work effectively.
- **Visualization** : We use charts and dashboards to display attendance data in a way.
- **Bar charts are one way to do this.**
- **Word clouds are another way.**
- Graphs also help to show the data patterns.

5. Outcome : The system works well. Can track attendance automatically with little human help. It saves time. Prevents people from pretending to be someone else.

Proposed Algorithm

- ✓ The proposed algorithm has the following steps:
- ✓ First we need to take a person's face picture using a camera.
- ✓ We get the face image of the person using the camera.
- ✓ Next we find the face in the picture. We use either Haar Cascade or a CNN model to do this.
- ✓ The face detection process uses Haar Cascade or a CNN model to identify the face.
- ✓ Then we take out details from the face picture. We use FaceNet or a similar model for this.
- ✓ FaceNet or a similar model helps us extract features from the picture.
- ✓ After that we change these features into codes called embeddings.
- ✓ We convert the features into embeddings for comparison.
- ✓ A person's attendance is marked when their face image matches one in the database.
- ✓ Finally we save the attendance information along, with the date and time.
- ✓ The attendance data, including date and time is stored for each face image.

V. Proposed Solution

The new system uses intelligence and computer vision and database management to make an automated attendance system. This automated attendance system makes sure that it identifies people correctly and records attendance in time. The automated attendance system also has an administrative interface that is easy to use. The automated attendance system is really useful because it does all these things.

Main Parts of the Face Recognition Attendance System

1. Face Detection Part

The Face Recognition Attendance System has a part called Face Detection that searches for faces in pictures or videos from the camera. It finds the faces. Figures out where they are in the picture or video. The Face Recognition Attendance System uses this Face Detection part to get things started.

2. Face Recognition Part

The Face Recognition part of the Face Recognition Attendance System figures out who each person is. It does this by looking at the features of each face and comparing them to the faces that are already stored in the database. The Face Recognition Attendance System uses the Face Recognition part to know who is who.

3. Database Management Part

The Face Recognition Attendance System stores information in a system called Database Management. This system is like a filing cabinet for the Face Recognition Attendance System. It stores information, about faces and user details and attendance records. So we can look at this information later.

4. Attendance Management Part

The Attendance Management part is a part of the Face Recognition Attendance System. It marks people present automatically when it sees their face. The Attendance Management part also makes reports so we can see what is happening with the Face Recognition Attendance System. We can use these reports to understand what is going on and know what is happening with the Face Recognition Attendance System. The Face Recognition Attendance System uses the Attendance Management part to keep track of everything.

Steps included in Data Preprocessing:

The Data Preprocessing

Data preprocessing is an important part of making a Face Recognition Attendance System. It is about getting the raw facial image data ready so that it can be used by machine learning algorithms. When you do this step properly it makes the recognition system more accurate, reliable and efficient. This means that the input data is clean, structured and good for analysis.

1. Data Collection

The first thing you do in data preprocessing is collect images of the people who will use the attendance system.

2. Data Cleaning

After you collect all the data the next step is to clean it up. This means getting rid of any quality, blurry or duplicate images that might make the recognition model not work as well. You get rid of pictures that have more than one face or were not taken properly. Cleaning the data makes sure that only good relevant images are used to train and recognize faces.

3. Data Transformation

Data transformation is when you change the images you collected into a format that machine learning can use. This can mean making all the pictures the size turning them into grayscale if needed adjusting how bright and clear they are and making sure the pixel values are all the same. The system might also make sure the faces are all lined up so that the eyes, nose and mouth are in the place. This helps the recognition algorithm work with the images better.

4. Data Integration

Data integration is when you combine the facial image data with information in one database. The facial embeddings from the images are linked with the persons details like their name, ID number and attendance record. Putting all this data from different sources makes it easy for the system to find and update attendance information when someone is recognized.

5. Feature Selection

Feature selection is finding the important things about a persons face that make them different from someone else. Machine learning models look at things like how apart someones eyes are, the shape of their nose and the shape of their face. By picking the important features the system can recognize people more accurately and it is not as hard, on the computer.

Outcome of Data Preprocessing

When you are done with data preprocessing you have an organized and standardized dataset that the face recognition model can use easily. Doing this step properly makes the system work a lot better by reducing mistakes and making sure it can identify people correctly. The Face Recognition Attendance System works well because of data preprocessing. Data preprocessing is what makes the Face Recognition Attendance System accurate.

RESULT EVOLUTION AND ANALYSIS

The system was checked for how it works how fast it is and how much we can rely on it. The tests we did showed that the face recognition system really helps to cut down on mistakes made by people and makes tracking attendance quicker. The system was really good at recognizing people who are registered and automatically marking them as present. The results show that using AI to recognize faces can work well as a replacement, for fashioned ways of tracking attendance. The face recognition system gives results and makes it easier to track attendance. The AI-based face recognition system is efficient and reliable.

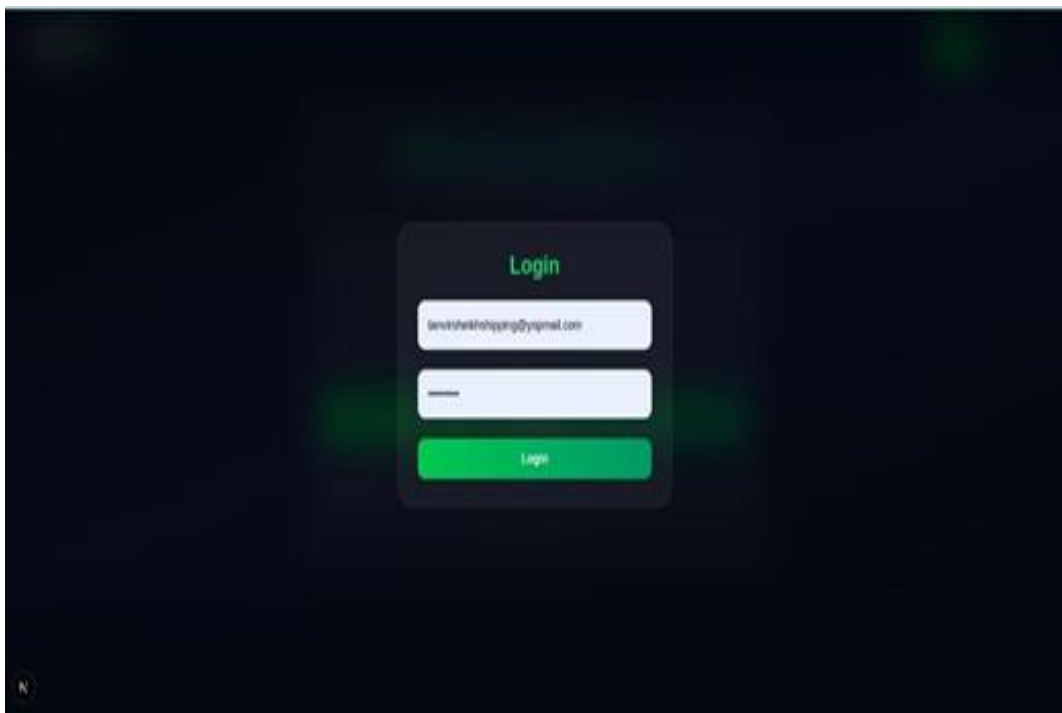


Figure 1: User Login Interface of the System

The picture shows the Login Interface of the FFace Recognition Attendance System or Web Application. This is where people who have signed up can get into the system by putting in their email address and password. The login page looks really nice with a theme and a special box in the middle where you can log in. This page has spaces where you can put in your email and password and a button that says Login. When you click this button the system checks your information to make sure it is correct. If everything is okay you can then use the Face Recognition Attendance System and all its features, such as checking if newss real looking at it closely and using the dashboard.

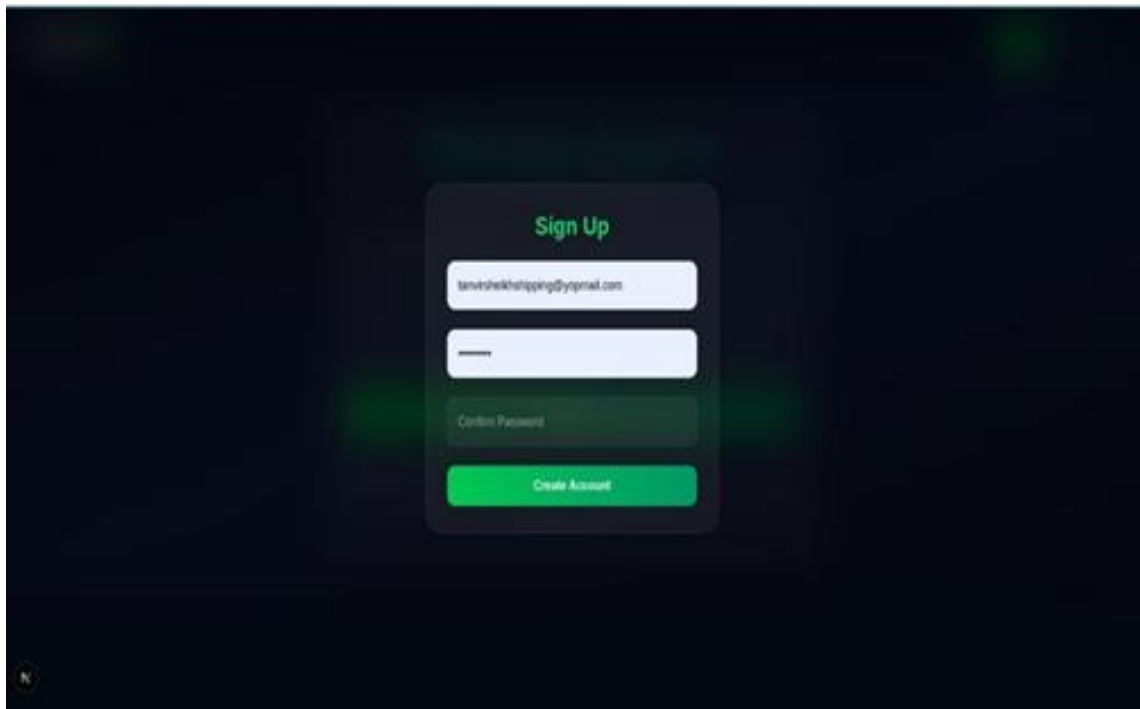


Figure 2: User Registration (Sign Up) Interface

The picture above shows how new users sign up to use the system. This is where people can create an account and get access to the system. The design of the system is easy to use. It looks clean. It has a background that makes the form easy to see on the system. When users are done filling in all their details they click the Create Account button to complete the sign up process for the system. Their details are then added to the system. After users have signed up for the system they can log in to the system using their email address and password for the system. The sign up part of the system is important for keeping user information safe and secure for all users of the system. It also makes sure that only the right people can use the system. The system keeps track of who's using the system and what they are doing on the system. Only people with an account can use the system. Only people with an account, for the system can use the system.

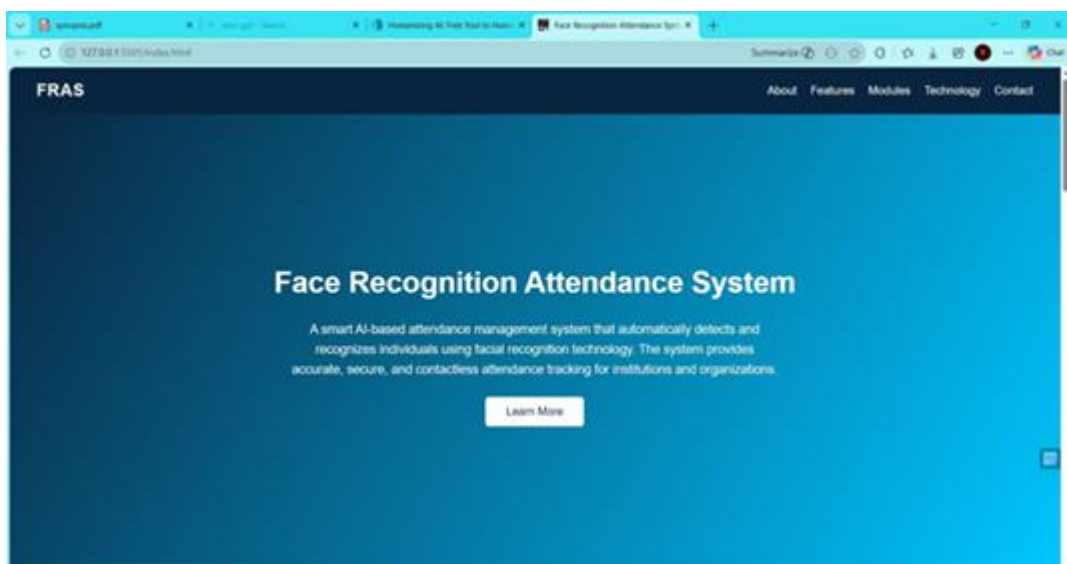


Figure 3: Main Analysis Interface – Home page

The Home Page of the Face Recognition Attendance System is like a page. It tells you what the Face Recognition Attendance System website is about. The Face Recognition Attendance System is a

project that uses recognition to track attendance. This makes things easier and more accurate than the ways of tracking attendance. The Home Page of the Face Recognition Attendance System explains how the Face Recognition Attendance System is better than the ways. It is more efficient and secure. The Home Page of the Face Recognition Attendance System also shows the title of the project and a short description. This helps people understand what the Face Recognition Attendance System is and what it does.

The Home Page of the Face Recognition Attendance System is where you start when you visit the website. From the Home Page of the Face Recognition Attendance System you can go to parts of the website. You can learn about the features of the Face Recognition Attendance System the modules it uses the technologies, behind it and how to contact the people who made it.

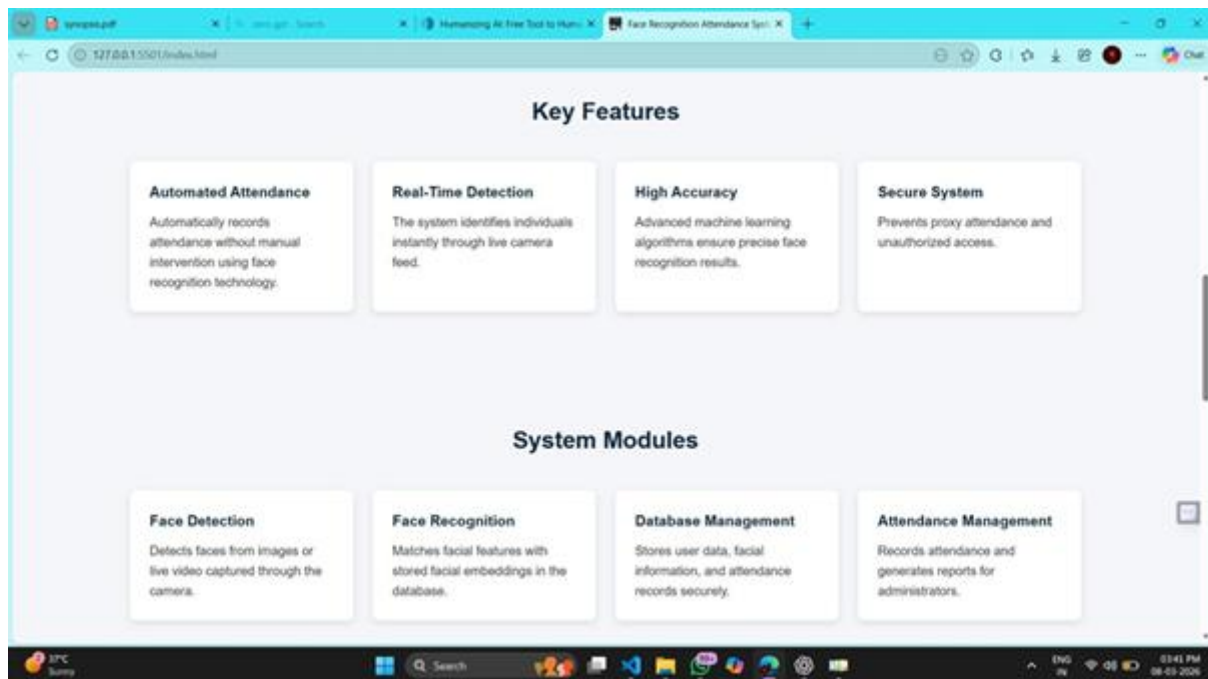


Fig: 4: Key Features and System Modules Description

The Face Recognition Attendance System has some cool features. The Face Recognition Attendance System is made up of parts that all work together to make it run smoothly. The Face Recognition Attendance System uses technology and computer vision and a way to manage data to work really well.

The Face Recognition Attendance System has a feature called Automated Attendance. This Automated Attendance feature lets the Face Recognition Attendance System take attendance without anyone having to lift a finger. The Face Recognition Attendance System uses facial recognition technology to find people and verify who they are and mark them present. This helps cut down on the work people have to do and the mistakes they make.

The Face Recognition Attendance System can spot people away. The Real-Time Detection feature lets the Face Recognition Attendance System find people soon as they step in front of the camera. The

Face Recognition Attendance System takes a look at the face processes it to figure out who it is and that helps the Face Recognition Attendance System keep track of attendance quickly.

The Face Recognition Attendance System is really good at getting it right. The High Accuracy feature makes sure the Face Recognition Attendance System identifies people correctly. The Face Recognition Attendance System uses formulas to look at the features of a face and match them with data it has stored. This makes the results really precise.

The Face Recognition Attendance System is also very safe. The Secure System feature stops people from taking attendance for someone. Since attendance is based on the features of a person's face it is hard for someone to take attendance for them. The Face Recognition Attendance System is made up of modules. The Database Management module stores user attendance records, in a place. The Attendance Management module takes attendance automatically. Makes reports that administrators can use to look at attendance data.

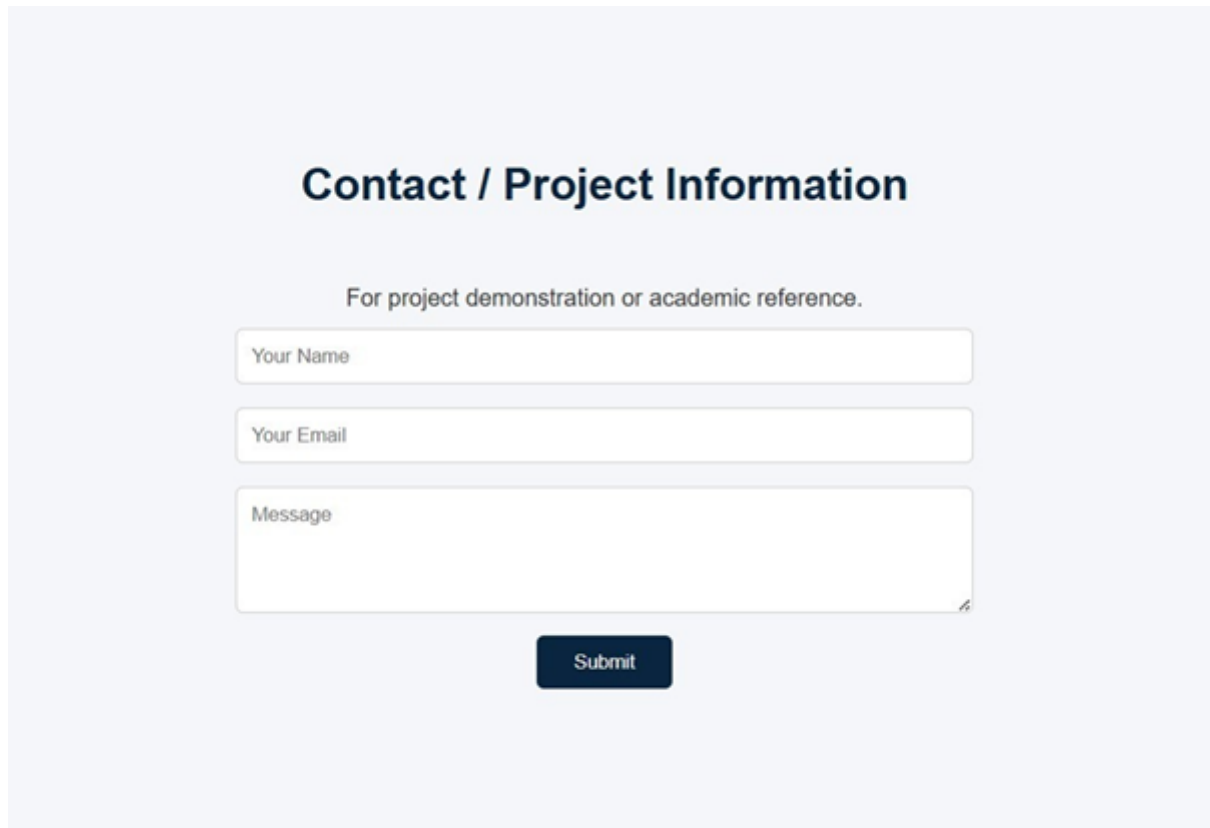
A screenshot of a web form titled "Contact / Project Information". Below the title is a subtitle "For project demonstration or academic reference." The form contains three input fields: "Your Name", "Your Email", and "Message". The "Message" field is a larger text area. At the bottom of the form is a dark blue "Submit" button.

Fig: 5: Contact Us Section

The Contact section is a way for users, administrators or evaluators to talk about the Face Recognition Attendance System project. It helps visitors send queries, feedback or requests about the project. They can ask about how the project's implemented how it works or how to see it in action. The section has spaces for the user's name, email address and message. This makes it easy for people to communicate in a way. The Contact section helps us interact with users. Makes it easy to share information about the project. It also helps us get suggestions, for making the Face Recognition

Attendance System project in the future. The Face Recognition Attendance System project team can then use this information to make improvements.

Conclusion

The Face Recognition Attendance System is a way to track attendance. It uses intelligence and computer vision to make it more accurate and secure. This system gets rid of methods, like manual registers and fingerprint scanners. The Face Recognition Attendance System makes tracking attendance more accurate. It also makes it more secure. This system is contactless. Makes managing attendance more efficient. Artificial intelligence will keep improving. So Face Recognition Systems will keep helping with security and monitoring.

References

1. O. M. Parkhi, A. Vedaldi, and A. Zisserman, "Deep face recognition," in *Proc. British Machine Vision Conference (BMVC)*, York, U.K., 2015.

2. F. Schroff, D. Kalenichenko, and J. Philbin, "FaceNet: A unified embedding for face recognition and clustering," in *Proc. IEEE Conf. Computer Vision and Pattern Recognition (CVPR)*, Boston, MA, USA, 2015, pp. 815–823.
3. P. Viola and M. Jones, "Rapid object detection using a boosted cascade of simple features," in *Proc. IEEE Computer Society Conf. Computer Vision and Pattern Recognition (CVPR)*, 2001, pp. 511–518.
4. I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. Cambridge, MA, USA: MIT Press, 2016.
5. R. Szeliski, *Computer Vision: Algorithms and Applications*, 2nd ed. Cham, Switzerland: Springer, 2022.
6. S. Z. Li and A. K. Jain, *Handbook of Face Recognition*, 2nd ed. London, U.K.: Springer, 2011.
7. H. Rowley, S. Baluja, and T. Kanade, "Neural network-based face detection," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 20, no. 1, pp. 23–38, Jan. 1998.
8. A. Krizhevsky, I. Sutskever, and G. E. Hinton, "ImageNet classification with deep convolutional neural networks," in *Proc. Advances in Neural Information Processing Systems (NIPS)*, 2012, pp. 1097–1105.
9. G. Bradski and A. Kaehler, *Learning OpenCV: Computer Vision with the OpenCV Library*. Sebastopol, CA, USA: O'Reilly Media, 2008.
10. S. Zafeiriou, C. Zhang, and Z. Zhang, "A survey on face detection in the wild: Past, present and future," *Computer Vision and Image Understanding*, vol. 138, pp. 1–24, Sept. 2015.
11. Usha Kosarkar, Gopal Sakarkar, Shilpa Gedam, "Deepfakes, a threat to society", *International Journal of Scientific Research in Science and Technology (IJSRST)*, 13th October 2021, 2395-602X, Volume 9, Issue 6, PP. 1132-1140, <https://ijsrst.com/IJSRST219682>