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Digital Polling System through Face Recognition and UID Verification

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Abstract: *The primary goal is to provide a manual voting system using a camera for facial recognition and OTP generation, as well as an online voting platform that will help reduce fraud in early online voting iterations. For voters who are unable to travel to the voting location (their hometown), we are also introducing a location-free voting mechanism. Here, we provide a system with many levels of authentication, including facial recognition and OTP verification with validation data, to guarantee the device's dependability. Every voter must be recognised and verified against the provided database of registered voters before they are allowed access to the system. The voter can move on to choose their chosen candidate from the panel once the matching face has been matched with the data given.*

Keywords: Smart Voting System, Digital Election System, Voter ID, OTP, Facial Recognition, winning party, python, OpenCV.

I. INTRODUCTION

In a democratic society, elections will inevitably occur, and it is the government's and the people's only obligation to ensure that they do so in a secure and orderly manner. The person is needed to register his face using this technique prior to the election, and the same is compared when voting. The desktop application programme is in charge of managing the Individual Database.A confirmation message with the words "voted successfully" is sent by the system when a citizen casts his ballot. Voting, stating their preferences, or expressing their opinions.The primary objective of this project is to ensure that a voting system is created utilising facial recognition technology and an OTP system to allow voters to cast ballots from any location on Earth with an internet connection. The server database contains the voting-related data. Since the world is always evolving and must be adapted to in order to thrive and adhere to global norms. This innovative technology refers to online electronic voting systems that use a central database to facilitate smooth data transfers and accurate result calculation. To ensure a fair election, a smart voting system must be created and implemented.

1.1 Problem Statement

Even though our nation has made progress towards digitising India, the voting system still has significant shortcomings. For the existing method, voting can only be registered if individuals visit the polls. The voter's name appears in the list for his or her particular area while casting a ballot. They are unable to vote further than the voting card's listed address. Therefore, voters who have relocated to other locations are unable to do so physically. The vulnerability of this system is demonstrated by the current CoronaVirus epidemic. Due to the requirement that the voter be there in person to cast their ballot, this might result in a failure of social distance throughout the voting process.

1.2 Digital Voting

The voting process has changed from the old manual counting to an electronic voting system that uses paper, punch cards, optical scanners, and mechanical levers [1], This voting programme requires a lot of time to use. They cannot vote as a result due to India's enormous population, and voting is a highly laborious process for registered users [2].

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Through online voting, the secure online voting method resolves this issue. Voters can easily exercise their "voting rights" online via the "secure online voting system."

1.3 Facial Recognition in Machine Learning

Machine learning is used in the field of facial identification, which entails teaching a computer to spot and recognise people in photos and videos. This technology analyses and categorises facial traits such the space between the eyes, the shape of the nose and mouth, and the general structure of the face using deep learning algorithms and convolutional neural networks (CNNs). Large datasets of labelled photos are used to educate the computer how to recognise various faces while training a facial recognition model. Thousands or even millions of photos, each labelled with the name or identity of the individual in the image, are sent to the computer throughout this training process. Once trained, the face recognition model may be used to recognise people in pictures and videos automatically. From social media and entertainment to security and surveillance, this technology has a wide range of uses. Facial recognition poses privacy issues as well as the possibility of biases in the training data, both of which might provide unreliable or biassed results.

II. RELATED WORK

Online voting systems have been the subject of several studies and research papers, with an emphasis on their efficacy, usability, and security. The following are some relevant works on electronic voting systems:

[1] Advances in mobile device, wireless and web technologies have resulted in new applications that can make the voting process very simple and efficient. Electronic voting promises the possibility of convenient, simple and secure vote collection and counting in elections. This research project provides specifications and requirements for electronic voting using the Android platform. Electronic voting means the process of voting in an election using an electronic device. The Android platform is used to develop electronic voting applications. At first, an introduction about the system is presented through a general diagram. Sections II and III describe all the concepts (survey, design and implementation) that would be used in this work. Finally, the proposed e-voting system will be presented with the obtained results.

[2]Secure Online Voting System is an interactive voting system application with which users can vote from any location remotely using their information stored prior in the database securely. Online voting system involves transmission of ballots and votes via network. Security is maintained at different levels like while voting and at the time of transmission of ballots also.[5].An electronic voting system (e-voting) is a voting system in which election data is recorded, stored and processed primarily in the form of digital information. There are two types of electronic voting: online and offline. Online for example. Online and offline using voting machines or electronic voting booths.

[9].This paper proposes a new face recognition algorithm called local derivative tetra pattern (LDTrP). The new technique LDTrP is used to alleviate the face recognition rate under real-time challenges. Local derivative pattern (LDP) is a directional feature extraction method to encode directional pattern features based on local derivative variations.

[12].A local binary pattern (LBP) is a non-parametric descriptor that effectively summarises the local image structure.

In recent years, many areas of image processing and computer vision have been of increasing interest and have shown their effectiveness in several applications, especially facial image analysis, including various tasks such as face detection, face recognition, and facial expression analysis and demographic classification.

The obstacles that must be overcome to ensure the efficacy and validity of online voting systems are often highlighted in these connected publications, as well as the significance of building safe, open, and user-friendly systems.

2.1 Existing System

The existing voting method, which relies on both machines and paper ballots, is labour- and resource-intensive. Because this voting method manually counts the votes, it also has problems with the counting process. According to the current voting procedure, ballet machines display insignia from numerous political parties. The vote is finished when we select the choice with the political party insignia. Fake voting cards might be used by those with voting rights, which could lead to issues. To cast a ballot under the existing system, a person must go a considerable distance. It is vital to finish the election in one day since it takes a lot of staff to maintain order and security. The voting location and

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time are set in advance. Each polling place would be open for at least 8 hours on election day [3]. As we previously stated, a smart voting system offers a practical solution for improving the voting process as a whole. The web-based "smart voting" programme enables people to cast ballots using their smartphones.

III. PROPOSED APPROACH

Users must first register in the system by entering information such as Aadhar number, mobile number, city, age and password. The voter data set contains this data. When a user logs in, the system uses the webcam to capture the input image. To match patterns, these images are kept in a face dataset. You can vote by logging in with your Aadhar number and password. If validated correctly, the user will be taken to the next page where they can select a candidate to vote for. As soon as the user presses the voting button, the webcam is turned on and the user's face is verified using the provided dataset. If face authentication is successful, a one-time password will be sent to the user's registered mobile number.If the OTP is confirmed,the vote is considered successful. Admin announces the outcome of the voting procedure after the conclusion.

3.1 Components

Voter (User): In this case, the voter is crucial in choosing which candidate to support. The voter is a confirmed user who has been given admin permission to vote.
ML method: Machine learning is a method that trains voters to recognise candidates when it is time to cast their ballots.
Facial and OTP Verification: According to the suggested design, there are two ways to authenticate voters at voting time; facial recognition and OTP verification.

3.2 Used Algorithms

A. Local Binary Pattern Histogram

A discernible descriptor style used for computer vision classification is called local binary patterns (LBP). LBP was made into a special case from the 1990 Texture Spectrum model. The first time LBP was represented was in 1994. As a result, it has been utilised as a texture for identifying solid components. When LBP and the descriptor histogram of oriented gradients (HOG) are coupled, identification execution on some datasets is improved. Figure-1 shows the LBPH algorithm flowchart diagram.

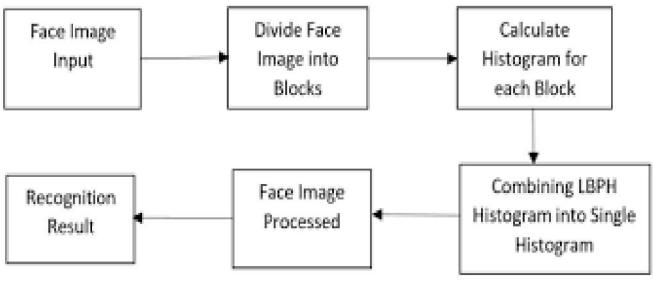

Fig-3.1: LBPH flowchart

To encode features, the input picture is partitioned into cells (4 × 4) of pixels. By carrying the surrounding pixel values either clockwise or anticlockwise, the contrast is achieved. Every neighbour's intensity value is compared to the value of the focal pixel. The location has been given a 1 or a 0 depending on whether the difference is higher or lower than 0. The results are an 8-bit value in a single cell. The following Figure-3.2 shows how the face is converted to gray scale and Figure-3.3 shows the conversion statistics.

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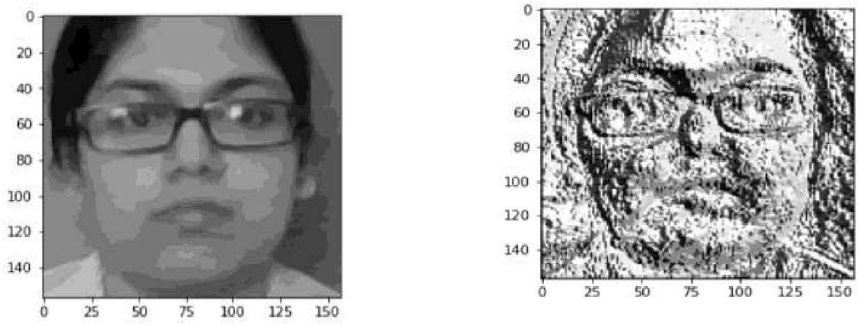

Fig-3.2: LBPH for Face Recognition

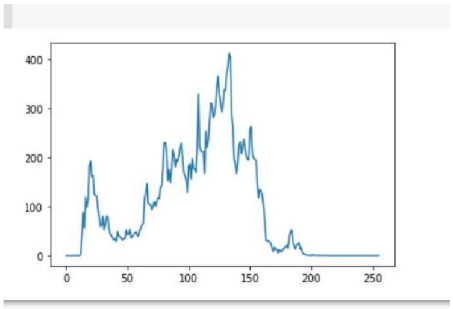

Fig-3.3: Histogram of Face By LBPH

B. Haar Classifier Algorithm

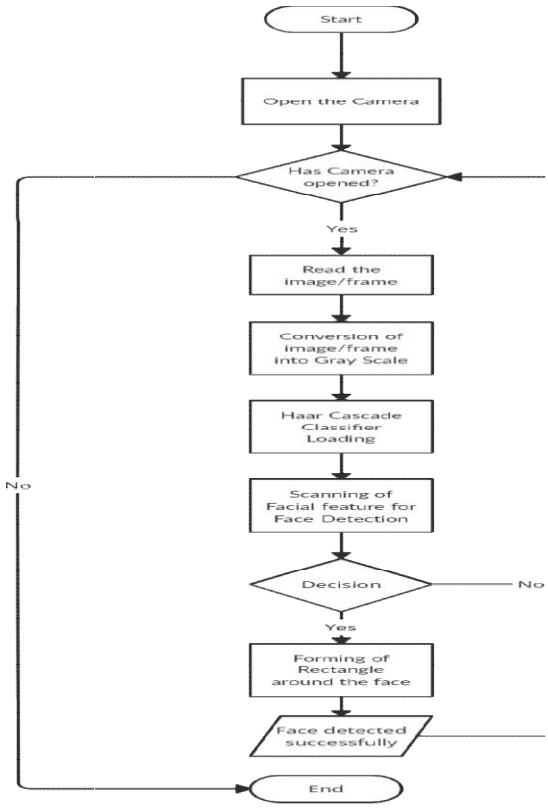

Fig-3.4: Haar Classifier Flowchart

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The main building block for Haar classifier object recognition is a set of Haar-like characteristics. It modifies the contrast values between adjacent rectangular groupings of pixels rather than the pixel's intensity values. Using contrast variances between pixel groups, it is possible to detect how bright and dark a region is relative to another. Two or three neighbouring groups with relative contrast variance combine to generate a Haar-like feature. By simply raising or lowering the size of the pixel group, it is simple to scale the Haar characteristics, allowing them to be applied to objects of different sizes. With sub image analysis, which enables the cascade of classifiers, the maximum likelihood of analysing the Haar-features that differentiate an object is achieved. It permits a classifier's accuracy to change just once. You can reduce the number of steps by increasing the number of false positives and positive results. This method, developed by Viola and Jones, used 200 straightforward characteristics to recognise human faces with 95% accuracy. The first step is to train a Haar classifier cascade to recognize human facial features such as lips, eyes, and nose. To train the classifier, we need to use the AdaBoost method together with the Haar feature method.However, Intel has created the Open Computer Vision toolkit (OpenCV), an open source toolkit that makes it simple to design computer vision-related programmes.Following Figure-3.4 depicts the working flow of Haar Classifier algorithm.

3.3 Objectives

The purpose of these efforts is to create a voting system that allows people to participate using data that has already been pre-stored in the database while generating an Aadhar ID. With this method, anybody with Indian nationality who is at least 18 years old and of any gender can cast their vote online without visiting a real voting place. The ID and voter photograph stored in the database are used to confirm the user each time they log in to the system. With the help of this advancement, we can create a safe website that unifies all forms of voting.

Pseudo Code of Proposed System

1. First create a Virtual Environment and import Django, OpenCV, MySQL Client based on your python version.
2. Then create a Django project.
3. Design user interface using Html, CSS and Java script of smart online voting system
4. Design both admin and user side. In user side, make a page of login to which user can login with their respective Aadhar and DOB. And after that give options to verify user by face recognition or OTP verification.
5. In admin side, add all the respective feature to maintain the details of the user and results of vote which is done by user.
6. Design Database Structure in model.py inside migrations.
7. Create migrations and apply to the database.
8. Write all code of web-based application pages in views.py with appropriate functions.
9. Run Django Server using terminal.
10. Add all user details to the application then they can vote.

3.4 Dataflow Diagram

Figure 3.5 describes the flow of data in the proposed system.

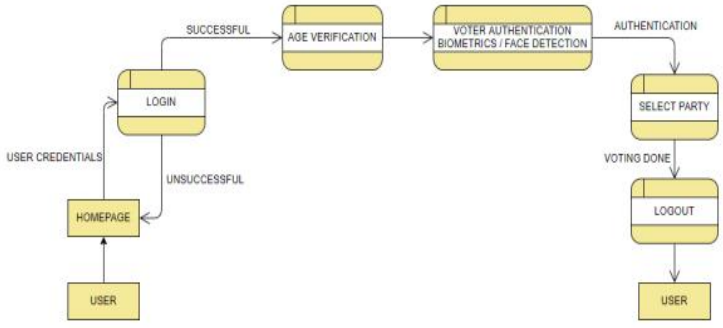

Fig-3.5:Dataflow diagram

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IV. METHODOLOGY

Viola Jones Algorithm Used for Face Recognition. There are four phases to the algorithm elaborated here.
Selection of the Haar features, The input image's subsections are where the Haar features are computed. The subdivisions of the picture are distinguished by calculating the difference between the sum of pixel brightness of neighbouring rectangular portions. For face features to appear, several Haar-like traits must be present. The use of an integral image restricts the computation to four pixels since executing operations on all pixels would need an excessive amount of computer resources. The technique is hence quite rapid. Given a sub-window size of 20 x 20, the Viola Jones method has a total of 45891 potential features. Hundreds of photos are fed into trainers (like Adaboost) with the purpose of finding the best Haar features, and these trainers are used to build the images. To train the adaboost, numerous face datasets are used. Applying all the characteristics to every part of the image is not beneficial since every region is not a face region. Group the characteristics into the various phases of the classifier rather than utilising them all at once. Apply each step separately to a specific area of the face. The classifier will discard an area from subsequent iterations if it fails at any point. Only the face area will make it through all of the classifier's phases.
The OpenCV Local Binary Patterns Histogram technique is used for face recognition. Each face in the training set is individually and independently examined by LBPH. When a new unknown image is supplied, we conduct the same analysis on it and compare the outcome to each of the photos in the dataset. This process locally characterises each image in the dataset.

4.1 Working

Image procurement: The initial step involved in the phase is image acquisition i.e., obtaining the face image of the students present in the classroom. It can be obtained through the High Definition Video Camera. From the video sequence, frames of each sequence are extracted from the video and numbered for further processing.

- **Face detection:** From the extracted frames, each face image needs to be segregated. For this segregation purpose, we go with the process of face region bounding box methodology usually called marking the Region of Interest using HAAR cascade classifiers. After segregating the frame, the first frame is taken and the face image is detected and marked. Then the second frame is taken and the face image is detected and marked. The same process is repeated for all the available frames
- **Model training:** scatter matrix is mainly created when the covariance matrix calculation is much harder or too costly to calculate. Scatter Matrix plays a huge role in the process of dimensionality reduction. Corresponding LBPH Face gets calculated as the next step by which the scatter matrix is input. LBPH Face has superiority over Eigen faces because of the effort in maximising the separation between various domains or classes in the training pairs. Recognizer function has been derived from the calculated LBPH Face and this function is used for comparing the unique id with the actual inputs.

Instead of using offline methods, our suggested solution allows users to cast their votes online. Users must enter their information and photo into the system before they may cast an online ballot. Each user's individual information, including their facial image, is recorded more than once and kept in the provided database. To guarantee accuracy when voting, many images are taken. The voter is prepared to cast a ballot once they have entered all of their information and registered their face in the system. Anyone can view the results of the ongoing election using the website given after the voting procedure is over or even before the user has cast their vote. The voting count database is regularly updated as the results are being published, preventing any errors from occurring. As a consequence, it takes much less time to publish the results and tally the votes because the computer can do everything in a couple of seconds. Thus, the technique considerably reduces the mayhem that occurs around election time and will also save money, time, and labour.

V. RESULTS & DISCUSSION

In many respects, the suggested system will be advantageous. Voter identification, facial recognition, and Aadhar verification will all be used for voter verification. Voting is limited to confirmed voters. Voters are limited to one vote. Multiple voting and virtual voting are thus forbidden. The suggested technology will restrict the voting window and

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only permit voting during that window. There won't be any crowds, thus there won't be any opportunity for violence. Elections do not need to be scheduled in various areas because of the automated method. Voting results may be produced swiftly and automatically. The suggested system is continuous, centralised, cost-effective, and time-focused. Now, we'll present some screenshots of the suggested system in this area.

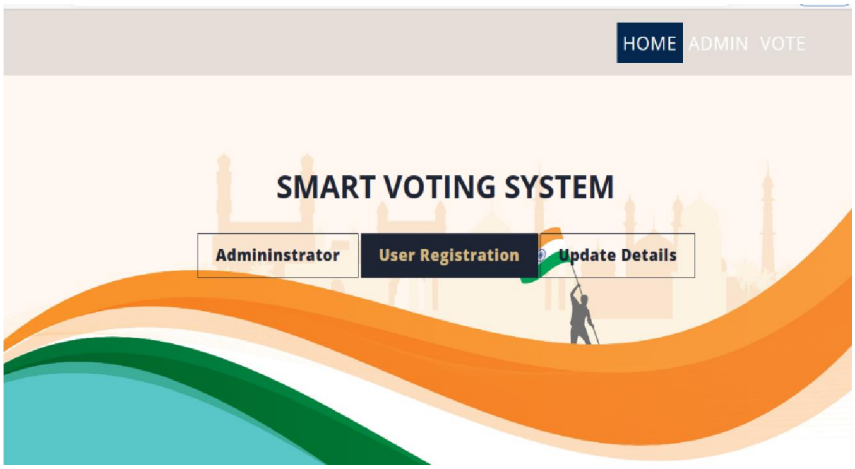

Fig-5.1: Homepage

Fig-5.1: Voter registration

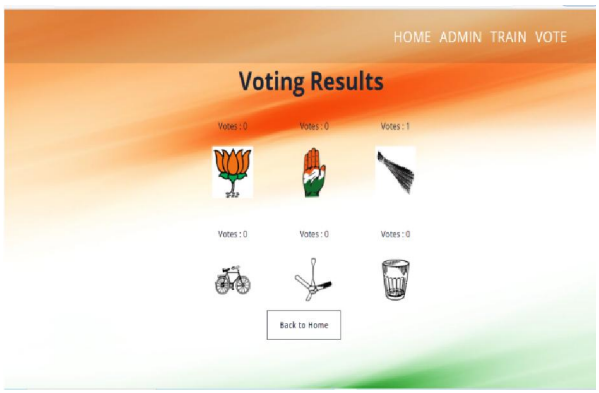

Fig-5.2: Voting results

Fig-5.3: Update voter details

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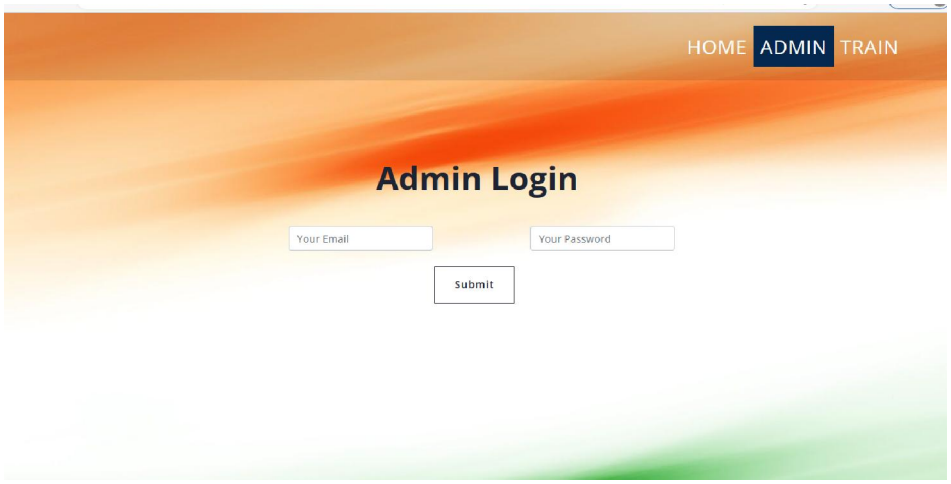

Fig-5.4: Admin login

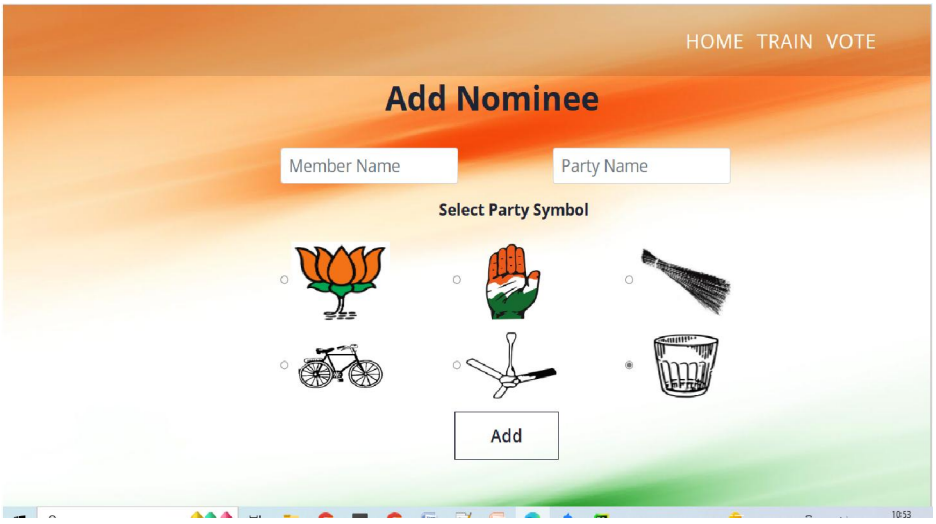

Fig-5.5: Add nominee

VI. CONCLUSION & FUTURE SCOPE

This online voting system will manage all of the voter's information, which allows them to login and take practice exams on the voting process. The system will include all of the voting options. There are other tools to track the number of votes cast for each party and for each individual candidate. The administrator is in charge of a database that contains all of the voter's information, including the very basics. After enrolling their information in the database, voters must check in using their individual email address and password in order to cast their ballots for any candidate from any party. A database is analysed and used to store the results of the vote. Online voting now represents a larger percentage of votes cast overall. With this voting method, expenses and time are negligible. This is simple and takes less time. Errors are also fairly simple to fix. The project's primary goal has been proven. The planned objectives were followed, and the outcomes were successful. A feature that may be used in the future is two factor authentication. Despite meeting user needs, the app isn't fully utilised because visitors to the website are constantly researching its benefits and how it works. Therefore, once the user becomes accustomed to the system's performance, it may also be improved in the future.

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