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Real-Time Attendance Management System UsingAI and Django Full Stack Web Development

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ABSTRACT—Face recognition technology is a bio metric tech- nology that identifies a person by their facial traits. The distinctiveness or individuality of a person's face serves as a symbol of their identity. The concept uses a person's face to automatically indicate their attendance. The traditional technique of collecting attendance involves yelling out a student's name or roll number, which not only consumes time but also requires energy. Assume that a single subject lasts for about 60 minutes or an hour. It should take 5–10 minutes to record attendance. Through this research work, propose the design and development of an automated attendance system using the Django framework, which is based on image processing, an automatic technique is applied to prevent these losses. Face detection and recognition are employed in this situation. Face detection is used to locatethe position of the face region, and face recognition is used for marking the attendance. The database of all the students in the class is stored, and when the face of an individual student matches one of the faces stored in the database, The attendanceis recorded.

Index Terms—LBPH,Django,Sqlite

I. INTRODUCTION

The occasions where people come into contact with com- puters are gradually expanding.As an important identity label for people to distinguish different individuals, face recognition technology has gradually entered people's lives. Face recogni-tion is the combination of artificial intelligence and computer. Because of its huge challenging innovation and broad appli-cation prospects, it has become the most challenging topic in this field.

Student attendance record has an important role in the educational process. Traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by elim- inating classical student attendance marking technique. There is a need to develop a real time operating student attendance system which means the identification process must be done within defined time.

Many attendance recording systems were widely developed using bio metrics, for example, face recognition, iris recogni- tion, and fingerprint recognition. In this study, focused on face recognition because the face cannot be duplicated and difficult to manipulate. Therefore, face recognition can eliminate fraud committed by students in recording attendance. In addition, this contact less system is safe and can minimize the risk of infectious disease than the contacted method.

Haar Cascade is a feature-based object detection algorithm is used here to detect objects from images. A cascade function is trained on lots of positive and negative images for detection. The algorithm does not require extensive computation and canrun in real-time.In this study used the Local Binary Pattern (LBP) histogram method which recognizes that certain local binary patterns.LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

The system will be connected with the database which includes the student's name, images, roll numbers, and timeof attendance. This application mainly follows three steps. Firstly, it will take images. Secondly, compare them with the existing images which are storing in the database. Thirdly, it will mark present all the matched images automatically on the sqlite database.

The first phase embeds the face detection

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and face recogni- tion of the students. The second and final phase presents the design and development of a web-based attendance system using the Django framework.

II. LITERATURE SURVEY

Real-time Face Recognition based on Pre-Identification andMulti-Scale Classification [1]

A real-time face recognition method based on preiden- tification and multi-scale classification is proposed in this paper.The face area is segmented based on the proportion of human faces in the pedestrian area to reduce the search range, and faces can be robustly detected in complicated scenarios such as heads moving frequently or with large angles. To accurately recognize small-scale faces, the Multi-scale and Multichannel Shallow Convolution network (MMSCN) was proposed which combines a multi-scale mechanism on the feature map with a multichannel convolution network for real-time face recognition. It performs face matching only in the pre-identified face areas instead of the whole image, therefore it is more efficient.

Firstly, pedestrian detection with face detection were com- bined, and tracked pedestrians as person pre-identification.After obtaining the area of the moving pedestrian by ACF features and SVM, the face area based on the proportion of the pedestrian area to reduce the search range of the detector were estimated.

Secondly, aimed at improving the face recognition per- formance on relatively small face images, and Multi-scaleand Multichannel Shallow Convolution network (MMSCN) recognized the face. Experimental results showed that the proposed face recognition method outperforms the existing methods in terms of effectiveness and efficiency.

Blur and Illumination Robust Face Recognition via Set-Theoretic Characterization [2] This paper addresses the prob- lem of unconstrained face recognition from remotely acquired images. The main factors that make this problem challenging are image degradation due to blur, and appearance variations due to illumination and pose. Main technical contributions of this paper are:

1) A set of all images obtained by blurring a given image forms a convex set. More specifically, the set is the convex hull of shifted versions of the original image. 2) Based on the set-theoretic characterization, a blur-robust face recognition algorithm were proposed, which avoids solving the challeng- ing and unnecessary problem of blind image de-convolution.

3) Additional information on the type of blur affecting the probe image can be easily incorporated into the knowledge of the algorithm, resulted in improved recognition performance and speed. 4) The set of all images of a face under all blur and illumination variations forms a biconvex set.Based on this characterization, a blur and illumination robust face recognition algorithm were proposed.

The algorithm is based on a generative model followed by nearest-neighbor classification between the query image and the gallery space, which makes it difficult to scale it to real life datasets with millions of images. This is a common issue with most algorithms based on generative models.

Deep Unified Model for Face Recognition based on Con- volution Neural Network and Edge Computing [3] This paper proposed an algorithm for face detection and recognition based on convolution neural networks (CNN), which outperform the traditional techniques. In order to validate the efficiency ofthe proposed algorithm, a smart classroom for the student's attendance using face recognition has been proposed. The face recognition system is trained on publically available labeled faces in the wild (LFW) dataset. The data generated by smart classrooms is computed and transmitted through an IoT-based architecture using edge computing. Automatic attendance system has been anticipated for the purpose ofminimizing the human errors which take place in the con- ventional attendance taking system to validate the efficiency of the proposed algorithm. The basic aim is to automate the system and implement the smart class room which is useful for educational organizations. Faster Region Convolution Neural Network along with the Edge Computing techniques are utilized to achieve the state of the art results.

The system managed to recognize 30 faces out of 35 detected faces, the achieved accuracy can be more enhanced by taking clearer image of students. Although the system achieved higher accuracy, but the main limitation of the system is distance, naturally as a distance increases, the picture becomesblurry, so the system produces false results on the blurry faces in some cases. The system works well if pictures are taken from around 20-25 feet. However, the outcome so far is very encouraging and promising. To increase the data latency and response time between the devices edge computing techniques have been utilized.

Low resolution face recognition across variations in pose and illumination [4] The

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proposed approach can be considered as an improvement over as it does not require localizing facial landmarks in non-frontal face images at low resolution during testing. A common transformation matrix for the entire face region that can map both low resolution probe images and high resolution gallery images into a common space is learnt using multi-dimensional scaling method during training. SIFT descriptors computed from the facial image are used as the descriptors of the face. During testing, the images are aligned based on detected eye locations and then high resolution gallery and low resolution probe images are transformed to a common output space using the learned transformation matrix. Stereo matching cost of the transformed images is used to compute the distance between the two images across pose variations. The above approach gives very good recognition performance, but it requires significant computation time since the stereo cost has to be computed between the probe and all gallery images separately.

In this work, a reference-based face recognition system was also developed to make the proposed method computationally efficient without affecting the recognition performance signif- icantly.

Domain Specific Learning for Newborn Face Recognition

[5] A learning based encoding and distance metric approach is introduced to the problem of newborn face recognition. The proposed approach combines deep learning based feature encoding scheme with a learning based distance metric to im- prove the performance of face recognition. The deep learning encoding approach learns a domain-specific representation of face images by utilizing the large number of unlabeled samples available. Next, a one-shot similarity distance metric is learned using relatively small amount of problem-specific information (newborn face images) for effective recognition.

1) Domain Specific Representation via SDAE: The input face image is first tessellated into nine overlapping patches. Separate sets of multi-layer encoders are learned for each overlapping patch of a face image, that helps enhance the depth of the encoders. The patch encoding ensures spatial coherence of the resultant representation. Each encoder provides the representation of a component of the face image, such as forehead, particular, mouth, and chin regions. The represen- tations thus obtained are concatenated into a single feature vector. [6] The optimal configuration of each encoder (SDAE) is determined experimentally as [2500—1000—500]. SDAE is trained on a large number of domain-specific samples, i.e., face images with varying illumination and expression. Itis then hypothesized with that of the SDAE learns patternsthat are adequate representation of face images. However, the special constraints of newborn faces must also be aug- mented in the recognition framework. Next, this research shows that problem-specific fine-tuning and classification can be performed with a learning based distance metric to match the aforementioned learned representations of two input face images in a meaningful distance space.
2) Problem Specific Distance Metric Learning via One Shot Similarity with 1-classonline-SVM: Low-level feature descriptors of images suffer from a semantic gap effect when dealing with matching for a specific application. This gap arises due to the difficulty in mapping features to meaningful interpretations, such as the identity of a subject. [7] Recent approaches for face recognition have proposed learning feature relevance using explicit training samples. In this research, a distance metric learning technique is explored to reduce the semantic gap effect in newborn face representations. Using problem-specific training samples, the structure of the new- borns' face manifold can be analyzed. Further, the best metric that is suitable to the classification task for faces of that par- ticular manifold can be learned and then utilized for matching. Specifically, for newborn face recognition, a distance metric that learns the mapping space in which two newborn faces can be best matched can improve the recognition performance.

III. PROPOSED METHOD

Face registration is a key step to improve the performance of face identification and authentication systems. Registration is done to align sample faces to a reference face. In real time systems, the subjects need not be cooperative with data acquisition. So input faces can be of different poses. Registration brings all faces to a common coordinate system. At the time of registration, the camera captures 30 images of an individual which is used for the training model. In order to capture this image the user should register into the website with user details. The images captured gets stored into the media folder as a .yml file. Trainer.yml file is used for future prediction.

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The systems marks the attendance if the face matched with the referenced students database. Entering the attendance of each student in logbooks is a difficult task and also wastes the time. So an efficient module has been designed that uses face recognition to detect the student and manage the student's attendance records. [3] The module populates the database by enrolling the student's face. This enrolling is only one-time process and student's face and its metadata will be stored in the database. A system is required during the time of face enrollment since it is a one time process. Also, a unique id is required to uniquely identify each student such that student enrollment number in the institute. The system will update the presence of each student in the database.

1) Face detection using OpenCV : Machine converts im- ages into an array of pixels where the dimensions of the image depending on the resolution of the image. The computer reads any image as a range of values between 0 and 255.[5] A matrix is built by the library for every primary colour. Then the combination of matrices provides a Pixel value for the individual R, G, B colours.

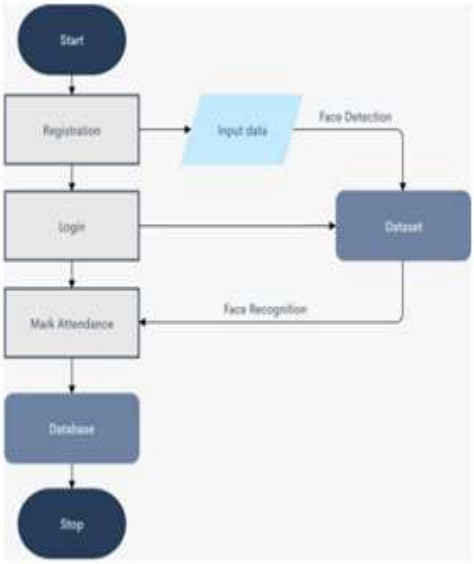

Fig. 1. flow of the system design

Once the image is displayed using OpenCV functions, next step is to convert the input images to gray scale images. COLOR BGR2GRAY : Stands for converting the image into gray scale. Next the input image is resized using OpenCV library. By default in resizing, it only changes the width and height of the image. The darker areas in the haar feature are pixels with values 1, and the lighter areas are pixels with values

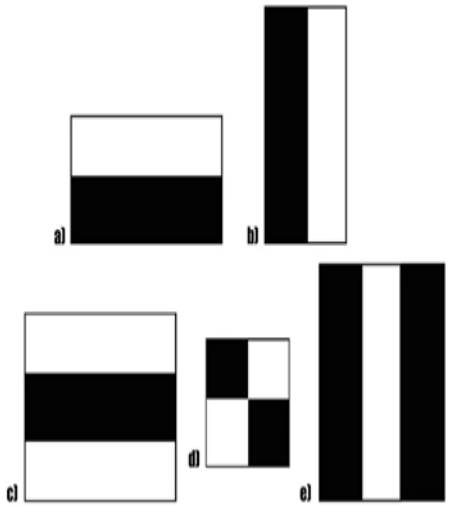

Fig. 2. A sample of Haar features used in the Original Research Paper published by Viola and Jones.

0. Each of these is responsible for finding out one particular feature in the image. Such as an edge, a line or any structure in the image where there is a sudden change of intensities. Forex. in the image above, the haar feature can detect a vertical edge with darker pixels at its right and lighter pixels at its left.

2) Face Recognition : After detecting faces, the faces can also be recognized and the object/Person name can notified. The user is logged in by authenticating the user information. Once authentication is done, face is recognized from the data set of images which is stored in the media folder at the time of registration. The recognized face will be labelled with a unique Identification Number ID and gets stored in thedatabase. The output will be displayed with the recognized face, name and positive confidence value. Both face detection and face comparison systems can provide an estimate of the confidence level of the prediction in the form of a probability or confidence score.

The facial image is in grayscale. It can also be represented as a 3x3 matrix containing the intensity of each pixel (0 255). Then,set the the central value of the pixel as threshold. This value will be used to define the new values from the 8 neigh- bors. For each neighbor of the central value set a new binary value. 1 for values equal or higher than the threshold and 0 for values lower than the threshold. The matrix will contain only binary values need to concatenate each binary value from

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eachposition from the matrix line by line into a new binary value but the final result will be the same. Then,convert this binary value to a decimal value and set it to the central value of the matrix, which is actually a pixel from the original image. At the end of this procedure (LBP procedure),new image which represents better the characteristics of the original image.

Using the Grid X and Grid Y parameters to divide the image into multiple grids,Since the image is in grayscale, each histogram from each grid will contain only 256 po- sitions (0 255) representing the occurrences of each pixelintensity. Then,concatenate each histogram to create a new histogram.The final histogram represents exactly the charac- teristics of the original image.

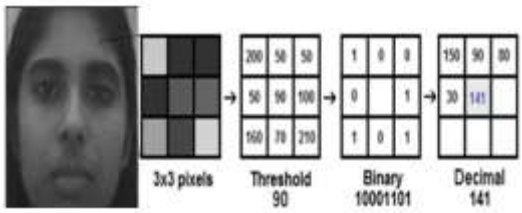

Fig. 3. Applying the LBP operation

Fig. 4. Extracting the Histograms

3) Attendance Marking : The first step in the Attendance marking is to create a database of registered face that willbe used. Different individuals are considered and a camera is used for the detection of faces. [6] An administration login is created where the admin has access and has two tables- ”Users Table” and ”Attendance Table”. The users table will have all the information of the registered user such as Name, Email ID, Username etc. The attendance table will have the details of the users logged in at that time. The attendance table will have the information of Name, Date and Time recorded at the time of log in. The time is set with a duration of 60 mins such that not more than one attendance can be stored within the given time frame. The database can be used to remove, edit and update the details of attendance table.

A. Django for Automated Attendance System

Django- is an open-source, free, and high-level web frame- work that works on python (programming language) for rapid, pragmatic, clean, and hassle-free web development. The Django framework provides several software tools, packages, and features required for the easy design and development of an automated attendance system.Django provides several func- tionality features such as “CRUD (Create, Read, Update, and Delete)” functionalities, cross-site scripting, HTTP Responses, Software administration features, and user management capa- bilities.

The proposed system is built using the Django framework. From the student end, the student requires web browser with the user login credentials. The Server side consists the Django framework involving Uniform Resource Locator (URL), Django’s Model View Template (MVT) model, anda database (SQLITE3 is considered) for storing data and Django-data models.

1) Design and Development of Modules :

- Templates: A Django template are the combination of static HTML layout and Django syntax which ids essen- tially python code.The main purpose of Django template is to separate the data representation with the data it- self.The browser part is only to render the HTML sendto it by the server and all the relevant data is given to the template by Django itself.This makes the process much easier and pages render easily as there is less clutterin both the front-end and back-end The templates are capable of generating text-based formats such as XML, HTML, and CSV.
- Views: Django Views are indeed an essential feature of the Django MVT Structure. The view file receives and responds to a web request. This response could be a web page’s HTML content, an XML, a redirect, an image, a 404-error message, or anything else.
- Models: A model is the sole source of data information.It includes all necessary fields and actions for the stored data. Generally, each database table corresponds to a single model. Briefly, Django Models is the database SQL that is used with Django.
- Forms: Django forms simplify and automate complex works such as customized display, HTML rendering, validation, cleaning, and convenient editable interface. There are three distinct works involved in forms

IV. RESULTS AND DISCUSSIONS

The expected system engages the face recognition approach for the automating the

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attendance procedure of students. A web cam is used for capturing the images of student. The faces in the captured images are detected and compared with the images in database and the attendance is marked. The last step after the representation of faces is to identify them. For automatic recognition built a face database. Various imagesare taken for each person and their features are extracted and stored in the database. Then when an input image is fed the face detection and feature extraction is performed and its feature to each face class is compared and stored in the database.

Fig. 5. Register page

Fig.5.Introduces the main page of automatic attendance system here the students can register their account by usingthe username and password of each individual.

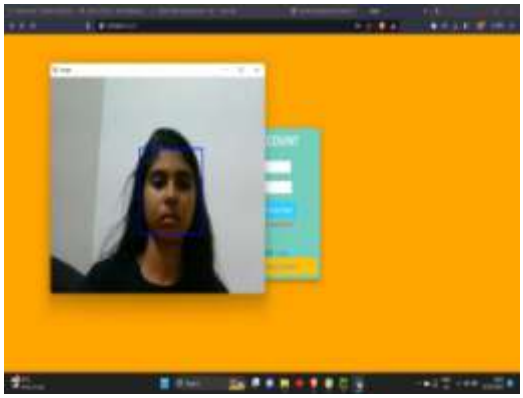

Fig. 6. Face Detection

Fig.6.Captures the image and detects a face presents in that image if there exists a human face then it stores to the database and the registration process done. The proposed system used both mathcing and recognizing. Whereas the matching part used histogram similarity, the recognition process can detect the name of the student according the captured face image.The image stored in the databse matches with the new image then the attendance marked along with the date

Fig. 7. Registretion-II

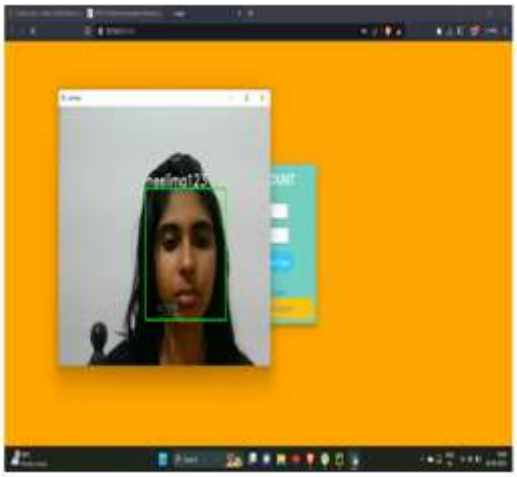

Fig. 8. Face Recognition

and time. Attendance marking becomes foolproof in nature, studentscannot carry out the previous means of false proxies fortheir friends as the system needs faces of the students andnothing else.Helps save time that at moments can get lost due to stu-dents disrupting the normal attendance markingmethod.

Other research entitled ”Iris Recognition Using Feature Lo- cal Binary Pattern and Rbf Classifier” concluded that feature extraction using LBP and RBF can be used to recognize iris. The test uses 3 scenarios as follows. First, six left iris images were used for training and the results showed the highestaccuracy of 53.33%. Second, six right iris images were used for training and the results showed an accuracy of 66.67%. Third, the scenario used six left iris images and six right iris images for training. The result showed an accuracy of 83.33%. This study shows that LBP

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representation is less sensitive to illumination changes. This means that LBP can detect or classify objects in varied lighting conditions . Therefore, this method is more sustainable than the others. The object's texture is minimally affected by lighting conditions.

Eigenfaces is relatively fast compared to other techniques for classifying faces The feature extractor must be retrained if large number of new faces are added to the system It is not accurate enough by itself and needs boosting methods for improvement.

Fischerfaces yields much better recognition performancethan eigen faces. However, it loses the ability to reconstruct faces because the Eigenspace is lost. Also, Fischer faces greatly reduces the dimensionality of the images making small template sizes.The studies shows that LBPH is one of the easiest face recognition algorithms. It can represent local features in the images. It is possible to get great results mainly in a controlled environment. It is robust against monotonic gray scale transformations.

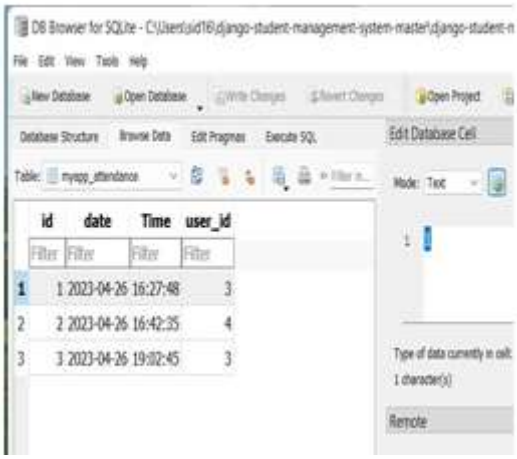

Fig. 9. Marked Attendance

Fig.9. Shows the attendance stored in SQLite database.SQLite data storage is a relational database management system (RDBMS) that uses structured query language (SQL) to manage data. It has a well-defined structure, where data is stored in tables and can be queried using SQL statements.The previous works are used, Excel spreadsheets for storing attendance informations are flat files that can store data in a tabular format but lack a well-defined structure. SQLite is designed to handle large amounts of data and is capable of supporting multiple concurrent users. Excel spreadsheets and CSV files, on the other hand, are not designed to handle large amounts of data and can becomeslow or unstable when the data set becomes too large. SQLite has built-in mechanisms to enforce data integrity, such as constraints and foreign keys, which ensure that data entered into the database is consistent and correct. Excel spreadsheets and CSV files have no built-in mechanisms to enforce data integrity.

SQLite databases can be protected by user authentication and encryption. Excel spreadsheets and CSV files, on theother hand, do not have built-in security mechanisms and are more vulnerable to unauthorized access. SQLite databases are excellent choices for storage, manipulation, and analysis of large amount of data.

V. CONCLUSION

Face recognition is an essential feature of Image processing owing to its excellence in many areas. Keeping and monitor- ing of attendance records play an important function in the investigation of the execution of any business. The idea of developing an appearance control method is to computerize the common way of using attendance. The advanced face recognition technology helps in improving the performance of the employee in attendance of daily activities and analysis with reduced human intervention. This project is different asit creates the data set at the time of registration. This will capture 30 images of an individual automatically. The images gets stored in a media folder and recognized at the time of login. If face is not recognized, a 'who are you?' is shown with a negative confidence value. When recognized, the face is detected with the corresponding ID and a positive confidence value. The attendance is marked along with the date and time and stored in the database. The attendance is automatically recorded every 60 minutes.

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