



Geo-Fence Based Facial Image Recognition Attendance System

Shubham Yelve¹, Dikshita Patil², Roopesh Singh³, Janhavi Sangot⁴

^{1, 2, 3}Final Year Student, Computer Engineering Department, VIVA Institute of Technology, India

⁴Assistant Professor, Computer Engineering Department, VIVA Institute of Technology, India

ABSTRACT

Attendance is the most common element throughout our life, starting from schooling days, right to the corporate world. The Attendance system, especially in companies is demanded to help assess the attendance and discipline of employees. Some attendance systems that have been made based on the detection of biometrics, QR Codes, and barcodes have not been able to simplify the attendance process where employees still have to stand in a queue in front of the attendance machine. The proposed system aims to design an attendance system that can simplify and speed up the process by using a mobile application based on geofencing and face recognition so the company does not need to expend the extra cost to buy the dedicated machine. The system is using a mobile application as a device to present. Considering Location Based Services and Image Processing as central to the security of wireless network security. In this Location Based Service and Image, Processing Technology emerges as a key construct. Geofencing applications used in the framework of an organization can turn from less secure when it uses a wireless network to highly secure. This Geofencing application framework was developed with the projection that applying the concepts of statistical process control. The employee face images are sent to the server from the mobile application for the attendance process which includes a detection process using Haar cascade and a recognition process using Local Binary Pattern Histogram (LBPH). The main aim of the proposed system is to give a solution to the touchless attendance system due to the COVID-19 pandemic.

Keywords: Biometrics, QR Codes, Barcodes, Geofence, Haar cascade, LBPH, COVID-19.

1. Introduction

Technology is currently developing very fast where in the industrial era 4.0 all activities can be connected and accessed by using the internet and smartphone. The attendance system is also growing to make it easier for employees to use and facilitate the monitoring of employees. For companies that have branches in various locations, data synchronization is the main thing. The system is demanded to accommodate each employee who could make a presence at each branch. Currently, many of the attendance systems used in companies use presence machines located at a particular location where each employee must take turns to make absences both using biometric recognition such as fingerprints, and QR Codes and by using face recognition on the machine. Some companies have locations that are difficult to reach or often have obstacles for their employees to reach work locations. Other companies have employees who work outside the office so the static attendance system is not feasible. To have a secured record of staff attendance is not an easy task because of authorization issues and limited kiosks of the clock-in and clock-out. Many companies/colleges/office employees are using thumbprint (biometric) which is expensive and also cannot be accessed from outside of the colleges as the device is fixed [1]. GPS attendance system using android mobile helps an employer to record their attendance in a much easier and cheaper way [2].

The objective of the proposed system is to show how the implementation of the android attendance application developed using the geo-fence technique to examine the location of a person using a GPS android phone. It is a system that is designed to minimize inputs from users. The application is developed on the android platform with GPS and WIFI technologies to operate the system user just have to tap on the application and turn on face authentication then whenever they will enter the geo-fence location attendance will be marked automatically and will be recorded into the database by the help of GPS. Apart from this, the proposed system will be showing the algorithm to verify the boundary of GPS location which the system has created using geo-fence to make a virtual boundary around a particular area/location. In the proposed system, every employee is required to have a login password and register a face photo before being able to use attendance through an existing mobile application.

2. Related Work

This section describes the various methodologies used in prior studies O. Shoewu, et.al [1] propose the development of an attendance control system using biometric data. Managing the attendance of people during lecture hours has become a difficult challenge. This method can eliminate the need for stationary equipment and manpower to maintain the records. Harsh Shinde, et.al [2] integrated the RFID device with the help of a GPS system by using the Google API and Mobile APK for handling the GPS coordinates. RFID technology was used to tag unique IDs for each and every student and staff. Chitresh Saraswat, et.al [3] propose an approach for developing a correct, rapid, and well-organized automatic attendance system using fingerprint verification technology. They propose a system where fingerprint verification is done by minutiae extraction and the system automates the whole process

of manual attendance detection. In this paper, an efficient automatic attendance system using a minutiae-based fingerprinting technique is presented. Simple, effective, and accurate methods are used for faster execution of fingerprint image enhancement and thinning algorithms. Qinghan Xiao, et. al [4] Provide colorful security technologies that have been developed, similar to authentication, authorization, and auditing. formerly the stoner logs on, it's assumed that the system is controlled by the same person. So it developed a demonstration system that uses facial recognition technology to corroborate the identity of the user. Akshay A. Kumbhar, et.al [5] provides a new system for monitoring the attendance of the students using the android platform. In today's world, a paper-based approach is followed for marking attendance, where the students sign on the attendance sheets. This data is then manually entered into the system. Managing the attendance of the students during lectures is a difficult task and it becomes more difficult during the report-generation phase. Md. Shakil, et.al [6] present an approach to attendance management, which is about managing attendance in the workplace that maximizes and motivates employee attendance. This paper demonstrates the improvement of attendance systems based on fingerprint identification for implementation on large databases. Benfano Soewito, et.al [7] provides a model for developing an attendance system that is integrated with the system payroll so that overtime can be calculated automatically, while also providing a feature to monitor employees who are working out of the office. Nikita Kakra, et.al [8] proposed an automatic attendance detection system, where students can use smartphones to present their presence in parallel. The identity of a student is verified in collaboration with a fingerprint and position in real-time. There are various forms of presence systems, such as the ERP system, RFID cards, and the biometric assistance system where fingerprints are considered the best and fastest method. Sherman Enayet, at. al [9] propose to use of a GPS system in their research work. GPS is used for taking or handling the attendance of students and employees. Android application is used to identify the Student and Employee. A GPS is on then the database matches with the store database server. Sharanya T, et.al [10] have used a Deep Learning and Convolution Neural Network technique to capture a face. Deep learning and CNN algorithms are used to increase the speed of the system. This system marks attendance when a face is matched with the store database. Anshun Raghuvanshi, et.al [11] propose and compares the methodologies for an automated attendance system using video-based face recognition. Here input to the system is a video and the output is an excel sheet with the attendance of the students in the video. Amritha, et.al [12] propose The identification of a person from facial features is referred to as face recognition. In this approach, three different methods such as SVM, MLP, and CNN were presented. DNN is used for face recognition.

3. Proposed System & Methodology

A hybrid approach is being employed in this proposed system, the face recognition technology which is an Android-based software development framework for real-time face detection and recognition using the OpenCV library applicable in several mobile applications alongside a location-based monitoring system using geo-fencing and WIFI RSSI. The approach suggested is to use facial recognition technology for authentication and geofence technology to monitor the presence of the employee for attendance using real-time presence within the set perimeter and for more security Wi-Fi RSSI to mark the attendance.

3.1 Module Description:

This framework mainly consists of two users that are Staff (Users) and Admin. The proposed system design for authentication and there are some modules for authentication are Geo-fence Authentication, Wi-Fi RSSI Authentication, Face Authentication, and Clock-In and Clock-Out.

- Geo-fence Authentication:

Every employee who works at the company needs to be registered in the attendance system. Each of the employees can have one or more Geofence based on their working location. Geofences are virtual perimeters or boundaries around actual geographic areas implemented with the help of software or hardware. The proposed application would implement geofencing as virtual boundaries around the company it defined using latitude and longitude. Every employee will be given an attendance in the Geo-fence area and attendance records will be obtained only when they clock in and clock out within that Geo-fenced area. It uses GPS to pinpoint the exact position of an employee.

- Wi-Fi RSSI :

While applying facial recognition via the smartphone's frontal camera to determine the employee's identity, the system also makes use of the company Wi-Fi network to determine the employee's location as they provide a potential pre-built infrastructure for small area localization. The proposed system does not require high monetary cost or specialized hardware and yet incorporates adequate foolproof measures to counter fake or proxy attendance. The two main options for doing Wi-Fi localization are triangulation and Face recognition. The proposed system uses Triangulation it involves mapping signal strength as a function of distance

- Face Authentication:

Face Authentication consists of Face Detection and Face Recognition. For Face Detection we use the Haar Cascade algorithm and for Face Recognition we use the LBPH algorithm.

Algorithms :

- [1] Haar Cascade algorithm:

Before Face Recognition identifies a person's face, first it must be able to retrieve the region of interest (ROI) for a face through face detection. Thus, the Face Detection process was performed by using the Haar Cascade algorithm. In Haar Cascade, a lot of positive images (i.e the images which we want

our classifier to identify) and negative images (i.e the image which does not contain the object we want to detect) are used to train the classifier. The initial stage of this test was to determine the performance of the face detection process within frontal conditions or face-to-face with the camera. The system indicator could detect the face captured by the camera by the appearance of a box enclosing the detected face. These images are in JPEG format.

[2] LBPH algorithm:

Face recognition utilizes facial features for security purposes. In Face Recognition the facial images are already extracted, cropped, resized, and generally converted to grayscale, the face recognition algorithm is responsible for finding characteristics that best describe the image. For Face recognition, we use Local Binary Pattern Histogram (LBPH) algorithm. The first computational step of the 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 parameter's radius and neighbors.

- Clock in and Clock out:

After the face of an employee is recognized, the attendance of the employee will be marked. For the first recognition, clock-in time will be saved, while clock-out time will be updated for the second recognition of the same user. Besides that, the clock-in and clock-out time, the system will also automatically identify whether the employee is on late or early leave by comparing the office hour preset by an administrator.

3.2 System Flowchart Diagram:

Fig 1. Shows the flow of our proposed system. Now a day with the use of android phones every work can be optimized and modified. Our aim is to optimize the work of an organization through our application. So we are developing an online attendance application.

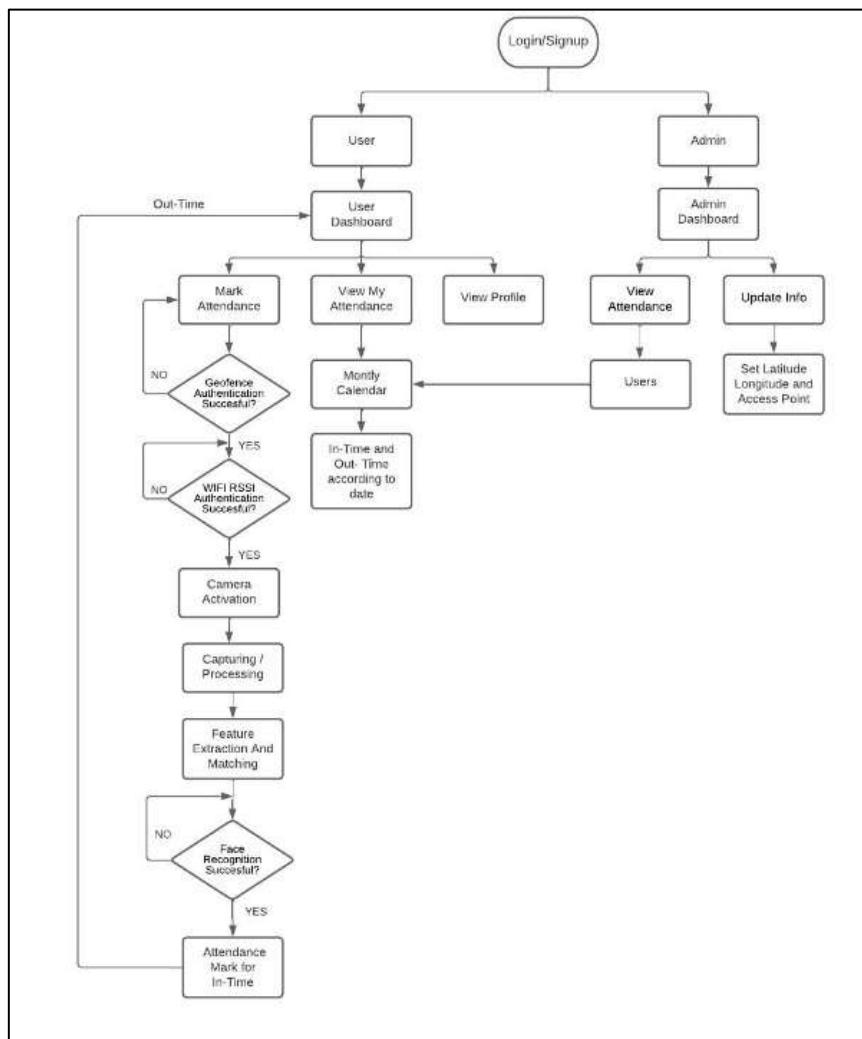


Fig - 1: Flowchart Diagram

4. Results

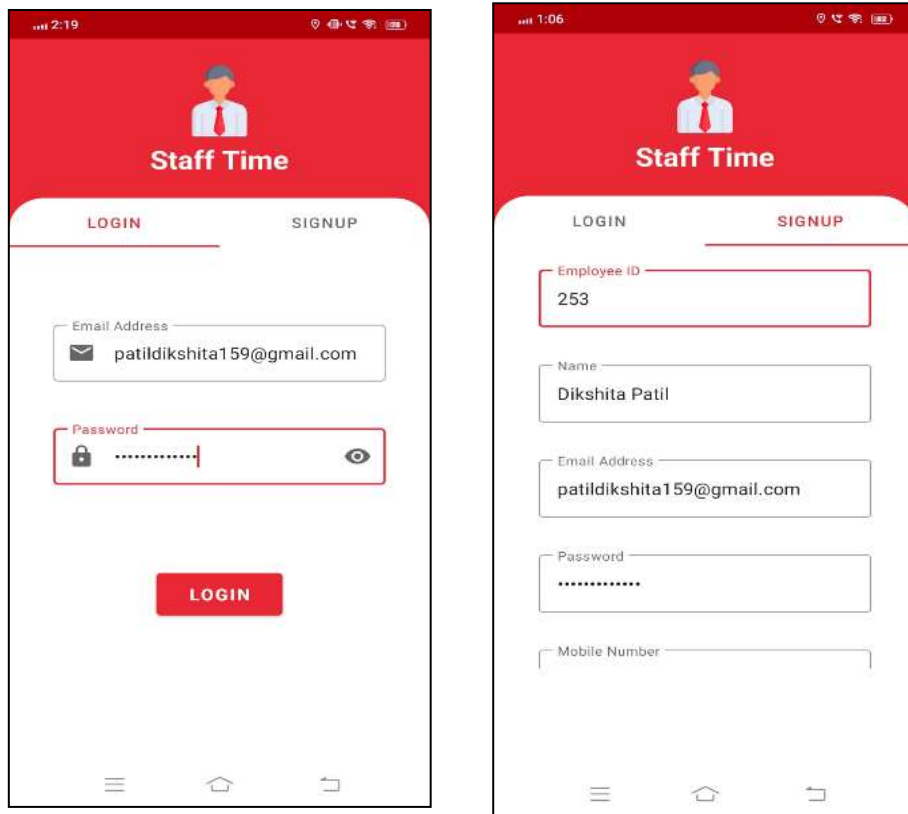


Fig -2: Login Page & Registration form

Fig 2. Shows the Login Page & Registration form. To use this interface, users can register themselves. If the user successfully registered they can simply sign in using authenticated credentials.



Fig -3: User Home Page

Fig 3. Shows the User Home Page. After successful login the system user is redirected to the home page there are some modules to access i.e Mark Attendance, View My Attendance, and System Info.

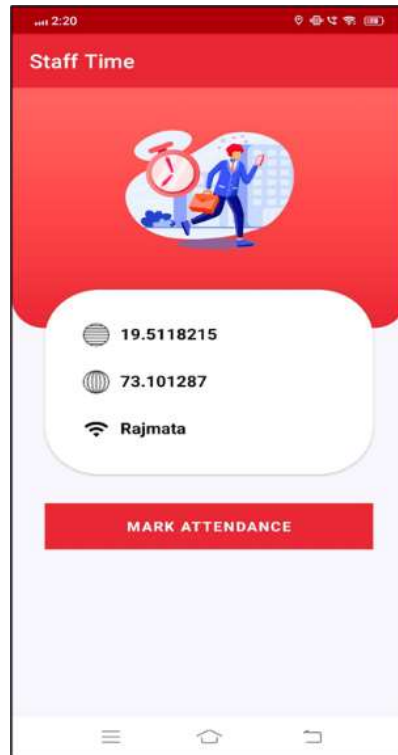


Fig -4: GPS Co-ordinates & Wifi RSSI

Fig 4. Shows the GPS coordinates & Wifi RSSI. Before an employee takes a presence, several processes are carried out consisting of taking of Office wifi, the strength of wifi, current GPS location, and authenticating current employee locations with employee geofencing settings. Based on the GPS data, the system checks the longitude and latitude of the current employee location with the stored geofencing data. When location data are incompatible with the stored data then the system will lock the presence button until the location matches the geofencing.

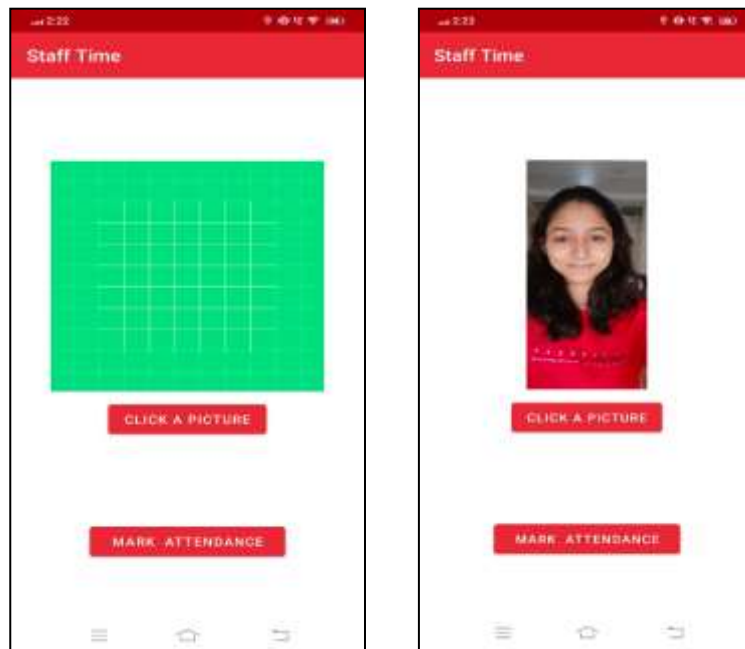


Fig -5: Camera Activation & Face Recognition

Fig 5. shows the Camera Activation & Face Recognition. If the longitude latitude and Wifi RSSI of the user match with the database, the camera is activated takes the picture, and match with the stored images. If the face is recognized attendance is marked.



Fig -6: Attendance Mark

Fig 6. shows the Attendance Maek page where users can view the Marked Attendance of a particular day with respect to time.

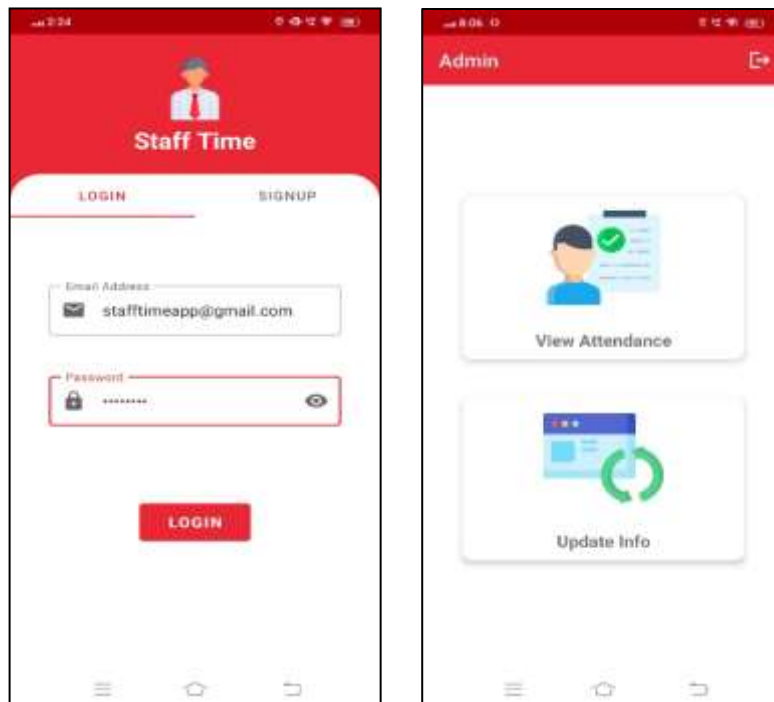


Fig -7: Admin Login & Home page

Fig 7. Shows the Admin Login & Home page. The Admin successfully login with their authenticated credentials. And redirected to the admin home page there are two modules to access i.e View Attendance and Update Info.

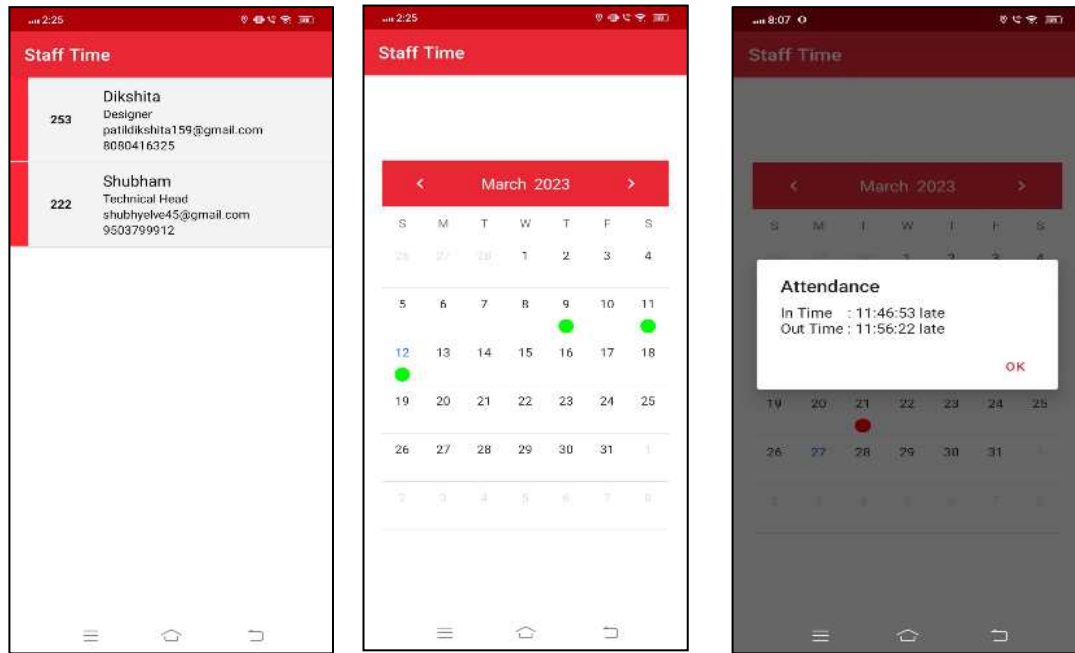


Fig -8: View Attendance

Fig 8. Shows the View Attendance. Here Admin views the attendance of a particular user in calendar form. The green dot represents the attendance mark in office time and the red dot represents the attendance mark as a late mark.



Fig -9: Update Info

Fig 9. Shows the Update Info. Here admin set 4 coordinates of Latitude and Longitude according to the office premises and also set the Access Point.

5. Conclusion

This paper has created a mobile-based attendance system using geofencing, Wifi RSSI, and face recognition. The function of the entire system is very simple and easy to understand. To get staff location and to automate clock-in and clock-out attendance in real-time GPS Geofencing is embedded in the system. The system captured images of the employee when the employee is inside the geofencing area. By using geofencing, the employee does not need to wait and queue in the attendance machine which is better than the other system. WIFI RSSI authentication and Face Recognition add more value to the system and make it more secure and removes all the flaws in the conventional system. The GPS attendance system is a possible option for replacing

current attendance methods such as biometrics. It helps the process of taking staff attendance efficiently and cost-effectively. GPS mobile attendance system is a must-have application for those staff that values every minute of their working time.

References

- [1] O. Shoewn and M. Olaniyi, "Embedded Computer-Based Lecture Attendance Management System", African Journal of Computing and ICT, 2011.
- [2] Harsh Shinde, Sagar Shirke, "GPS-based Attendance Management System with RFID Technology", International journal of engineering research & technology (IJERT), April 2018.
- [3] Chitresh Saraswat, Amit Kumar, "An Efficient Automatic Attendance System using Fingerprint Verification Technique", (IJCSE) International Journal on Computer Science and Engineering Vol. 02, No. 02, March 2010.
- [4] Qinghan Xiao, Xue-Dong Yang, "Facial Recognition in Uncontrolled Conditions for Information Security", EURASIP Journal on Advances in Signal Processing, 2010.
- [5] Akshay A. Kumbhar, Kunal S. Wanjara, Darshit H. Trivedi, "Automated Attendance Monitoring System using Android Platform", International Journal of Current Engineering and Technology, Jan 2014.
- [6] Md. Shakil, Rabindra Nath Nandi, "Attendance Management System for Industrial Worker using Finger Print Scanner", Global Journal of Computer Science and Technology Volume XIII, August 2013.
- [7] Benfano Soewito, Ford Lumban Gaol, Echo Simanjuntak, "Smart Mobile Attendance System Using Voice Recognition and Fingerprint on Smartphone", International Seminar on Intelligent Technology and Its Applications (ISITIA), July 2016.
- [8] Pooja Kumbhar, Nikita Kakra, Priya Kumbhar, "Smart Location Based Student Attendance Management System using Fingerprint Recognition", International Journal of Advanced Research in Computer and Communication Engineering, December 2017.
- [9] Shermin Sultana, Asma Enayet, Ishrat Jahan Mouri, "A SMART, LOCATION BASED TIME AND ATTENDANCE TRACKING SYSTEM USING ANDROID APPLICATION", International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), Vol. 5, No.1, February 2015.
- [10] Sharanya T, Ms. Dhivya V, "Online Attendance using Facial Recognition", international journal of engineering research & technology (IJERT), June 2020.
- [11] Anshun Raghuvanshi, Preeti D Swami, "An automated classroom attendance system using video-based face recognition", International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), May 2017.
- [12] Amritha, Sudhakar, "Face Recognition based Attendance System using Machine Learning", IJEDR 2019.