

Online Attendance System Using Face Recognition

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ABSTRACT

An attendance management system is a system used to record the daily attendance and can be used to compile insightful data for better decision making. During the Covid-19 pandemic period, most employees at University College of Yayasan Pahang (UCYP) were instructed to work from home in order to reduce the spread of the disease in workplace. The UCYP's Human Resource (HR) department record attendance and tasks done by employees during working at home by using word-processing based manual form. IT Department of UCYP has developed portal-based attendance system to keep electronic record of staffs' attendance to cope with working from home condition. However, there is a need to create a more reliable attendance system. The objective of this project is to create an online attendance system using face recognition technique to overcome the problem faced by the HR department. The first step is to develop a mobile-based attendance system using face recognition technique to capture images of legal employees, store images in the database and provides function for clock in and out. Next, a web-based system is developed to generate attendance reports for personal and HR Department's usage. Personal Extreme Programming (PXP) methodology has been used to develop the system. Based on the testing done, the system able to function as required in capturing the face images of legal employees and allowed them to perform checking in and out. An online attendance management system using face recognition technique able to solve the problem faced by the organization and can achieve high accuracy during employee identification.

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1. Introduction

According to (Elmi et al., 2016), an attendance system or attendance management system is a system that uses to record the daily attendance or evaluation of someone within an institution or organization. As stated in (Chiradeep, 2019), any solution that can help monitor an employee's time spent in an office is called an attendance management system. Based on what was stated in (Sowmya, 2020), an attendance management system is a system that tracks the employee's working hours, times off, breaks, login, and logout time. An attendance management system is referred to as a system that can track the employee's attendance and working hours of an organization, (Krediliy, 2019). In agreement with (Tanya, 2020), attendance software is a system that provides tracking on employee hours worked information, the organization uses it to automate payroll schedule vacations and limit absenteeism. It can be concluded that from five of the researchers, an attendance system or attendance management system is a system that is used to track or record someone's attendance within an institution or an organization.

2. Literature Review

There are many ways to develop an automated attendance system such as using Radio Frequency Identification (RFID), Near-field communication (NFC), biometric, barcode, QR code, face recognition system. There are

pros and cons for every kind of automated attendance system, the way to choose to develop an automated attendance system is by choosing the most suitable for the situation and need.

The first way to develop an automated attendance system is by using an RFID system, according to (Sarah, 2021), radio frequency identification is a form of wireless communication technology that uses electromagnetic or electrostatic to uniquely identify an object or a person. Also as stated in (Nicole, 2021), RFID tags are a type of tracking system that uses smart barcodes to identify items, RFID tag utilize radio frequency technology the RFID reader receives transmit data from a tag. An RFID system includes three components such as a scanning antenna, a transceiver, and a transponder, and an RFID reader or interrogator is the combination of scanning antenna and transceiver. RFID reader requires a network connection, the RFID uses radio waves to transmit a signal that activates the tag and the tag sends back a wave to the antenna then the antenna will translate the wave that receiver becomes digital data. And again as reported in (Nicole, 2021), the RFID system has many advantages but also it is time-consuming and labor-intensive to set up the system.

The second way by using Near-field communication (NFC) system, as stated in (Robert, 2019), NFC is a mainstream wireless technology, it can use for communication between two devices within a short-range, NFC works on sending information or data over radio waves, NFC uses another standard of wireless data transition method. In agreement with (Asadbeigi et al., 2016), NFC is a low-power short-range communications protocol between two devices, it is a technology that is normally used on the smartphone. According to (François, 2020), NFC is a short-range wireless technology that operates at 13.56MHz, that can enable device communication between 10cm, and data transmission rates are up to 424kbit/s. NFC system works similar to the RFID system, it also uses electromagnetic induction to transmit information.

The third way to develop an automated attendance system is by using a biometric method such as using fingerprint system. In agreement with (Rutgers, n.d.), there are no two fingerprints that are alike for every person around the world, and starting from the 19th century examining a person's fingerprint can identify the individual and exclusion the person from others. Currently, there are many systems around the world that are using fingerprints as a way to identify a person's identity. According to (Woodford, 2020), there are many ways to turn human fingerprints into digital data, such as by using an optical scanner, capacitive scanner, or ultrasonic scanner. Those scanner devices can turn human fingerprints into digital data and use them for further analysis and process.

The fourth way is by using the barcode or QR code method, as stated in (Adriana, 2020), barcode and QR codes is using a similar technique, bar code store information horizontal and QR code store information horizontal and vertical. As reported by (Lewis, 2021), a QR code can hold up to 2,500 numeric characters compared to a barcode which is 43 numeric characters. As stated in (Graham, 2020), QR code series of dots and squares have their own meaning within a QR code which stands for a position, alignment, timing, version information, format information, 13 error correction key, and a quiet zone. The QR code or barcode scanner uses the three large squares to quickly identify and orient the image.

The fifth way to develop the automated attendance system is by using face recognition technology, as reported by (Arsenovic et al., 2017), using a combination of state-of-the-art method and deep learning techniques can make the automated attendance system with face recognition archive high accuracy which is 95.02% in overall in their experiment. Other than that, according to (Salim et al., 2018), there is 95% accuracy with the dataset of 11 person images in their experiment.

3. Method

There are many selections to develop an online automated attendance system, to select a device and development method is based on the requirement and need. There is a superiority to develop an online automated attendance system using smartphone device. Because based on the statistic from (Metev, 2021) shows that, there are 52% of mobile internet user around the world population in year 2020 and also 94% of people between aged 18 to 29 have smartphone. Using smartphone as the device to record attendance can reduce the employee physical contact. As reported in (CDC, 2020), physically near and direct contact with the infester have greatest risk of infection. Therefore, using a suitable device to develop the attendance system is very important. In many previous research about develop an attendance system is by using Radio Frequency Identification (RFID), Near-field communication (NFC) and Finger print attendance system are not suitable for current situation because of the physical contact with the organization device. According to (David, 2021), facial recognition doesn't require any physical contact or direct human interaction to process. So, to conclude that from the researcher that stated out, using the combination of smartphone and face recognition technology

can achieve high accuracy and it is suitable to use in the current pandemic situation either in a working environment or for work from home method environment.

3.1 Face Recognition Algorithm

The based face recognition algorithm of this project system is according to (Marcos, 2020), the face detection and process in the image is performed by the Firebase ML vision model, and the MobileFaceNets model is to process, classify and transform the data that get within a face image into a data structure such as an array of number that can save into a database. As reported in (Marcos, 2020), the Firebase ML vision provided the face detection API, which can use to detect faces in an image, identify the key facial features and obtain the contours of detected faces. It has well pre-processed the image to detect the zone to be cropped and processed by the MobileFaceNet model. As stated in (Marcos, 2020), the MobileFaceNet model are a set of CNN models, which that use less than 1 million parameters and are specifically tailored for high-accuracy real-time face recognition or verification on mobile and embedded devices.

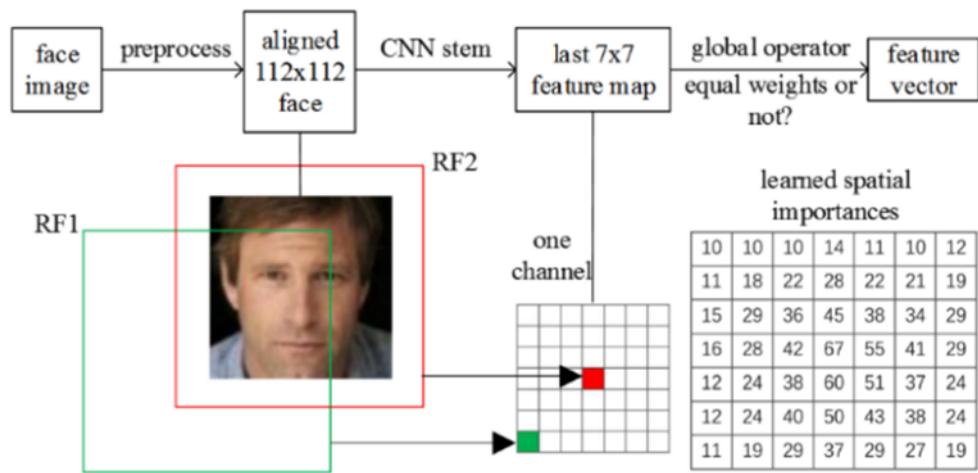


Figure 1. Face Recognition Algorithm

Figure 1 shows how the algorithm works during face recognition. It receives a matrix of 112x112 inputs and returns as output a matrix of 7x7 with values adjusted according to importance, because of the noise in the edges, so the corner unit will be less importance than the center unit.

3.2 Personal Extreme Programming Development

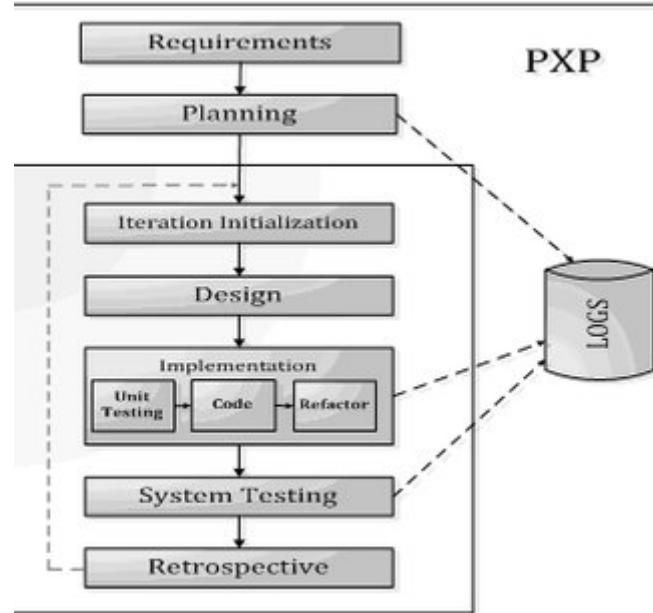


Figure 2. Personal Extreme Programming (PXP) Model

Figure 2 shows the Personal Extreme Programming (PXP) Model used in developing the system.

3.3 PXP Phase and Tasks

3.3.1 Requirements phase

The task for the requirement phase of this project will be doing on kick-off meeting to gather the objective of this project, data collection, and list down functional and non-functional requirements.

3.3.2 Planning phase

The task for the planning phase of this project will be assemblies' tasks which is assemble the task according to function and requirement that get from the requirements phase and also the programming language and framework that are planning to use.

3.3.3 Iteration initialization phase

The task for this phase of this project will be is to set tasks priority that uses for the design phase according to what planed in the planning phase.

3.3.4 Design phase

The task for this phase of this project will be is to model and design the system module according to the task priority used for the implementation phase.

3.3.5 Implementation phase

The task for this phase of this project is to start the development of the system that defines in the design phase, after that all the developed functions or modules will be integrated.

3.3.6 System testing phase

The task for this phase of this project is to deliver the completed system to the user and the user will test whether the system has achieved the requirement or not.

3.3.7 Retrospective phase

The task for this phase of this project is to analyse the all the data collected in the iteration phase then propose an improvement process and changes if necessary.

4. Results and Discussion

During the development and testing phase of the project system, some report has been generated. The system strengths that have been identify during the development and testing phase are the mobile-based system has well performance on most of the Android platform devices, the face recognition in this project system has high accuracy most of the time, and the face recognition algorithm used in the project system doesn't need pre-training. The system weaknesses that have been identify during the development and testing phase are during face recognize, some factor will affect the face recognition accuracy, such as the camera direction and during face recognize, some factor will affect the face recognition accuracy, such as the camera direction. Future improvement on the system is needed. Some of the requirement and features that can increase the usability of the system in the future are improvement of face recognition accuracy from different camera direction, implement the system that supports for iOS platform, GPS location recording and more.

5. Conclusion

The employee's attendance is very important to the employee and also for their organization because the employee salary system is dependent on employee attendance, and also the organization business is dependent on employee productivity. The pandemic of Covid-19 experienced being required to work from home and it is very challenging to track employees' attendance and time while working remotely. The project system has achieved the main objectives as system is developed in an android-based platform using face recognition to identify the user with the usage of the web-based administration system-generated attendance report. The architecture of the project was identified, objectives and scope were defined, literature related to the project was studied, methodology for analysis and development of the system was specified and discussed and, implementation and testing of the system has also been conducted.

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