Attendance System on Android Smartphone

Benfano Soewito
Graduate Program
Bina Nusantara University
Jakarta, Indonesia
Email: benfano@gmail.com

Ford Lumban Gaol
Graduate Program
Bina Nusantara University
Jakarta, Indonesia

Echo Simanjuntak
Graduate Program
Bina Nusantara University
Jakarta, Indonesia

Fergyanto E. Gunawan
Graduate Program
Bina Nusantara University
Jakarta, Indonesia

Abstract—**Attendance system which is currently excist still has weaknesses. The first is the long queues in front of the attendace machine at the time to come to work and leave work. The second is cheating, employees can ask her/his friend to do attendance process. The third is mostly attendance system has not been connected with the payment system in human resouces software or in the finance department. The fourth, employees who work outside the office can not do attendance process. In this paper, we introduced an attendance system based finger print technology and GPS using a smartphone integrated with payment system that will eliminate all the problems above. Our research also based on prediction that in the next few year all the smart phone will have a fingerprint scanner.**

I. INTRODUCTION

Attendance system has been known since ancient time. In the beginning, attendance system using only paper and performed manually by calling the name of an existing name listed and marked as present or not present along with the notes [1]. This way is not efficient, it would be very time consuming if we have to call one by one all the people who exist on the list. In line with technogical developments in the field of clock then created the attendance system used machine that more efficient than manual attendance system. The first attendance machine was very simple, the employees just inserting the attendance paper or called timesheet into the machine, and the time will be printed on the timesheet [2]. Basically, this attendance machine consists of a manual card slot or hole to insert the timesheet employees and an analog clock showing the current time. The time when the employee insert the card into the slot is what will be printed on the timesheet. This attendance system has several disadvantages:

1) In this system, the data on timesheet has to process manually. Human Resources Division should note and record employee attendance manually that it can be take a lot of time [3].
2) Inefficient due to spend a lot of paper. The use of this manual attendance machine card is not environmentally friendly and efficient because of the paper used as employee timesheet [4].
3) Vulnerable fraud. Using this attendance system has a vulnerable fraud because the fact is, many fraudulent employee timesheet entrust them to his friend so that when it comes late or absent, their cards will remain in the list of attendance [5], [6], [7], [8].
4) Long queue. In the morning when employees will come to work as well as at the time employees leaving work will be long queue in front of the attendance machine.

The second generation of attendance system is attendance machine digital which is the attendance machine that uses a digital method for the record employees attendance introduced in 1970. In general, digital attendance machine has a few buttons (number and alphabet) and a digital display that shows the time or the text displayed [9]. Along with the machine, there are number and alphabet keys to allow employees to enter a password or barcodenya. Cheating employees are still likely to occur in the use of digital attendance machine because they may share the PIN with friends to do attendance. And also still there is a long queue in front of the digital machine.

Lately, it appears attendance machine that using biometric. The biometric attendance is machine attendance machine that uses biometrics to authenticate employees when the doing the attendance process [10], [11]. Biometrics is a special technology that is commonly used in medical to identify the man by detect certain characteristics of human beings. The characteristics of which were identified using a biometric system may be in the form of fingerprints, the shape and characteristics of the face, the eyes, and the human voice. The weakness of this system are:

1) Prices tend to be expensive. By using sophisticated biometric technology, attendance machines tend to be expensive because of the components / materials specifically for detecting human facial characteristics.
2) Error at the time of identifying the employee. Employee identification using biometric systems tend to encounter some problem or error. For example, the facial characteristics are processed slowly and can not even be identified by the machine when the employee has been registered. Another example is the characteristic sound, an employee who is impaired in his voice sound like a cough or lost will be difficult to be identified by the attendance machine.

In this paper, we introduced a attendance system using fingerprint and GPS (Global Positioning System) on smartphone or mobile devices. Fingerprint attendance machine is one type of biometric attendance machine that uses fingerprint detection methods through employee to record employee attendance list. This type of fingerprint becoming known and used since 1997 [12]. Inventors and creators of technology realize that attendance machine fingerprint is one part of the human body is unique and different from each other. In fact, even identical twins have different types and shapes of different fingerprints. This is the trigger for the emergence of the idea of integrating the fingerprint attendance machine.

The advantages of using fingerprint and GPS on smart-phone for attendance system are:

1) Its use is practical and simple. Employees can instantly do attendance process and prove its presence by placing one finger or all fingers on the screen that has been available on the attendance machine.

2) Attendance data collection more accurate. Because the media used to record employee absences is their fingerprints, then the accuracy of attendance will be guaranteed. No more employees who like to cheat by ask the friend to do attendance process like in the attendance machine cards because they themselves should be authenticated.

3) Capacity that many users / unlimited. Fingerprint attendance machine can accommodate the data to the tens of thousands and even infinite because there should be no production of paper / card ID.

But attendance system using this fingerprint can not eliminate the problem of long queues at entry work and also at the time out of work. Therefore, we introduced a attendance system based finger print technology and GPS using a smartphone that will eliminate the problem of long queues. Our research also based on prediction that in a few year all the smart phone will have a fingerprint scanner.

II. LITERATURE REVIEW

Fingerprint usually in the form of horizontal lines and vertical or a combination of both and there is also a form of arches. All humans in the world created by fingerprints are different from each other. Therefore, every fingerprint is used to identify every human being. No fingerprints are identical in this world even if in between two twin sisters [13].

In table I show the comparison of biometrics factor evaluation such as FAR (False Accept Rate), FRR (False Accept Rate), and EER (Equal Error Rate). FAR is the percentage of unauthorized users are authenticated as a legitimate user. The lower the FAR, the better the accuracy of the biometric method [8]. FAR is the percentage of unauthorized users identified as legitimate users. The lower the FAR, the better the accuracy of the biometric method. FAR can only be determined based on data collected by a sample from another person who is not an actual person. FAR also directly related to the threshold used in biometric identification process, the lower the FAR, the threshold used will be higher. The higher threshold probable cause an unauthorized person to access the system becoming less and less, but also will be has impact to user comfortable, because the user who has the right to enter into the system will be more difficult when they have to perform biometric identification. The relationship between FAR, FRR, error and sensitivity can be seen in figure 1.

FRR is the percentage of legitimate or authorized users who rejected in the process of authentication [8]. FRR can be determined from each user either authorized users accessing the system or not by analyzing data collected from each user in a certain time frame, could be in weeks, months or years. There are a variety of reasons why the false rejection such as biometric image quality is poor, the user is in a hurry to authenticate so that the system is difficult to identify the user. FRR is also dependent on the threshold value, where the higher

TABLE I. BIOMETRIC FACTOR EVALUATION

Biometric	EER	FAR	FRR
Face	NA	1%	10%
Fingerprint	2%	2%	2%
Hand Geometry	1%	2%	2%
Iris	0.01%	0.94%	0.99%
Keystrokes	1.8%	7%	0.1%
Voice	6%	2%	10%

the threshold value, then the FRR will also increase and vice versa.

EER is the level where FAR and FRR have the same value. The lower the EER, the more accurate the system. EER is most appropriate description to describe the error rate of an algorithm because, as described above, the lower the EER, meaning the lower error that will occur on an algorithm.
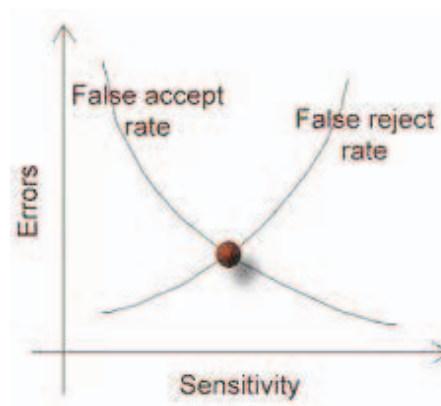

Fig. 1. The relationship between FAR, FRR, error and sensitivity.

In this paper we selected the fingerprint method to intergrate in attendance system. This is because the fingerprint has EER about 2% that better than voice. We did not select the Iris method because of two reason. Firstly, in the next five year, in each smart phone will be has the fingerprint scanner as well as the camera. Secondly, the equipments to do attendance system with iris technology can not be perform on smart phone or other mobile devices.

III. SMARTPHONE ATTENDANCE SYSTEM

There are several phases in this research. The first phase is to collect various issues contained in attendance system that already exist today. Various problems include the limitations of existing attendance system either manually or electronically. After we collecting the problems and limitations, then we design an attendance system that is accurate, efficient, and dynamic. The second phase is to perform a variety of literature related to attendance systems, biometric methods as user identifier concerned, and mobile systems to be used as a platform for the attendance system. The reference collected by searching online or offline, online journals or obtained by finding the appropriate studies related objects on the internet, while the offline method gathered from various media such as books. The third phase is preparations on a research tool, this preparation includes checking the version and type of operating system, check whether the device is being used to support of the hardware fingerprint scanner. Checking of availablelity

fingerprint scanner is also done, it is useful to determine the next step in which if the device already has a fingerprint scanner then no mounting hardware fingerprint scanner again and vice-versa. The fourth phase is learn the existing payroll system today and its relationship with the attendance system, this is done in order to know the extent of integration and the effectiveness of the existing integration. After all the observations and analyzes carried out, then will proceed with the developing mobile applications based attendance system using the android operating system. Then develop the payroll application and integration of these systems with mobile attendance system that has been created previously. The phase is to perform simulations with predefined scenarios to determine the success of the implementation of the attendance system integrated with the payroll system. Based on the results of the simulation will be made conclusions about the effectiveness of the attendance system and accuracy of the data.

Fig. 2.   Architecture of smartphone attendance system.

In figure 2 shows our proposed architecture system. There are five componets in our attendance system: Smart phone, Parser, Application Server, Administrator Computer and Printer. Basically the research method followed the architecture system in 2. We begin developed application on android smartphone using java. Then developed the application for admin. The last step was developed parser that can connected all the components in the system.

IV.   RESULTS

In this research, we build a coding for attendance system to be run on android smartphone, that will be integrated with payment system and human resources application. We choose android smartphone because the number of android user is very huge in the world [14] and [15].

A.   Attendance Application on Android Device

This application runs on the android device associated with employee payroll application on the admin side through an internet connection. This application will takes the information about user, such as the user position through the GPS coordinate that available on the android device [16] and [17],

the user's fingerprint that will matched with a database on the server, and retrieve the date and time when the user is doing absent. With this method, it will improve the accuracy of the attendance system because it takes a position, the date, and time in real time. With this particular method, the employee who works in project out of building also can do absent and also there will not long queue anymore. The use of user identification by fingerprint method will also reduce fraud because the user can not ask friends to do attendance. There are several menu on the main screen of applications, such as About Application and Registration, which is classified as a second menu bar menu. Then there are two menu again which is a main menu: Attendance and Payroll & Schedule created using the button.
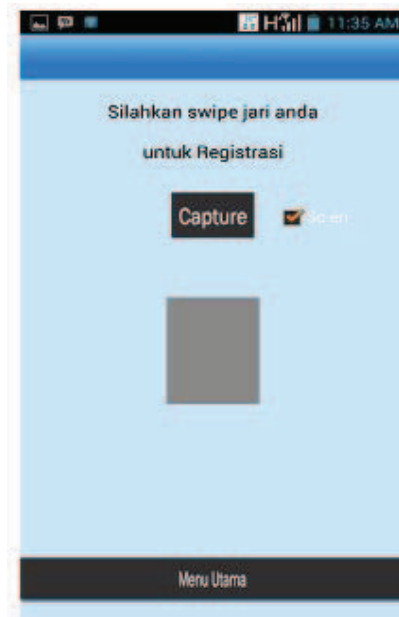

Fig. 3.   Finger print scanner on smartphone attendance system.

When users want to use this application, then user has to register the device and user information to the employee payroll application on the admin side, if the user has not been registered, the registration menu can choose to display the registration form. In order to send the information about the finger print, user has to send the finger print through the application on the android device as shown in figure 3. Users must put his finger on a fingerprint sensor and press a button that sends the fingerprint scan results to the server, then server will check whether the device and fingerprint are already registered previously or not. After registration process done, then user can do attendance process by put the finger on the fingerprint scanner.

B.   Application for admin payroll

At this payroll application, the admin can take over attendance management of employees. Admin can change or create information about shift employees, add or edit employees, and admin can also display data involving payroll timesheet management and perform logtime to the employee through this application. In figure 4 showed screenshot of timesheet at the admin site. We develop many option or menu and create

database for admin such as employee personal information, logtimes, shift schedule, group employees, overtime payroll, and timesheet. We discuss all of them in journal separetely with this paper.
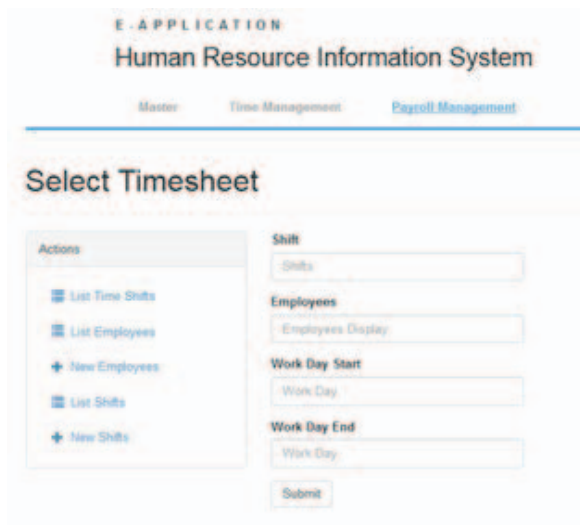

Fig. 4.   Screenshot of timesheet at the admin application.

V.   Conclusion

Fingerprint as one way to do idenifikasi against someone can be collaborated with GPS and mobile technology to create an accurate attendance system applications. In this paper we introduced the attendance system utilize fingerprint and GPS on smartphone that can solve the problems in attendance system. Our attendance system can avoid long queue in front of attendance machine because the process of attendance in our system used smartphone or other mobile devices. The problem of cheating can be reduced because we used fingerprint technology. Our attendance system also was integrated with the application of human resources, the human resources staff do not need to calculate manually for overtime salary and payroll. The last, the employees who work on project out of office can do absent, because our system will collect the GPS coordinate beside the date and time.

Acknowledgment

References

[1]   Ashbourn, J. Biometrics: Advanced Identity Verification: The Complete Guide. Springer-Verlag, London, Springer.2000

[2]   Wayman, J.L. and L. Alyea. Picking the Best Biometric for Your Applications. National Biometric Test Center Collected Works. National Biometric Test Center: San Jose. p. 269-275, 2000

[3]   Bredin, K. Human Resource Management in Project-Based Organisations. 2008 - Challenges, Changes, and Capabilities. Doctoral thesis, Department of Management and Engineering, Linkping University, Linkping.

[4]   M.S Cardon and C.E. Stevens. Managing Human Resources in Small Organizations: What do we know?. Human Resource Management Review, vol 14 (2004), pp. 295-323.

[5]   Prabhakar, S., S. Pankanti, and A.K. Jain. Biometrics Recognition: Security and Privacy Concerns. IEEE Security & Privacy. 2003.1(2): p. 33-42.

[6]   Lisa Myers, An Exploration of Voice Biometrics. SANS Institute InfoSec Reading Room. 2014

[7]   A. Tiwana. Web Security. Digital Press An imprint of Butterworth-Heinemann. 1999.

[8]   C.P. Pfleeger. Security in Computing. Second edition. Prentice Hall PTR. 1997.

[9]   Zhang, D. Automated Biometrics: Technologies and Systems. Norwell, MA: Kluwer Academic Publishers. 2000.

[10]   Allan, A. Biometric Authentication. Perspective. Gartner Research, 2002, p. 1-31.

[11]   Harris, A.J. and D.C. YEN. Biometric authentication: assuring access to information. Information Management andComputer Security, 2002.10 (1): p. 12-19.

[12]   Dugelay, J.L. Recent Advantages in Biometric Person Authentication. ICASSP International Conference on Acoustics, Speech and Signal Processing, Orlando, Florida, USA, 2002.

[13]   Woodward, J.D. Army Biometric Applications: Identifying and Addressing Sociocultural Concerns. 2001.

[14]   Chris Velazco. 2011. Android Still Most Popular Smartphone OS, iOS Holds Steady In Second Place. (on-line), Techcrunch web. http://techcrunch.com/2011/11/03/android-still-most-popular-os-ios-holds-steady-in-second-place/. 13 Januari 2013.

[15]   Tyler Lee. 2011. AuthenTec releases SDK for fingerprint sensor applications on Android phones. (on-line), Ubergizmo web. http://www.ubergizmo.com/2011/08/authentec-releases-sdk-for-fingerprint-sensor-applications-on-android-phones/. 13 Januari 2013.

[16]   Darcey Lauren and Conder Shane. 2011. Enable a Fingerprint Scanner for Android on the Motorola ATRIX 4G. (on-line), developer.com web. http://www.developer.com/ws/android/devices/enable-a-fingerprint-scanner-for-android-on-the-motorola-atrix-4g.html. 13 Januari 2013.

[17]   Sandi Fajar Rodiyansyah. 2011. Arsitektur Sistem Operasi Android.(online), http://educnology.web.id/opensource/rodiyansyah/arsitektur-sistem-operasi-android, 14 Januari 2013.