SECURE AND WIRELESS STUDENT ATTENDANCE SYSTEM

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and found that it has complied the partial fulfillment for awarding
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Signature: .....

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ABSTRACT

Existing student attendance systems essentially use RFID system where the student attendance is recorded when students put their RFID card near to the reader. Although this system is more efficient than the traditional paper based attendance sheet, it is vulnerable to fraudulent. This is because the attendance of a student can be done by other colleagues. Therefore, a more secure attendance system is required. This project aims to design a prototype that records the student attendance securely and wirelessly. This attendance system ensures that only authentic students can record their attendance. The established yet reliable fingerprint identification and Zigbee technologies are the core of the system. The project consists of two parts that are a fingerprint wireless reader and an attendance Windows application. The operation of the fingerprint wireless reader is controlled by the Graphical User Interface (GUI) that was developed. This GUI will identify the fingerprint image and convert the scanned fingerprint into data to be stored in the database. The fingerprint image data is then transferred to the computer wirelessly. In addition, the Windows application – developed using Visual Basic language – reads the transferred data and compares the fingerprint image and with the one stored in the database. It will then determine the attendance status of the student. An attendance report and analysis will also be prepared for this application. The prototype has been successfully designed and developed. Furthermore, performance evaluation shows that the prototype is able to function as desired. Future work is directed to the design of an optimum fingerprint algorithm and hardware, as well as the reliable fingerprint storage.

ABSTRAK

Sistem kehadiran pelajar yang sedia ada, asasnya menggunakan sistem RFID di mana kehadiran pelajar direkodkan apabila pelajar meletakkan kad RFID berhampiran kepada pengimbas. Walaupun sistem ini lebih berkesan daripada menggunakan kertas kehadiran, namun ianya terdedah kepada penipuan. Ini adalah kerana kehadiran seseorang pelajar boleh dilakukan oleh rakan-rakan yang lain. Oleh itu, sistem kehadiran yang lebih terjamin diperlukan. Projek ini bertujuan untuk menghasilkan sebuah prototaip yang rekod kehadiran pelajar secara terjamin. Sistem kehadiran pelajar ini akan memastikan bahawa hanya pelajar yang sahih boleh merekodkan kehadiran mereka. Pengenalan cap jari dengan menggunakan teknologi ZigBee adalah teras kepada system ini. Projek ini terdiri daripada dua bahagian iaitu pengimbas cap jari secara wireless dan kehadiran rekod kehadiran. Operasi pengimbas cap jari tanpa wayar akan dikawal oleh Pengantaramuka grafik (GUI) yang telah direka khas untuk pengimbas cap jari tersebut. Pengantaramuka ini akan mengenal pasti imej cap jari dan menukar cap jari ke dalam bentuk data yang akan disimpan di dalam pangkalan data untuk proses seterusnya. Data imej cap jari kemudian dipindahkan ke komputer tanpa wayar. Di samping itu, aplikasi Windows yang dicipta menggunakan bahasa Visual Basic akan membaca data yang dipindahkan dan membandingkan imej cap jari dengan seseorang pelajar yang disimpan di dalam pangkalan data. Seterusnya ianya akan menentukan status kehadiran pelajar tersebut. Satu laporan kehadiran dan analisis juga akan disediakan dari aplikasi ini. Secara kesimpulannya, sebuah prototaip telah berjaya dicipta untuk sistem ini. Tambahan pula, penilaian prestasi menunjukkan bahawa prototaip ini dapat berfungsi seperti yang dikehendaki. Kerja masa depan akan menumpukan kepada reka bentuk algoritma cap jari dan perkakasan yang optimum, serta penyimpanan cap jari yang mempunyai kebolehpercayaan yang tinggi.

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CHAPTER I

INTRODUCTION

1.1 BACKGROUND

Attendance system is a system that tracks and records the attendance of students for administration purpose. At UTEM for example the attendance may be entered by students or by teachers/lectures or possible by both. There are several ways to record student attendance such as by signing the attendance paper or touching student card on the radio frequency identification (RFID) reader. Paper-based attendance system has been long used whereby students will write down their signature while the paper is pass from one person to another inside the class.

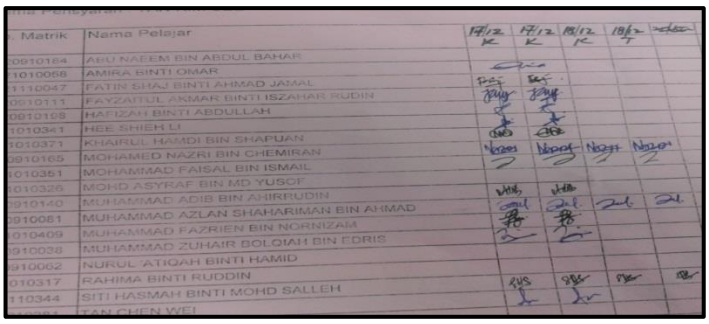

Figure 1.1: Paper Based Attendance System

A newer attendance system is based on RFID technology where students can just swap their matrix card in order to record their attendance into the system.

Figure 1.2: RFID Based Attendance System

1.2 PROBLEM STATEMENT

There are some problems to the current attendance systems in terms of efficiency and dependability. For paper-based attendance system, it requires a long time to complete as students need to sign will pass around the attendance sheet. In addition, this paper-based attendance system is prone to fraudulence whereby other students can write down the signature on behalf of their colleagues. In some cases, some lectures will call students' name one by one to avoid fraudulence. Yet, this repetitive action may even take more time to complete take the time of the class lesson. Moreover, the time for a lecture session will be shortened, hence affected. Although the RFID-based attendance system is fast compared to the paper, it still vulnerable to reliability problem. Students can pass their student card to a colleague to perform record their attendance.

1.3 OBJECTIVES

There are three objectives that have been set to guide the project flow. The objectives are as follows:

i. To develop a prototype of a secured wireless attendance system.
ii. To design and test a fingerprint scanner that will scan students' fingerprint and send to computer wirelessly for the authentication process.
iii. To develop and test a Windows application that compares a fingerprint scan with the pre-scanned images stored in the database and record students' attendance.

1.4 SCOPE

As mentioned before, this project aims to design a prototype of wireless attendance system based on fingerprint biometric for recording student attendance. The project belongs to computer engineering scope whereby hardware and software parts are integrated. The hardware part includes the design, develop, fabricate and test the attendance system. The software part includes the development of the Graphical User Interface (GUI) and database for attendance system using Microsoft Visual Basic and Access tools. Scanned fingerprint of students are transmitted from the hardware to the computer installed with the attendance system software over the Zigbee communication. The fingerprint reader will capture the image of the student and stored in the database. It uses Genetic Algorithm to scan the image where it will recognize the upper bit and lower bit of the frame and the recognition process will be done. This system is suitable to be used at school, universities, colleague and for security of home.

1.5 PROJECT SIGNIFICANCE

The project that is proposed in this thesis addresses the limitations of existing projects on attendance system in terms of dependability, portability and efficiency. In terms of dependability, the attendance system proposed by H Hamid [1], R. Kaliyamah [2] and Z.Z. Abidin [3] are based on RFID, which is lacks security features. On the contrary to this limitation, our proposed project is based on biometric identification that is difficult to be cloned. As fingerprint reader is unique for each human being (or student in this project), it can improve the dependability of the attendance system.

In terms of portability, the existing projects [1,2,3] require a RFID reader that is placed at a fixed places. Hence, their projects lacks portability feature. On the other hand, our proposed project is based on a wireless communication. The fingerprint reader is integrated with a Zigbee module and is powered by batteries. With such technologies, the reader can be passes around just like the paper-based attendance sheet.

In terms of efficiency, the fixed RFID projects [1,2,3] require students to record their attendance. This procedure will take a few minutes to complete. Therefore, the lecture session will be shorten and is not efficient. In contrast, using our wireless fingerprint reader, the attendance can be recorded while lecture session is being performed.

1.6 THESIS ORGANIZATION

This thesis comprises five chapters: Introduction, Literature Review, Methodology, Result and Analysis, and Conclusion and Recommendations. Introduction has been provided in this chapter whereby it serves as the background for understanding the project described in this thesis. Chapter II reviews the theory on fingerprints and existing work related to the project. Chapter III discusses the methodology that was followed during the course of this project. Experimental results and analysis is presented in Chapter IV. Finally, this thesis ends with Chapter V that concludes the project followed by a number of recommendations for future research.

CHAPTER II

LITERATURE REVIEW

2.1 BIOMETRIC SCHEMES

The increasing demand for reliable human large scale identification in governmental and civil applications has boosted interest in scientific testing of biometric systems. Biometrics is the science and technology of measuring and analyzing biological data. In information technology, biometrics refers to technologies that will measure and analyze human body characteristics, such as DNA, fingerprints, eye retinas and irises, voice patterns, facial patterns and hand measurements, for authentication purposes.

The most popular method of keeping information and resources securely is to use password and User ID/PIN protection [4]. These schemes require the user to authenticate them by entering a "secret" password that they had previously created or were assigned. These systems are prone to hacking from either a brute force attempt to crack the password or from passwords which were not unique or even which were posted near the computer itself. A biometric identification system is one in which the user's "body" becomes the password/PIN [5]. Biometric characteristics about the individual are what make that person unique and therefore can be used to authenticate a user's access to various systems.

2.1.1 FINGERPRINT MINUTIAE

Fingerprint recognition has become one of the most reliable biometric authentications due to its permanence, universality, accuracy and distinctiveness. Fingerprint are the ridge and furrow patterns on the trip of the finger and have been used extensively for personal identification of people.

Matching two fingerprints (in minutiae-based representation) is to find the alignment and correspondences between minutiae on both prints [6]. For matching regular sized fingerprint images, a brute-force matching, which examines all the possible solutions, is not feasible since the number of possible solutions increases exponentially with the number of feature points on the prints. In order to increase the efficiency of the matching process, other methods instead of brute-force matching must be applied. Intuitively, a pre-alignment method may obtain the alignment parameters of two fingerprints. Pre-alignment methods that depend on the global singular points are not suitable for partial fingerprint matching. Other pre-alignment techniques need to reprocess all the images thus they cannot be used on already existing databases. There are two major types of features that are used in fingerprint matching: local and global features. Local features, such as the minutiae information and our secondary features, contain the information that is in a local area only and invariant with respect to global transformation. On the other hand, global features, such as number, type, and position of singularities, spatial relationship and geometrical attributes of ridge lines, size and shape of the fingerings, are characterized by the attributes that capture the global spatial relationships of a fingerprint due to the nature of partial fingerprints, partial fingerprint matching requires a set of local features that does not depend on global singular structures. Furthermore, localized features have the ability to tolerate more distortions.

There are several types of biometric identification schemes:

i. **Face**: the analysis of facial characteristics.
ii. **Fingerprint**: the analysis of an individual's unique fingerprints.

iii. **Hand Geometry**: the analysis of the shape of the hand and the length of the fingers.

iv. **Retina**: the analysis of the capillary vessels located at the back of the eye.

v. **Iris**: the analysis of the colored ring that surrounds the eye's pupil

vi. **Signature**: the analysis of the way a person signs his name.

vii. **Vein**: the analysis of pattern of veins in the back if the hand and the wrist

viii. **Voice**: the analysis of the tone, pitch, cadence and frequency of a person's voice.

Figure 2.1 shows the minutiae based matching technique where the recognition will based on the partial fingerprint. It represent the fingerprint by it local features such as termination, bifurcation, crossover, core, ridge ending, island and delta pore.

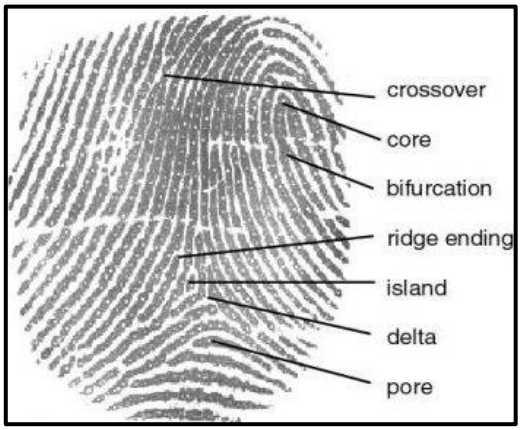

Figure 2.1: Minutiae Based Matching Technique

Fingerprint identification is one of the most used and important biometrics. Fingerprint also offers advantages when compared to other type of biometrics.
There are several advantages for using fingerprint system[7]:

i. High Permanence

Fingerprint is formed in the fetal stage and remains structurally unchanged throughout life.

ii. High Universality

Majority if the population in the world is more than 96% have legible fingerprints.

iii. High Performance

One of the most accurate forms of biometrics available. This method is best tradeoff between convenience and security.

iv. High Distinctiveness

According to research, identical twins even have different fingerprints. Besides that, individuality of fingerprints established through empirical evidence.

2.1.2 IRIS

The colored part of the eye is called the iris. It will control the light levels inside the eye similar to the aperture (the space through which light passes in an optical or photographic instrument, especially the variable opening by which light enters a camera). The round opening in the center of the iris is the pupil. The iris are embedded with tiny muscles that dilate (widen) and constrict (narrow) the pupil size. The sphincter muscle lies around the very edge of the pupil. In bright light, the sphincter contracts, causing the pupil to constrict. The dilator muscle runs radially through the iris, like spokes on a wheel. This muscle dilates the eye in dim lighting. The iris is flat and divides the front of the eye (anterior chamber) from the back of the eye (posterior chamber). Its color comes from microscopic pigment cells called melanin. The color, texture, and patterns of each person's iris are as unique as a fingerprint.

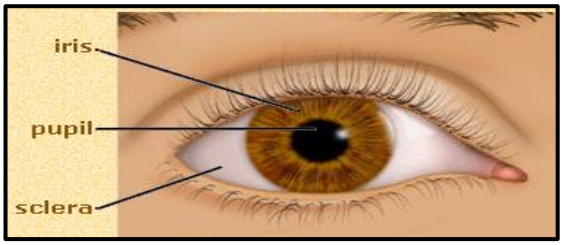

Figure 2.2: Iris Based Matching Technique