Embedded Door Lock System Using Biometric Technology (EDLS)

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Abstract. This study is to design and implement a digital security system which can be used in secured zone which can only be entered by the authorised person. This security system is using biometric identification which can activate, authenticate and validate the user and unlock the door in real time for secure access using finger prints identification as fingerprint based identification. The model consists of hardware module and software which provides a functionality to allow the door to be controlled through the authentication of finger prints by the microcontroller unit. By creating the data base on track record of the user, the expectation results of this study will increase the security level especially in the laboratory rooms and workshop at Electrical Engineering Department, Politeknik Tuanku Sultanah Bahiyah.

Introduction

The urge to have a high security systems towards lives and properties have been a big issue over the years. Many developers and companies have been working to fulfill these needs, by preventing unauthorized intruders entering the buildings or rooms. Electronic locks, discrete access code, and biometric methods such as the finger prints, thumb prints, the iris and facial recognition have been deployed to fulfill this intention. Finger print of every human is unique, and the chances of them having cloned are very less. It was proven as one of the highest security method that can be used in biometric system. The primary purpose of an embedded door lock system (EDLS) is to secure access-controlled zones by restricting access to zones to only those persons (or assets) who are allowed to access.

Before this, the records about the users and their log time and date are kept manually inside the books in each lab. By implementing this system, all the records can be kept in the system automatically, every time the users enter the labs. This feature can ensure the safety of the equipments stored in each lab, by restricting the access only to an authorized person. It is very common for us to open and close the doors by using handle and locks. This is a manual method which is control fully by the users. The idea of implementing an embedded door lock system technique is to enable automatic verification of identity by assessing the computer database of one or more behavioral and/or physiological characteristics of a person. Recently, biometric methods are used for personal authentication utilize such features as the face, the voice, the hand shape, the finger print, and the iris patterns of an individual [1]. Each method has its own advantages and disadvantages based on their usability and security [2].

The choice of using finger print identification in the system is based on the fact that biometric characteristics of each individual are unique. The probability of two people sharing the same biometric data is virtually none. Their characteristics also extremely difficult to duplicate or share as it are intrinsic properties of each individual. Other than that, the benefit of using this type of verification is that we can avoid from using a card or password which can be forged or

retrieved easily by someone else. This system will ensure the highest security to our labs and also improve the lab management system.

Problem Statement

Today most classrooms and laboratories in Malaysian Education Institutions, such as schools, colleges and universities still use a conventional key system where the key is required to open and close a room. This key is sometimes shared by many users such as lecturers, teachers, technicians and students. Electical Engineering Department (EED) of Politeknik Tuanku Sultanah Bahiyah often faces problems of miss locating the laboratory or workshop keys. This is due to the weakness of user track record system of the lab and workshop at EED. In addition, the user of the lab or workshop needs to take and return the keys immediately after using which is time consuming and requires a disciplined user. The security of the lab and workshop can also be questioned since the mobility of the lab keys is not well monitored thus can cause damages and lost of equipment. The use of conventional keys can also cause damage if the door of the laboratory or workshop is harshly operated.

The developement of this system is expected to solve all the problems mentioned above and laboratory as well as workshop management will be more efficient where all the records will be kept systematically.

System Design

The system consists of a hardware module and an application program for microcontroller unit developed in programming language such as C programming and assembly language programming. The hardware module comprises a few stage: The finger print, embedded lock interface, the microcontroller stage and the power supply unit. Figure 1 illustrate the Embedded Door Lock System.

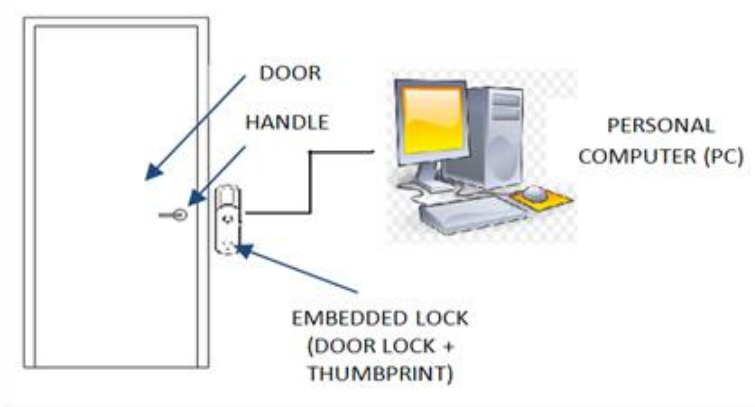

Figure 1 : Embedded Door Lock System using Biometric Technology

The control action is actually performed by the microcontroller. It processes the signals (requests) that are inputted from the finger print at the entrance. The output section of the microcontroller is connected via relays for the desired operational actions. The stages involved in this design are shown in the Figure 2.

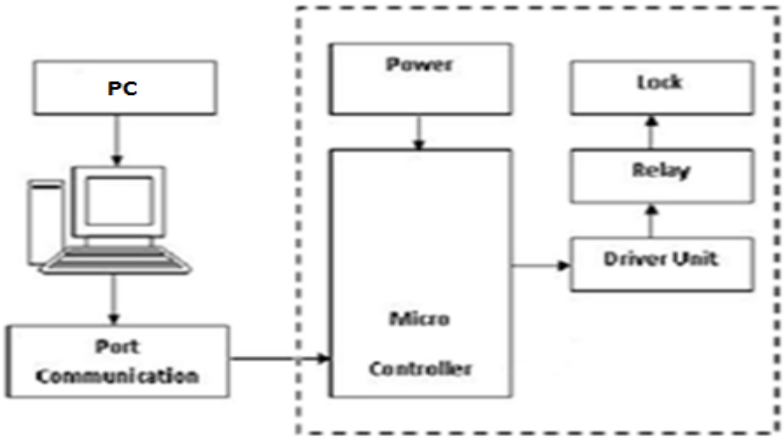

Figure 2.Diagram of Embedded Door Lock System

Fingerprint scanner provides an identification of a person based on the acquisition and authentication of patterns of fingerprint ridges as shown in Figure 3. The actual fingerprint identification process will change slightly between products and systems. The basis of identification, however, is nearly the same. Standard systems are comprised of a sensor for scanning a fingerprint and a processor which stores the fingerprint database and software which compares and matches the fingerprint to the predefined database. Within the database, a fingerprint is usually matched to a reference number, or PIN number which is then matched to a person's name or account. The information contains details of user as name, Id no, category, check-in time, check-out time, date and photo as well [3]. In instances of security the match is generally used to allow or disallow access.

Figure 3 : Fingerprint is a Biometric Technology.

This module already has a built-in converter circuit. This converter convert the analog signal from thumb print image to digital signal. Then, it will transfer the bit via TX/RX to PIC. The PIC will process the bit transferred to match with bits in memory. If matches, it will process to activate the DC motor and the door will open. At the same time the system will record the details of user such as name, time and date of check-in and check-out and the duration of using the lab.

Embedded door lock: The Magnetic lock uses an electrical current to produce a electromagnetic force [4]. This lock combines electromechnical lock and thumbprint scanner in a lock. Thumbprint activates a solenoid which retracts the latchbolt when fingerprint scanning essentially provides an identification of a person. Latchbolt remains retracted until door is

opened approximately 2 inches, then it will releases automatically the latches and deadlocks when the door is closed. Mechanically, latchbolt is retracted with a key at the door, and remains retracted until the door is opened approximately 2 inches, then it releases and automatically latches and deadlocks when the door is closed. Figure 4 shown proposed diagram for lock installation.

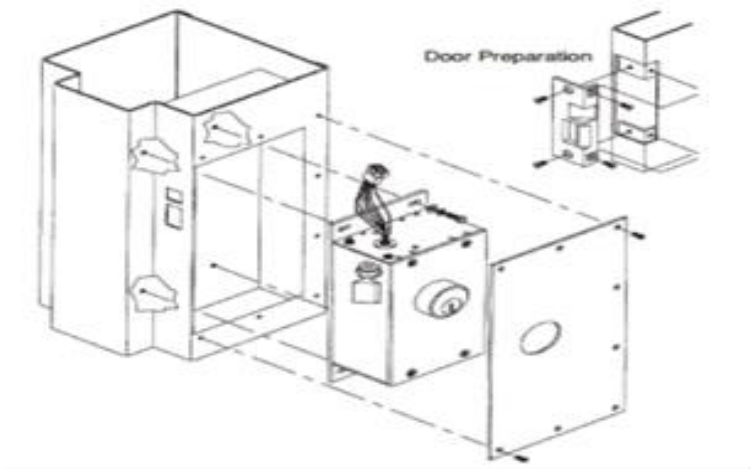

Figure 4: Frame preparation

The System Control Program

The system control program can be accomplished using program written in either low level or high level language such as C, Java, and mikrobasic. A compiler for a high level language helps to reduce production time [5]. Although inline assembly is possible, the programming was done in the Mikrobasic language. The source code has been commented to facilitate any occasional future improvement and maintenance. The code written followed all the three steps of microcontroller program development that is, Compilation, Burning and Evaluation before it was transformed to the microcontroller through the programmer.

The System Operation

After the system is turned on, press the ENTER button once at fingerprint scanner and ensure that the finger is centered and place flat to the surface and fully covers the sensor window. Finger must remain on the sensor window until the door control acknowledges that the finger has been scanned by sounding a beep and turning off the red light. This will take approximately 1 second. An unauthorised is denied an entry upon the mismatch of an invalid fingerprint. Flow chart in Figure 5 illustrate about operation system of the system.

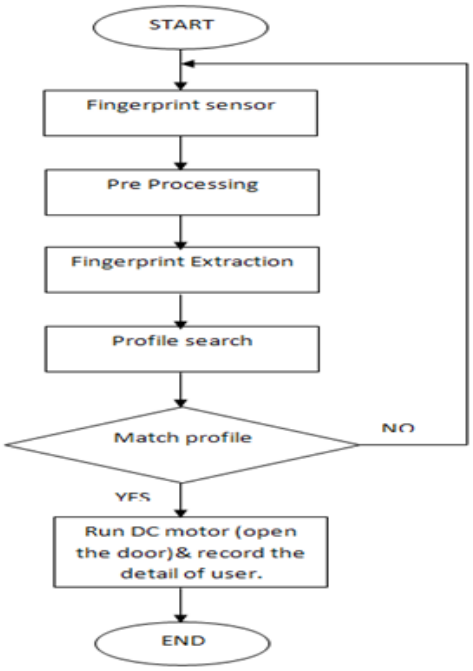

Figure 5: Flow Chart of Operating System

Summary

This study has proved that an embedded door lock system using biometric identification is better than a manual door lock system. The system utilized biometric technology to provide solution for secure access of a space while keeping record of the user. The conclusion of this whole paper is that the biometric door lock system should be implement in Electrical Engineering Department. It is more convenient and more secure compare to conventional method of using lock and keys [6].

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