Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF AUTOMATED FINGERPRINT RECOGNITION SYSTEM FOR THE DOORBELL USING ARDUINO

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Bachelor of Electronics Engineering Technology with Honours

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I declare that this project report entitled “Development Of Automated Fingerprint Recognition System For The Doorbell Using Arduino” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Student Name : NURNILAMSARI BINTI SALIM

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology with Honours

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DEDICATION

To my beloved mother, Puan Jamni Binti Omar, and father, Encik Salim Bin Abu

ABSTRACT

Conceptual security is a subject of concern for the general public. Burglars are opportunists who take advantage of the mindlessness of homeowners and single females. With the increasing trend of online shopping and home deliveries, women are more exposed to a security threat at their doorstep. Furthermore, privacy and modesty are also important for many women living alone. Unexpected or untimely guests can be an inconvenience and cause apprehensiveness. A prototype of a smart biometric fingerprint-based door lock with an identification doorbell system is presented. The system reads the fingerprint and classifies the owner of the fingerprint into four categories, i.e., house owner, family, friends, and others. Each category is assigned to a specific doorbell chime indicating who is at the front door. This will help the owner to be in a state of awareness and readiness. This prototype significantly enhances people’s quality of life while also contributing to the advancement of smart homes.

ABSTRAK

Keselamatan konseptual adalah subjek yang membimbangkan masyarakat umum. Pencuri adalah oportunis yang mengambil kesempatan daripada ketidakpedulian pemilik rumah dan wanita bujang. Dengan peningkatan trend beli-belah dalam talian dan penghantaran ke rumah, wanita lebih terdedah kepada ancaman keselamatan di depan pintu mereka. Tambahan pula, privasi dan kesopanan juga penting bagi kebanyakan wanita yang tinggal bersendirian. Tetamu yang tidak dijangka atau tidak pada masanya boleh menyusahkan dan menimbulkan kebimbangan. Prototaip kunci pintu berasaskan cap jari biometrik pintar dengan sistem loceng pintu pengenalan dipersembahkan. Sistem membaca cap jari dan mengklasifikasikan pemilik cap jari kepada empat kategori, iaitu pemilik rumah, keluarga, rakan dan lain-lain. Setiap kategori diberikan kepada loceng pintu tertentu yang menunjukkan siapa yang berada di pintu hadapan. Ini akan membantu pemilik berada dalam keadaan kesedaran dan kesediaan. Prototaip ini meningkatkan kualiti hidup orang ramai dengan ketara sambil turut menyumbang kepada kemajuan rumah pintar.

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LIST OF SYMBOLS

δ	-	Voltage angle

LIST OF ABBREVIATIONS

V	-	Voltage
LCD	-	Liquid Crystal Display
RTC	-	Real Time Clock
IC	-	Integrated Circuit
IDE	-	Integrated Development Environment
GUI	-	Graphical User Interface
IOT	-	Internet of Things
RFID	-	Radio-Frequency Identification
UART	-	Universal Asynchronous Receiver Transmitter
USB	-	Universal Serial Bus
LED	-	Light Emitting Diode
TTL	-	Transistor-Transistor Logic
GSM	-	Global System for Mobile Communication
FAR	-	False Acceptance Rate
FRR	-	False Recognition Rate
PIR	-	Passive Infra Red
ID	-	Individual Details
PIN	-	Personal Identification Number
2D	-	2-Dimension
KB	-	Kilo Byte
PWM	-	Pulse Width Modulation
ICSP	-	In-Circuit Serial Programming
MHZ	-	Mega Hertz
SMS		Short Message Service

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

In today's advanced technical world, door access system using biometric recognition are commonly used. This security system technology were designed to ensure the safety and security of property owners. A normal doorbell functions to inform the property owner that a person is at the door. But it would not tell the owner who the person is. Adopting a biometric modality to the doorbell helps to inform the owner who the visitor is, and would allow time for the owner to make a decision of the information. The scanner has been assigned to four groups which are the user, family members, personal friends, and intruders

Theoritically, this device enables only the owner to access the home, with the scanner detecting the registered fingerprint and activating the electronic lock to open the door lock and generates few tunes. The scanner can identify the fingerprint that has been stored in the database with the other categories, such as family members and close friends who are frequently visit the home and will activate the door bell with various tunes according to the categories while the door stays locked. Meanwhile, the scanner will not identify strangers' fingerprint but will also ring the door bell with different tune that serves as a symbol or alarm to the owner.

With the addition of Internet of Thing (IoT), once the fingerprint is scanned, the system will send a message to the user using a smartphone application. This kind of application will build the log system to enhance the conceptual security.

1.2 Problem Statement

Concerns regarding safety and privacy of women has been a long-standing issue among women. Current security systems are inadequate and causes inconvenience when one has to fumble for the keys or security card. Security cameras may help, but it is still a non-preventive security method. In recent years, biometrics have been widely used to replace keys and security cards.

1.3 Project Objective

The main aim of this project is to propose a systematic and practical methodology to modernizing security system. The objectives are as follows:

a) To design a cost-effective home security system using finger biometric which emphasis on the security and privacy of women.

b) To develop a finger biometric system that is capable of recognizing and classifiying fingerprints into different categories of visitors.

c) To incorporate IoT into the security system to enhance the level of security.

d) To analyse the effectiveness of the developed prototype.

1.4 Scope of Project

To avoid any uncertainty of this project due to some limitations and constraints, the scope of the project are defined as follows:

a) Research of current door security systems on the market.

b) Research on current most advance fingerprint recognition system.

c) Understanding on how the fingerprint imaging process works and how it can integrate into a controller system.

d) Understanding the uses, durability and maximum capability of the fingerprints sensor with high imaging processing.

e) IoT understanding for wireless notification.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is important in understanding current related technology and trends in developing an innovative system. This chapter reviews and analyses previous research, projects, papers, and international journals that are applicable to this project. This chapter provides theoretical ideas as well as some project-specific recommendations. These were thoroughly investigated to improve the project's quality and reliability.

2.2 Overview of Existing Security System.

Most of the main security lock systems for doors have numerous setbacks such as misplacing, forget, disappear, and easy to duplicate [1]. Authentication is a validation mechanism for the identification of the user which adds another layer of the security to the system. Various authentication systems are used to identify users [2].

The authentication methodology utilised consists of three phases. The initial phase in access control is validation, and there are three regular variables utilized for verification which are something a person knows, has or is. Something a person knows refers to the information that an individual has such as his/her username and something a person has refers to a tangible thing such the keycard or smart card for authentications. Something a person is have to do with the user using biometrics methods to get access control. These authentication mechanisms allow user to get access to the system and they work differently.

The old-fashioned passwords and keys are originally regarded as sufficient for the provision of secure or other data interactions. In the current circumstances, however, the cyber assaults and illegal internet users have made them vulnerable. In addition, password authentication is occasionally shared by people who have the great technical expertise to crack these passwords by a multitude of channels [1]. The automated mechanism for monitoring and controlling the door is part of home security system that protects the residents from danger or threat of criminal acts or other unexpected events that disturb their privacy and safety. Consequently, more trustworthy security measures are continuously sought by the public [3].

The present security mechanism had shortcomings. Firstly, several attacks by hackers or unknown people make the current system unsafe. Thereafter, pin or password authentication is another means to unlock the lock. This is where the user must retain his password. In some circumstances the hackers can use the password to verify the finger print on the buttons using various assaults or the scanner. The disadvantage of the existing approach is that some systems have more than one system security, but it has to be authenticated to unlock the system [4].

2.2.1 Deadbolt System.

This system was followed by a "one key for one lock" security protocol. It was successful for a few days, but it proved incorrect for some time that it is easy to create a single lock using several keys. This method is thus considered unsecured and outmoded in contemporary times. While security concerns with conventional locks can be handled, everyone has a chance to enter the lock even if the duplicate key is utilized. The major cause for this difficult circumstance for this sort of authentication was the loss of the key and the key had to be carried constantly [5][6].

2.2.2 Password Authentication System.

In a security system, password identification is being employed but the primary issue is that passwords might be cracked by others. An attacker can sniff the password at different phases of transmission. The attacker can be easily recognised even if the password is strong.

The human aspect is a major difficulty with the password. Firstly, if it can be remembered easily, passwords are easy to guess or search. Likewise, if it has written down, passwords are easily stolen. A further important point is that users are allowed to share passwords and, if difficult to remember, passwords can be forgotten. The vulnerability allows attackers to hack the system with brute force [2].

Similarly, this system holds the authenticated user password for validation, providing the users with great security. Efficient power consumption and usage are easy to utilize. Unlicensed individuals can however readily access passwords via several techniques, such as hacking, guessing, etc [5].

2.2.3 Radio Frequency Identification (RFID) Reader Authentication System.

RFID is a fundamental and inexpensive technology that enables wireless data transmission. Wireless automatic identification with RFID has a special form such as object, location, or individual, with a unique code with an RFID tag which is attached to or in the