Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF RFID SAFE BOX WITH BIOMETRIC ACCESS USING MICROCONTROLLER

NURUL SYAHIRA BINTI ASHARI

Bachelor of Electronics Engineering Technology with Honours

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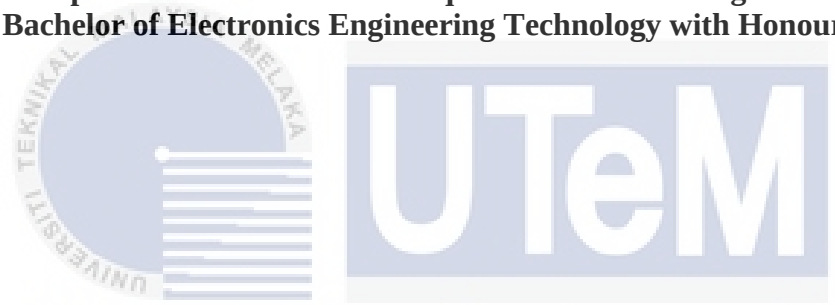
DEVELOPMENT OF RFID SAFE BOX WITH BIOMETRIC ACCESS USING MICROCONTROLLER

NURUL SYAHIRA BINTI ASHARI

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

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FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

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I approve that this Bachelor Degree Project 2 (PSM2) report entitled “Development of RFID Safe Box with Biometric Access using Microcontroller” is sufficient for submission.

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Supervisor Name : SITI HARYANTI BINTI HJ HAIROL ANUAR

Date : 13 JANUARY 2023

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

This thesis is dedicated to those who have helped me from the beginning to finish this project's development

To my beloved mother, Farah Nadiya Binti Mohd Jalaludin,
and father, Ashari Bin Abu Samah,
My families,
My supervisor.
My lecturers,
and
All my friends.
Thank you for all the guidance, endless support, and encouragement up to this point.

ABSTRACT

Biometrics is a technology that uses human senses and physical forms as a credential to identify a specific person. One of the most powerful and unpredictable security mechanisms is biometric fingerprint technology. Furthermore, Radio Frequency Identification (RFID) technology can verify a person's identity by using the chip as the person credential. RFID chips work as part of a wireless connection. While engaged by another chip, a little quantity of data can be sent between the two devices when they are only a few centimeters apart. This chip can be seen on tags, cards, and other items. The system utilizes a microcontroller to control the various components, including a servo motor for locking and unlocking the safe box, a buzzer for providing audio feedback, and a fingerprint sensor for biometric authentication. The RFID technology is used to provide an additional layer of security by requiring the user to present a specific RFID tag before the fingerprint sensor is activated. The Arduino will send a specific task to each component as programmed. The goals of this project are to protect and secure valuable items, confidential documents, and sentimental keepsakes. The development of this project would inspire people to entrust their personal things to this secure box, and it will be introduced to the market in the future, benefiting the industrial revolution 4.0 (IR4.0).

ABSTRAK

Biometrik ialah teknologi yang menggunakan deria dan bentuk fizikal manusia sebagai bukti kelayakan untuk mengenal pasti seseorang tertentu. Salah satu mekanisme keselamatan yang paling berkuasa dan tidak dapat diramalkan ialah teknologi cap jari biometrik. Tambahan pula, teknologi Radio Frequency Identification (RFID) boleh mengesahkan identiti seseorang dengan menggunakan cip sebagai bukti kelayakan orang tersebut. Cip RFID berfungsi sebagai sebahagian daripada sambungan tanpa wayar. Semasa terlibat dengan cip lain, sedikit kuantiti data boleh dihantar antara kedua-dua peranti apabila jaraknya hanya beberapa sentimeter. Cip ini boleh dilihat pada tag, kad dan item lain. Sistem ini menggunakan mikropengawal untuk mengawal pelbagai komponen, termasuk motor servo untuk mengunci dan membuka kunci peti keselamatan, buzzer untuk menyediakan maklum balas audio dan sensor cap jari untuk pengesahan biometrik. Teknologi RFID digunakan untuk menyediakan lapisan keselamatan tambahan dengan menghendaki pengguna membentangkan tag RFID tertentu sebelum sensor cap jari diaktifkan. Arduino akan menghantar tugas khusus kepada setiap komponen seperti yang diprogramkan. Matlamat projek ini adalah untuk melindungi dan mengamankan barangan berharga, dokumen sulit dan kenang-kenangan sentimental. Pembangunan projek ini akan memberi inspirasi kepada orang ramai untuk mempercayakan barang peribadi mereka kepada kotak selamat ini, dan ia akan diperkenalkan kepada pasaran pada masa hadapan, memanfaatkan revolusi perindustrian 4.0 (IR4.0).

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My highest appreciation goes to my parents, partner, and family members for their love and prayer during the period of my study.

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V - Voltage

LIST OF ABBREVIATIONS

LCD	-	Liquid Crystal Display
$RFID$	-	Radio Frequency Identification

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CHAPTER 1

INTRODUCTION

1.1 Background

In today's current world of technology, the issue of property security and reliance on technology is a very important thing to keep an eye on, because the variety of this sort of intruder is becoming increasingly effective in stealing private property illegally and without the owner's permission. As a consequence, it's essential to safeguard such property and assets from intruders using new and better innovative technology. Furthermore, this technology, dubbed "Smart Safes Using Biometric Technology," is designed to keep valuables safe and secure.

The primary intention of this final year project is to create a safe integrating RFID technology and biometrics fingerprints to ensure our safety belongings. The RFID works to make things easier to access by the owners. It is used to lock and unlock safes that contain valuables such as money, vital documents, and so on. This project's scope is in the field of obtaining residences and businesses from thieves and intruders.

1.2 Problem Statement

Having a safe is a smart idea, however the safe system's pre-existing security has several weaknesses and could be improved in a number of ways. In many places, including homes, workplaces, and banks, the necessity for secure storage of precious objects is prevalent. Electronic systems can be hacked or malfunction while traditional mechanical lock and key systems can be simply picked or replicated.

The existing system and gadget, on the other hand, are already antiquated and are at risk of being hacked due to a lack of exact system security features. Lastly, the adoption of biometric functions to identify true owners from intruders is no longer considered safe because the likelihood of being readily hacked is quite low.

1.3 Project Objective

This project is a development of RFID safe box with biometric access using microcontroller that will make use of most people. Therefore, there are a few goals needed to succeed for this project as shown:

a) To integrate both hardware and software by using Arduino IDE software with RFID and Fingerprint sensor.

b) To make system adjustments and modify the core of the present system components to improve the safe's security and create a system that is more reliable more resistant to tampering, and more difficult to hack

c) To produce and apply biometric functions to distinguish between the true owner and the intruder.

1.4 Scope of Project

The goal of this research is to determine the optimal system security implementation approaches for ensuring the safe's proper and secure operation.

a) Using Arduino microcontroller as the brain to control the components in this project.

b) Radio Frequency Identification (RFID) sensor to verify a person's identity by using the chip as the person credential.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is to obtain the relevant information and skills for this RFID Safe Box With Biometric Access Using Microcontroller. The majority of this part is derived from prior projects and theses related to this one. This source can provide some of information from books, journals, and articles on the internet. Project developers also can identify what features are missing from their work by conducting a researcher study of the project. It is one of the critical to improve and develop a successful project.

This report goes into greater information about the project's analysis, such as how weak security makes it easy for hackers to break to the safe system. As a result, the Using Smart Safes project Biometric Technology is the focus of this report, which focuses on improvements and tighter reforms. It's a method of employing RFID tags to lock and tighten the security of current safes.

2.2 Past Related Research

2.2.1 Development of Microcontroller-Based Biometric Locker System with Short-Message Service

[1] The research involved the creation of a microcontroller-based biometric locker system with short message service (SMS) that assures the protection of a person's personal and confidential possessions. The study employed a developmental research methodology that included both hardware and software development. The system was able to scan a user's finger, compare it to a previously saved pattern, and unlock the locker. When an unfamiliar

fingerprint was found, the GSM module was able to send a text message giving the locker's auto-generated passcode. As a consequence, all of the hardware components performed as expected. As the device completed its functions, the application uploaded to the system ran consistently.

Cortez and colleagues (2015) highlighted that it managed the functions of the biometric locker system in their paper "Development of Microcontroller-Based Biometric Locker System with Short Message Service." Other input and output hardware devices were compatible with the Arduino board of the ATmega644. The microcontroller's actions were made easier by the programmes that were uploaded to it. The goal of the project was to create a prototype of a microcontroller-based locker system that can: 1) save fingerprint patterns from the thumb and index fingers. 2) Use a fingerprint or an auto-generated code to unlock the locker. 3) When an unrecognised fingerprint is discovered, send a text message with the passcode.

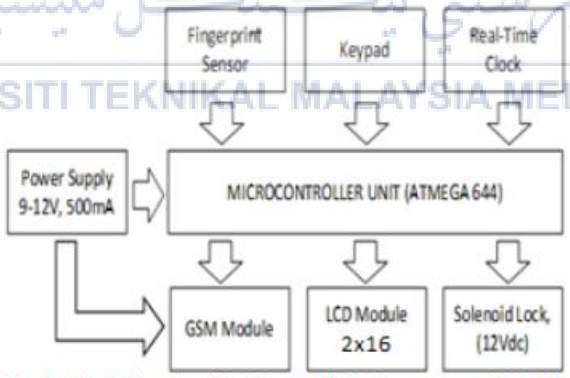

Fig. 1. Block diagram of the biometric locker system with SMS.

Figure 2.1 The block diagram for Biometric Locker System with SMS

2.2.2 Safe-Deposit Box Using Fingerprint on Blynk

Theft is one of Jakarta's most common crimes. In the 24th week of the PSBB period in Jakarta in 2020, there were 5,876 instances. Theft instances have increased in shopping areas, such as minimarkets. It requires improved security, particularly for the protection of assets such as money. Because it can only be accessible by persons who have enlisted on the fingerprint, biometric fingerprints can improve the security of a safe deposit box.

This study [2] will concentrate on a secure security system based on a fingerprint that is connected to the internet via the Blynk app, allowing the user to receive a secure notification when the servo state is open or closed. The fingerprint sensor is used to open doors, the Arduino Uno microcontroller is used to store command logic on the system, the stepper motor is used to open and close the servo, and the Esp8266 module is used as a Wi-Fi module that connects equipment components using the internet network with the Blynk application, which is used for distance control and notification of incoming access to homes with the Internet of Things concept (IoT).

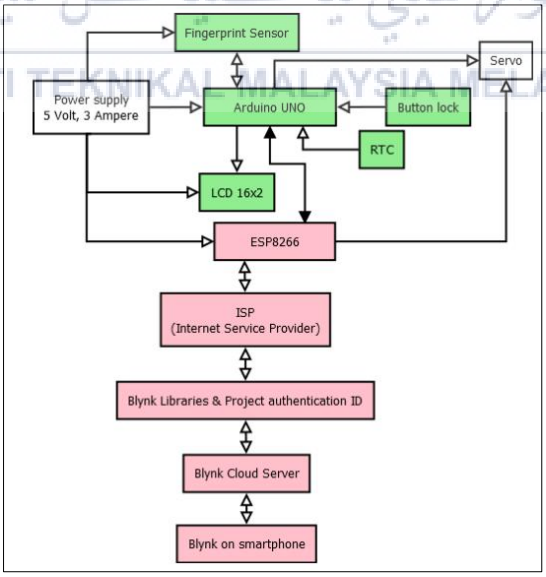

Figure 2.2 The Block diagram of stage III design of the project

2.2.3 Personal Storage with a Dual Security System Based on Arduino

The safe's double security mechanism can be accessed by successfully typing a combination of digits and tapping the fingerprint. Because there is a robust security system to send notification, if the safe is opened by someone else, it will be quickly known. The goal of this research is to create a personal storage system with a dual security system based on an Arduino microcontroller to reduce the occurrence of theft crimes without resorting to violence. The engineering technique was employed in this study, which included problem identification, product design, hardware and software design, data collection, and direct field application.

The goal of this research [3] is to create a personal storage system with a dual security system based on an Arduino microcontroller to reduce the occurrence of theft crimes without resorting to violence. Engineering research methods were used to conduct this study. The first key is opened using the telegraph programme on the smartphone, and the second key is opened using the fingerprint sensor, according to the findings of this study. Telegram also serves as a notification when the safe is unlocked and lifted, allowing it to detect whether the safe is being targeted for theft.

2.2.4 Personal Storage with a Dual Security System Based on Arduino

From this project, [4]In compared to conventional waste bins, the Arduino Safety Box with IoT Notification study can carry 8 times more waste. Initially, the design was based on the ESP8266's ESP-12 module, which is a Wi-Fi SoC with a Tensilica Xtensa LX106 core. Taking another person's property or services without their permission or consent is referred to as theft. As personal information becomes more accessible, identity theft accusations are becoming more widespread. Develop a remote monitoring and control system to transition the primary energy source to a backup if the primary source fails.