JCSITech
https://jcsitech-upiyptk.org/ojs
2024 Volume 10 Issue 4 Hal: 126-130 e-ISSN: 2502-1486

Design Of A Layer-Layed Security System For Jewelry Vaults Utilizing A Time-Based One-Time Password (Otp) Algorithm Using Fingerprint And Microcontroller-Based Telegram

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Abstract

On campus, the security of student and employee belongings is crucial. Currently, the security system for safes still relies on manual locks or card keys, which are vulnerable to theft and fraud. Therefore, the development of a more sophisticated and secure security system is necessary. One solution is to utilize the Time-Based One Time Password (OTP) algorithm to strengthen locker security. The OTP algorithm generates a unique password each time a user opens the locker, making it more difficult for unauthorized parties to access. Furthermore, the use of fingerprint technology and Telegram as a medium for sending OTP codes can also enhance system security. Fingerprints are used to identify authorized users, while Telegram is used to send OTP codes to users. This tool is processed with an Arduino Mega 2560 microcontroller as a connection.

Keywords: *Time-Based One Time Password (OTP), Fingerprint, Telegram, Mikrokontroler Arduino Mega 2560.*

1. Introduction

In this modern era, the development of computer technology has made a significant contribution to various aspects of life, including security. One pressing need on campus is the security of student and staff belongings, particularly in safeguarding valuable assets. Conventional security systems that rely on manual locks or card keys have weaknesses that make them vulnerable to theft and fraud.

As a solution, the development of more sophisticated security systems is essential. A multi-layered security system that combines various modern technologies can be the answer to enhancing the protection of valuables. The Time-Based One Time Password (OTP) algorithm is one promising technology for strengthening security due to its ability to generate a unique password each time a user attempts to open a locker or safe, making it difficult for unauthorized parties to access. The use of fingerprint technology as a method of identifying authorized users, along with Telegram as a medium for sending OTP codes, offers an additional layer of reliable security. A vibration sensor can also be integrated to detect forced opening attempts, which will then send a notification via Telegram. Furthermore, integration with Radio Frequency Identification (RFID) and microcontrollers, such as Arduino, is also possible. Mega 2560, allows better control and automation in security systems.

This research aims to design and develop a multi-layered security system for jewelry safes that utilizes a Time-Based OTP algorithm, fingerprint, RFID, and various other sensors and supporting modules. This system is expected to provide a more secure and sophisticated solution for protecting valuables and increase user confidence in the security of lockers and safes on campus.

2. Research Method

2.1 Arduino Mega 2560

The Arduino Mega 2560 is an Arduino board with an ATmega2560 microcontroller. It has 54 digital I/O pins (15 PWM outputs), 16 analog inputs, and 4 UARTs. Powered by a 16 MHz clock, the board can be operated via USB or a 7-12 V DC adapter.

Figure 1 Arduino Mega 2560

2.2 Fingerprint Sensor

A fingerprint sensor is an electronic device that reads a user's fingerprint as a method of identity verification. These sensors are often used in electronic devices such as smartphones, door locks, employee attendance devices, and various other devices requiring a high level of security. These sensors ensure that only registered users can access the device.

Figure 2 Fingerprint Sensor

2.3ESP8266

The ESP8266 is a microcontroller with WiFi connectivity, a processor, and memory that can be integrated with sensors and actuators via GPIO pins. This module supports IEEE 802.11 b/g/n standards, WiFi direct (P2P), and Access Point (soft-AP). It is equipped with 81 MB of RAM, 1 MB of flash memory, speeds up to 160 MHz, and a power output of 19.5 dBm. The ESP8266 is designed for mobile devices, wearables, and IoT applications with a power-efficient architecture that works in three modes: active, sleep, and deep sleep.

Figure 3 ESP8266

2.4 LCDLCD (Liquid Crystal Display) is a type of electronic display that uses CMOS technology, working by reflecting or transmitting light without producing its own light. LCD is used to display data in the form of characters, letters, numbers, or graphics. This display consists of an organic mixture layer between two layers of glass with transparent electrodes. When the electrodes are energized, the organic molecules align themselves, and light reflected by the polarizer cannot pass through the activated segment, so that the segment appears dark and forms the desired display.

Figure 4LCD

2.5 Mp3 Player Modul

The MP3 Player module is an audio file player/music sound player module that supports audio formats such as the widely recognized .mp3 file. The DFPlayer mini is rectangular, measuring 20 x 20 mm and has 16 pins. The output on this mini MP3 module can be directly connected to a mini speaker or amplifier.

Figure 5 MP3 Player Modul

3. Result and Discussion

3.1. Context Diagram A general explanation of the designed system. describes each external entity as a whole. A context diagram defines the entire system to be designed. It facilitates the analysis of the system as a whole. A context diagram serves as a medium, consisting of a process and several external entities

How the system works can be seen from the context diagram in Figure 6.

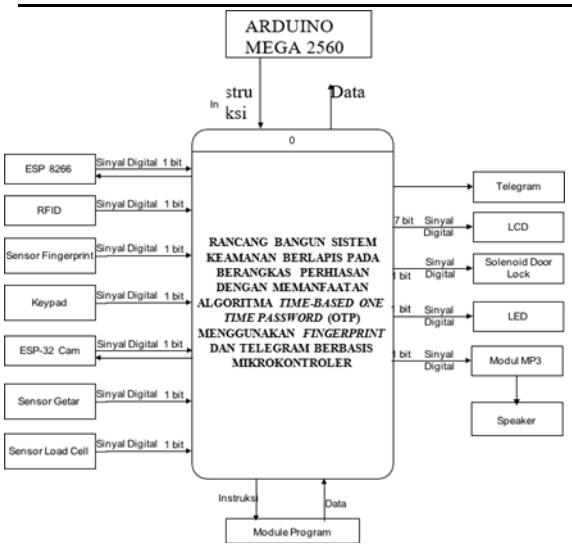

Figure 7. Context Diagram

3.2. Data flow diagram

A more detailed description of the designed tool. DFD is a program workflow in designing Automatic Sliding Door Designs in Supermarkets or Mini Markets. Image of level 0 data flow diagram.

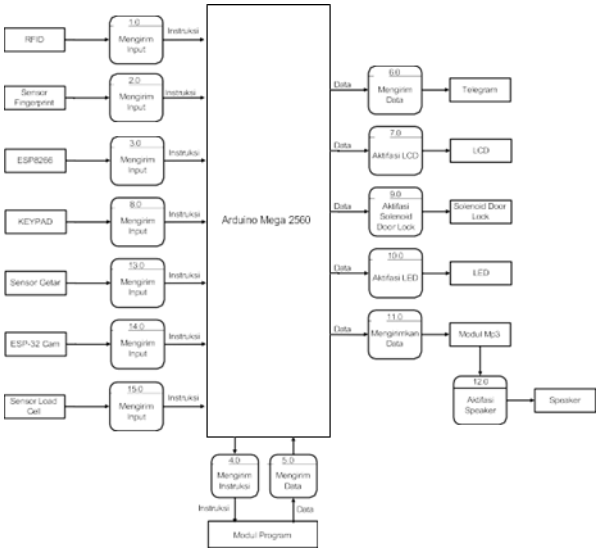

Figure 9. Data flow diagram

3.3. Blok Diagram

Referring to the Data Flow Diagram above, to find out the components of this system, you can see the block diagram in Figure 10

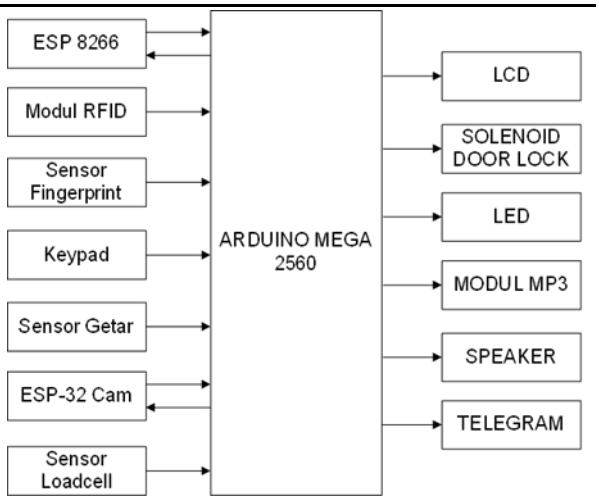

Figure 10. Data flow diagram

3.4 Flowchart

The designed program module has a structure with good quality, so it is necessary to start by determining the logic in the program. The basic logic described in this writing is by using the following flowchart.

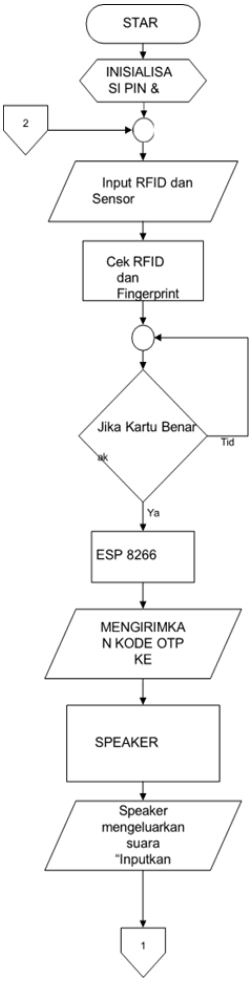

Figure 11 Flowchart

4. Conclusion

Using the Arduino Mega 2560 microcontroller, you can control the safe security system, using the ESP-8266 module can be a device connection with Telegram, the ESP 32 Cam you can monitor the situation inside the room, a Loadcell Sensor, users can find out the weight of the jewelry in the safe. Using an RFID module can be the first lock system and OTP code activation which will then be sent to Telegram, Fingerprint sensor can be the second option for the first lock system and activate the OTP code which will later be sent to Telegram, LED can be an indicator light on the safe when the OTP code entered is incorrect vibration sensors can detect if the safe is being forced open The keypad can be used as an input medium to enter the OTP password and become a second lock system

Acknowledgements

We would like to express our gratitude to the Putra Indonesia University YPTK Padang Campus.

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