

DOCUMENT SECURITY SYSTEM USING ARDUINO-BASED FINGERPRINT AND RFID MODULE

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DOCUMENT SECURITY SYSTEM USING ARDUINO-BASED FINGERPRINT AND RFID MODULE

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Abstract : Documents are valuable/important letters that can be used as evidence of printed or written information. The company where the author conducted research is a company operating in the logistics sector, which of course has a special document storage room, namely the Accounting room . The use of plastic folders containing documents and safes as a place to store important documents and files still carries a lot of risk of misuse and loss. The title of this research is Document Security System Using Arduino- Based Fingerprint and RFID Modules . One of the aims of this research is to minimize loss and prevent misuse of documents/files placed in plastic folders. A security system using fingerprint and RFID is very good to apply as document security because it has double security. The system created uses a fingerprint as a signal breaker or RFID tag electromagnetic waves which are attached to a folder containing important documents/files belonging to the company. This system is also supported by an Arduino kit Uno with an Atmega328 microcontroller as the brain for processing data from the fingerprint sensor and RFID Reader functions as an electromagnetic wave identification system for RFID Tags , therefore two pieces of hardware are needed, called Tags and Readers . Apart from the three main components mentioned, there are several other components used in making this document security system, namely micro SD kit, buzzer, push button, servo . Creating this system is very important to limit misuse of documents and the risk of losing documents in a company.

Keywords : System, Fingerprint , RFID Module, Arduino Uno

1. Background

As technology develops, each company has its own design system for organizing the company, so that it can develop more rapidly in terms of vision and mission. In its development, a company competes in business competition, but there are several things that are taken into account in terms of security. This is not only external to the work environment or within the company environment, in this case the author focuses on the document security system found in the document storage room where the author carries out research . Without the existence of a special security system in the document storage space and especially for the documents themselves, a document security system is needed whose aim is to prevent misuse of documents and anticipate the loss of important documents.

A room that contains important documents should have a special security system. Storing documents that are only put in a plastic folder and placed in a cupboard /box will cause problems and losses for the company if there is misuse and loss of important documents/files. From the observations that the author obtained, several weaknesses were found in the storage of important documents. Some of these weak points include: Documents/files that are only included in plastic folders and the storage process is only in container boxes without a special security system, resulting in minimal supervision.

In utilizing existing technological advances, the author wants to create a mini model of a document security system using Arduino-based fingerprint and RFID modules. With a wireless RFID tag identification system that is placed/placed in a folder containing important documents/files, it is hoped that it can minimize and even prevent loss and misuse in issuing documents or note files. It is hoped that the finished mini model can be applied to folders that are currently used to store files and documents so that it can minimize, limit and prevent misuse/loss of documents. In order to realize the company's vision and mission, the existing security system must be in accordance with current needs.

2. Identification of problems

Based on the background above, in identifying the problems that the author will discuss include:

1. Documents/files are only put in a plastic folder in the accounting room and the storage is only in a container box without any special security system.
2. The accounting party has the freedom to issue billing note documents/files manually when an employee (salesman/collector) requests a billing note/sales invoice outside the predetermined schedule without the approval of the audit party and management.

3. Formulation of the problem

Based on the background above, the main problems that the author will discuss include :

1. How a security system created using Fingerprint and RFID Arduino-based modules can limit and prevent misuse/loss of documents in the accounting room.
2. How can the security system created limit the accounting party from issuing documents/billing note files outside the schedule without the approval of the audit party and management by using Arduino-based Fingerprint and RFID Modules.

4. Restricting the problem

Problem limitations in creating a " Document Security System Using Arduino Based Fingerprint and RFID Modules" include:

1. The security system created for the folder containing documents utilizes several hardware devices consisting of fingerprint and RFID modules as well as Arduino as the system controller.

2. The resulting security system's capability only accepts commands via a fingerprint connection to the Arduino to retrieve a document folder.
3. The RFID module connected to the Arduino receives a signal to identify the RFID tag if someone does not have access to bring/remove a folder containing files/documents so that the warning system in the form of a buzzer sounds.
4. The warning system in the form of a sound from *a buzzer* and an LCD display can only be deactivated by pressing *the push button* .

5. Research purposes

The research objectives of creating a " Document Security System Using Arduino-Based Fingerprint and RFID Modules" include:

1. Creating a document security system using Fingerprint and RFID Modules so that documents/billing note files in the accounting area are not misused and reduce the risk of loss.
2. Creating a security system to limit and prevent accounting parties from issuing documents/bill notes outside of schedule by using Fingerprint and RFID Modules

6. Literature review

1) Understanding Systems

Quoted based on (Campbell, 1977) in the book title *Understanding Information Systems: Foundations for control* , it is emphasized that a system is "*any group of interrelated components or parts which function together to achieve goals*" (a collection of parts or components that are interrelated and together function or move to achieve a goal).

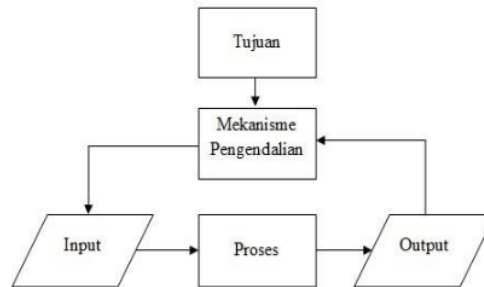


Figure 1 System Elements

2) Understanding Security

(Gollmann, 1999) in his book " *Computer Security* " states that: "Computer security is related to self-prevention and detection of unknown intrusive actions in computer systems".

Barry Buzan in his book entitled *People, States, and Fear* says that " *security, in any objective sense, measures the absence of threat to acquired values, in a subjective sense, the absence of fear that such values will be attacked* ". (Buzan, 1991:4)

3) Understanding Fingerprints

Fingerprints are lines on the skin of the fingertips. Fingerprints function to provide greater friction so that the fingers can hold objects more tightly. The security system using fingerprints began to be used in America by a person named E. Henry in 1902. Henry used the fingerprint method to identify workers in order to overcome double wages. Henry's system uses a *ridge pattern* (ridges of grooves in the skin, both on the hands and feet) which are centered on the pattern of the fingers and toes, especially the index finger. To obtain an image of a ridge pattern, this is done by rolling an inked finger on a printed card until a unique ridge pattern is produced for each individual. Human fingerprints consist of two layers : the outer layer (*epidermis*), and the inner layer (*dermis*).

Over time, fingerprint reading can be done using a fingerprint scanner machine.



Figure 2 *Fingerprint*

4) RFID

RFID technology is part of RF (*Radio Frequency*) which is used as a wireless identification medium which consists of two components (Karigianes, 2007) that is :

- a) RFID tags (*transponders*) consist of a small *device* embedded in a book such as a label, smartphone and others that have unique identification and writable memory.
- b) RFID reader is a *device* that can communicate without direct contact with a tag to identify if it is connected in a communication data association without direct contact (*wireless*) on a *radio frequency* .

An RFID reader is a link between the application software and an antenna that will radiate radio waves to the RFID tag (*transponder*) (Fangan , 2004). Identification of objects or data using RFID technology is done by matching the data stored in the transponder tag memory with the data sent by the reader . RFID is formed by the main components of a tag reader and a tag antenna that can use power (active tag) or not (passive tag) and is placed on the object to be identified. In passive tags, the signal is sent by the reader via electromagnetic waves , then the tag will respond and send data/information to it. Readers also have the ability to make data changes to tags in addition to reading and retrieving information data stored in tags. Meanwhile, the antenna in the RFID system influences the reading range or identification of objects.

Based on the working *frequency* used by TagRFID to send and receive signals, there are 4 types of implications for distance, operation, performance and reading speed, namely:

a) LF (*Low Frequency*)

LF has a frequency range of 125 KHz – 134 KHz with short distance use, approximately 50 cm. usually used for identification systems that only require short distances.

b) HF (*High Frequency*)

HF has a frequency operating range of 13.56 KHz with readings up to approximately 3 m, this frequency is suitable for reading at the item level and is widely used for matching items in shops, buildings or tracking that require a reading speed of 10 to 100 tags per second .

c) ¹ UHF (Ultra High Frequency)

UHF has 915 MHz with a reading range of up to about 9 m. UHF tags can be read at speeds up to 1000 tags per second. Usually widely used for tracking goods in truck containers.

d) Microwave

Microwaves have a frequency of 2.45 GHz with a longer reading distance (10 m). This frequency experiences more reflections from waves and surrounding objects and can interfere with the RFID reader's ability to communicate with RFID tags. This frequency is usually widely used for supply chain tracking.



Figure 3 RFID module

5) Arduino

⁴ Sulaiman (2012:1) believes that Arduino is a platform consisting of software and hardware . Arduino hardware is the same as microcontrollers in general, only the Arduino has added pin names to make it easy to remember. Arduino software is open source software so it can be downloaded for free. This software is used to create and insert programs into Arduino.



Figure 4 Standard USB Arduino Board

6) Development Methods

The research and development steps in creating a Document Security System Using Arduino-Based Fingerprint and RFID Modules are as follows:

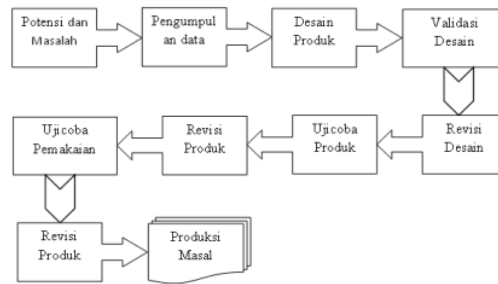


Figure 5 Research and Development steps

Information :

a. Potential and Problems

The main problem that is sought for a solution is the absence of a Document Security System Using Arduino-Based Fingerprint and RFID Modules.

b. Data collection

In collecting data here the author carried out literature studies and information gathering. Literature study is a series of activities related to methods of collecting library data, reading and taking notes, and managing research materials. Information collection is a form of activity to obtain data and information.

c. Product Design

In this step the author carries out a product design which is realized in the form of an image or chart, so that it can be used in guidelines for assessing and making it and the final result is a new product design that is equipped with specifications.

d. Design Validation

Design validation is one of the development processes carried out to determine the level of effectiveness of the product produced. Validity testing is carried out by experts or experts who are accompanied by an assessment.

The circuit block diagram of "Document Security System Using Arduino Based Fingerprint and RFID Module" can be seen in the image below :

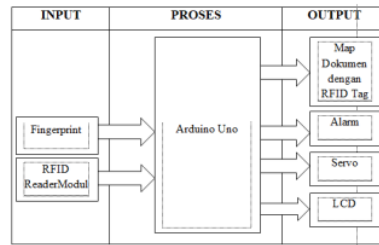


Figure 6 Block Circuit Diagram

7) **Circuit Schematic**

The circuit scheme for making " Document security system using Arduino based fingerprint and RFID module" can be seen in the picture below:

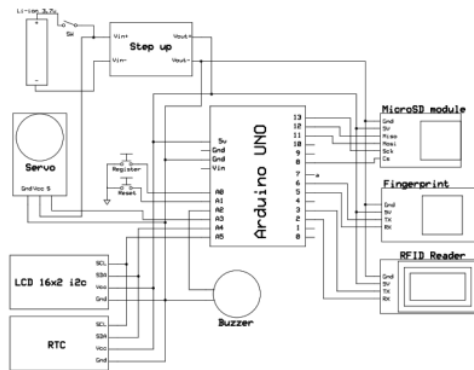


Figure 7 Overall circuit schematic

Document Security System Using Arduino Based Fingerprint and RFID Module

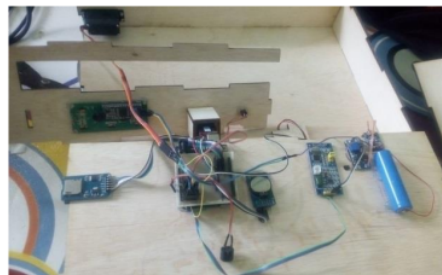


Figure 8 Document Security System Circuit Using Arduino Based Fingerprint and RFID Module

7. Interface and Tool Test Results

From the overall system circuit, after assembling the various components, a product is produced and can be seen in the picture below :



Figure 9 Tool Interface When Testing

Table 1 Tool test results

No	Jenis Yang Diujikan	Indikator Uji	Keterangan
1	Fingerprint	Scan Sidik Jari Sesuai	LCD menampilkan pesan Please take Doc lahu pintu box terbuka, yang berarti user bisa ambil dokumen
		Scan Sidik Jari Tidak Sesuai	LCD menampilkan pesan INVALID USER dan pintu box tertutup
2	Map Dokumen dengan RFID Tag	Data sidik jari dan Data RFID Tag sama (sesuai)	RFID reader menangkap sinyal RFID Tag dan LCD menampilkan Data RFID serta pintu box terbuka dan buzzer non aktif
		Data sidik jari dan Data RFID Tag berbeda (tidak sesuai)	RFID reader menangkap sinyal RFID Tag dan LCD menampilkan pesan ALERT!! serta pintu box terbuka dan ketika buzzer aktif pintu akan tertutup kembali
3	LCD	Kondisi Standby	Hanya sebagai pemanggil pesan dari setiap aktifitas yang terjadi
4	Buzzer	Ketika On	Ketika buzzer dalam keadaan On berarti ada kesalahan dari suatu aktifitas pengambilan map dokumen yang dilengkapi RFID tag
		Ketika Off	Aktifitas sudah sesuai dengan kondisi yang ditetapkan
5	Arduino	Kondisi On	Sistem Alat berfungsi sehingga alat dapat digunakan
		Kondisi Off	Sistem Alat tidak berfungsi

8. Conclusion

Based on the completion of the preparation and manufacture of the "Document Security System Using Arduino Based Fingerprint and RFID Module" tool, it can be concluded:

1. Document Security System Using Fingerprint and RFID Arduino-based Module is able to reduce misuse of documents/note files and the risk of document loss.
2. Can limit and prevent the accounting party's freedom in issuing billing note documents/files.

9. Limitations of Research Results

Based on the research results, the product/mini model produced has limitations, including :

1. RFID *tags* are only attached to folders containing documents.
2. The RFID module used is classified in the short distance category.
3. Adding fingerprint data or replacing fingerprint data requires *the user* to remove *the micro SD card* first and delete all stored data, requiring re- *input* .
4. *User* fingerprint data stored on *micro SD* is limited to 3 people.
5. If the warning system (*buzzer*) sounds, the *push button must be deactivated* .
6. When creating a document security system using fingerprints and RFID, the Arduino-based module does not use a database connected to a computer, so viewing log data requires removing the SD card first and connecting it to a PC/Laptop to view it.

10. Suggestion

The suggestions for developing research products are as follows:

1. The use of Arduino-based fingerprint and RFID modules as document security can be applied to objects other than document security.
2. It is hoped that fingerprints can be further developed to be used as room access.
3. Can be developed using an IoT (*Internet of Things*) based system

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