

**APPLICATION OF RFID FOR SECURING COMPUTER  
LABORATORY INVENTORY**



Paper

Submitted as a Partial Fulfillment of the Requirements for Getting Bachelor Degree of  
Department of Informatics Engineering in the  
Faculty of Communication and Informatics

Proposed By:

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MUHAMMADIYAH UNIVERSITY OF SURAKARTA

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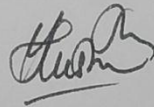
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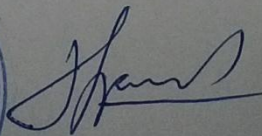
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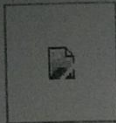
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# APPLICATION OF RFID FOR SECURING COMPUTER LABORATORY INVENTORY

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These days, there are many identifications using RFID (Radio Frequency Identification) technology. One of the RFID applications is inventory control. It can be used for recording and monitoring the inventory usage activity. Data recording and monitoring of the inventory usage in the laboratory of Faculty of Communication and Informatics still use the conventional system, which is recorded in a file or book manually, unavailability of direct detection when the inventory is taken in and out by the student, and also there is no inventory rental transaction recording. This system provides a solution that solves the problem using RFID technology. The purpose of the research is to improve the effectiveness and efficiency of monitoring and managing the inventory data and recording data of inventory rental transaction. This research uses some methods such as directly interview with laboratory staff, read the literature and get requirement analysis that help researcher to create the inventory management application program. This inventory control uses RFID as an object detector. The object to be identified is laboratory inventory such as a set of computer, access point and router. A tag is embedded inside each item as the identification number of item and it needs to be registered to database. A Subscriber is a student that wants to borrow the laboratory inventory and it must be registered. Rental transaction is an activity in which a subscriber may borrows the inventory that available in the computer laboratory. The results of this research is desktop application that help staff of laboratory to record the data of inventory and students as a subscriber, securing and monitoring the activity of inventory usage and record history of inventory rental transaction, and also provides the accurate data from inventory, subscriber and rental transaction.

Keyword: Inventory control, application of RFID.

## 1. INTRODUCTION

These days, technology is growing rapidly. This is indicated by the number of kinds of object that are created to assist and facilitate the work of all human beings, for example, a computer that can do many things and in any field of work, not least in the field of identification.

According to the Oxford dictionary (online), identification is the action or process of identifying someone or something or the fact of being identified. According to Poerwadarminta (1976: 369) “identification is the activity to define or determine of the identity of a person or object”.

There are many applications of identification, such as in of inventory control, including computer inventory where people record some computers that belong to an agency. Data accuracy of inventory is required to determine how many computers are in and out of the laboratory and count the numbers of computer. This identification is used to detect some computers to know about its attributes, such as name, registration number and year of entry

The existence of a technology can facilitate the identification to identify the attributes of inventory. This identification

technology is called Radio Frequency Identification (RFID). RFID technology can be used for inventory control and it has some advantages, such as it can read some registration numbers at once without directly contact (contact less) and it is not necessarily aligned with its reader.

## 2. LITERATURE REVIEW

Based on Maryono (2005), identification with radio frequency is a technology to identify a person or objects using radio frequency transmission, especially 125 KHz, 13.65 MHz or 800-900 MHz. RFID uses radio communication to identify an object or a person uniquely. This is a fastest automated data collection technology on its development.

A research from Muflihun (2004) claimed that the development and utilization of Auto-ID in this time is starting to enter a new phase. The emergence of new technologies, especially Electronic Product Codes (EPC) and RFID tag or label is expected to increase savings more real in a variety of industries. Range of RFID applications are starting from security systems and access to goods tracking system, inventory management and simplify the check-out of retail.

According to the researches above which are determinate the definition of RFID and its combination performance with other things, then the writer can do research on RFID is applied to the inventory control, especially inventory records of computers laboratory.

### 3. FUNDAMENTAL THEORY

RFID is an electromagnetic wave communication technology which is used for identifying or tracking of specific objects, such as inanimate objects, pets or animals and even humans. There are three main components of RFID such as tag, reader, antenna and software.

#### 1. RFID Tag

##### a. Active Tag

Active tag has its own power supply (battery) and its range is longer than passive tag. Its memory is also larger and then it can accommodate a wide variety of information inside it.

##### b. Passive Tag

Passive tag has not a power supply (battery), but it just has an antenna that reflects radio frequency transmitted by the

reader.

#### 2. RFID Reader Terminal

It consists of reader and antenna that will affect the optimal range of identification. RFID terminal will read the stored information inside the tag via radio frequency. The function of the antenna is a signal amplifier that sent its signal to the tag and read it back to processing.

Table 1 Frequency of RFID Reader

Frequency Type	Frequency Range	Frequency Uses	Range Distance
Low Frequency	30 KHz to 300KHz	125-134 KHz	Less than 0.5 m
High Frequency	3 MHz to 30 MHz	13.56 MHz	Up to 1.5 m
Ultra High Frequency	300 MHz to 3 GHz	800-900's MHz	865- 956MHz (5m)
Microwave	2-30 GHz	2,45 GHz	Up to 10 m

#### 3. Host Computer

Computer system that manages the flow of information from the item that detected within the scope of the RFID system. It is also manages the communication between tag and reader. The host can be a stand-alone computer or connected to computer network for communicate to server.

## 4. METHOD

### 4.1 Flowchart of Research

This research applied some steps in order to create application program runs well and achieve the expected research target. The process of research started from requirement analysis until research reporting arrangement.

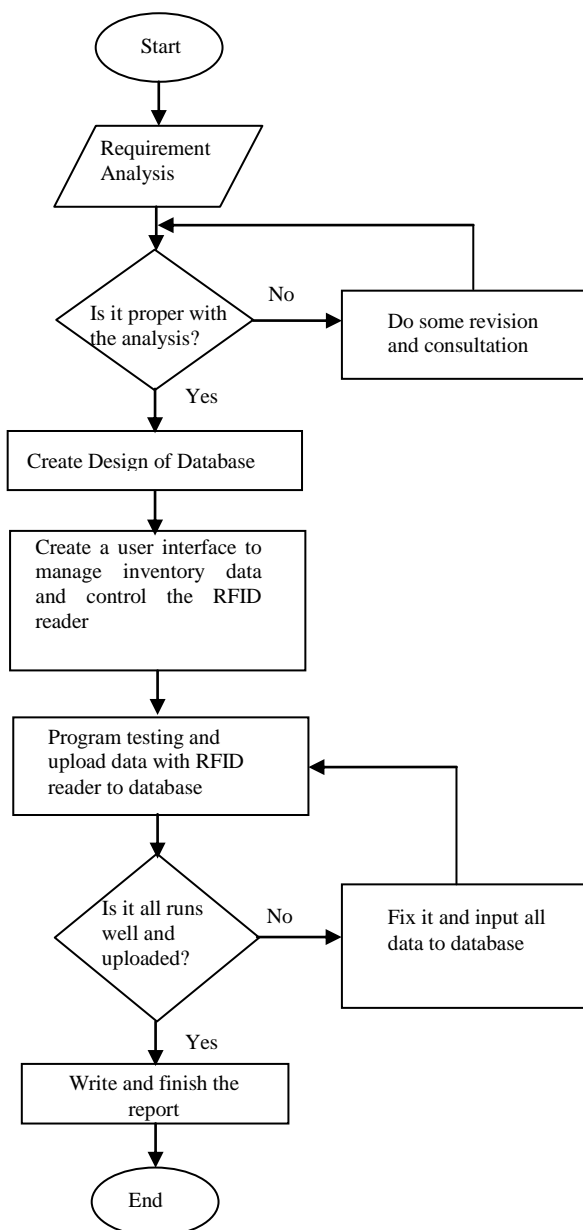


Figure 1. Research Flowchart

First step is requirement analysis about the system that to be built. This activity can help the author to create the database, user interface for managing data and controlling RFID reader. If the analysis is proper to inventory system (requirement), it will continue to database creation.

Database creation is used for provide data storage. This database at least was contained by information of inventory, subscriber and rental history, also recording of in-out of inventory. Every inputted data was saved on a database directly. When database creation is finished, then design and build user interface and function of reader controller. These are the main activities of this research, because this system is used to analyze the advantage of RFID. User interface is also used for managing the information or data of inventory, subscriber and rental transaction and as a controller function for the RFID reader to read.

Test the application program and reader, if user interface has been completed. This is an activity to find the errors on the program and



measure the level of accuracy reader to read ID tag. If there are some mistakes from the program algorithm, then fix it as soon as possible for generates better application program. After the program runs correctly, ensure the expected data such as data of inventory, subscriber and rental transaction is all uploaded.

#### 4.2 Flowchart of RFID reader Identification

The main function of this flowchart is to explain about detection process of RFID reader. This flowchart facilitates the people assumptions that read this research about a process of reading the RFID to read ID tag especially the reader is combined with the application program.

Detect ID number of each inventory. This is an input process from RFID reader and then it is forwarded to the process of ID checking.

Check inventory ID number on database. This is a process to check inventory ID that is already available/registered or not. If the ID is not registered, the administrator

should to register first the information of inventory with each ID number. If the ID number is available, then show the information of inventory from the ID number.

Show all the information of inventory is the last process of the identification of RFID reader. After detecting and availability checking of inventory ID number, then show all information with ID number.

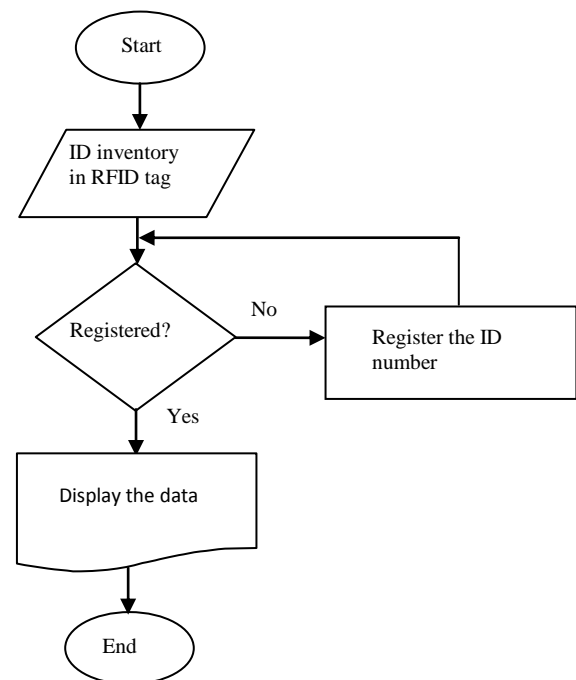


Figure 2. Identification Flowchart of RFID Reader

## 5. RESULT AND DISCUSSION

### 5.1 Program Testing

Program testing is performed internally and tested by 10 volunteers to determine the application program that has been created is good or not is using black box testing. This method can describe the program has any error or not in the function of the program, error in data structure and error in accessing the database.

#### a. Login

Testing for login form using black box table is displayed on Table 2.

Table 2. Login Form Testing

NO.	Function	Status
1	Login display	GOOD
2	Login as administrator	GOOD
3	Login as HOL	GOOD
4	Reset and exit button	GOOD

#### b. Real-Time Monitoring Table

Real-time Monitoring table is displayed after user login successfully. Testing for real-time monitoring form using black box table is displayed on Table 3.

Table 3. Real-Time Monitoring Testing

NO.	Function	Status
1	Real-Time Monitoring Table	GOOD
2	Menu	GOOD
3	Exit Button	GOOD

#### c. Form Laboratory Data Management

This form is displayed after administrator or HOL select menu "Laboratory Data Management". Testing for form laboratory data management using black box table is displayed on Table 4.

Table 4. Laboratory Data Management Testing

NO.	Function	Status
1	Tab of Inventory Data	GOOD
2	Tab of Subscriber Data	GOOD
3	Tab of Transaction Data	GOOD
4	Tab of Search Data on each tab	GOOD

Insert feature is accessed by administrator. Testing for insert laboratory data using black box table is displayed on Table 5.

Table 5. Inserting Data Testing

NO.	Function	Status
1	All input components	GOOD
2	Submit button	GOOD
3	Table of data	GOOD

Update feature is accessed by administrator. Testing for edit laboratory data using black box table is displayed on Table 6.

Table 6. Updating Data Testing

NO.	Function	Status
1	Table of data	GOOD
2	Edit button	GOOD
3	All input components	GOOD
4	Update Button	GOOD

Delete feature is accessed by HOL. Testing for delete laboratory data using black box table is displayed on Table 7.

Table 7. Deleting Data Testing

NO.	Function	Status
1	Table of data	GOOD
2	Delete button	GOOD
3	Confirmation Form	GOOD

Print feature is accessed by administrator, but HOL can see the collection of laboratory data on this table. Testing for

print laboratory data using black box table is displayed on Table 8.

Table 8. Printing Data Testing

NO.	Function	Status
1	Table of data	GOOD
2	Print button	GOOD
3	Print Document (Format and File)	GOOD

This application program or system is also tested to some volunteers. The author or program developer tells about this system to them. The author also asks to the volunteers to try the system that has been built. After that, each volunteers is given a questioner that should be completed and write their opinion about the system.

This table (Table 9) below is a recapitulation of the volunteer questionnaire.

Table 9. Recapitulation of the Volunteer  
Questionnaire

No.	Element of Evaluation	Alternative Answer			
		4	3	2	1
1.	System or program is easy to use ( <i>user friendly</i> )	4	6	0	0
2.	System help laboratory staff to secure the inventory	2	8	0	0
3.	Securing that is performed by the system is a real-time or actual detection	1	9	0	0
4.	Easy to record data of inventory, subscriber and rental transaction	4	4	2	0
5.	Inventory recording is more accurate	2	7	1	0
6.	Rental transaction is more effective and efficient	2	8	0	0
7.	The data or information can be found quickly with a current searching feature	3	7	0	0
8.	Easy to look the report of inventory, subscriber and rental transaction	4	5	1	0
9.	Preview and print is a feature that facilitate the laboratory staff in order to create the written report	3	7	0	0
10.	The appearance of application program is easy to understand	2	7	1	0

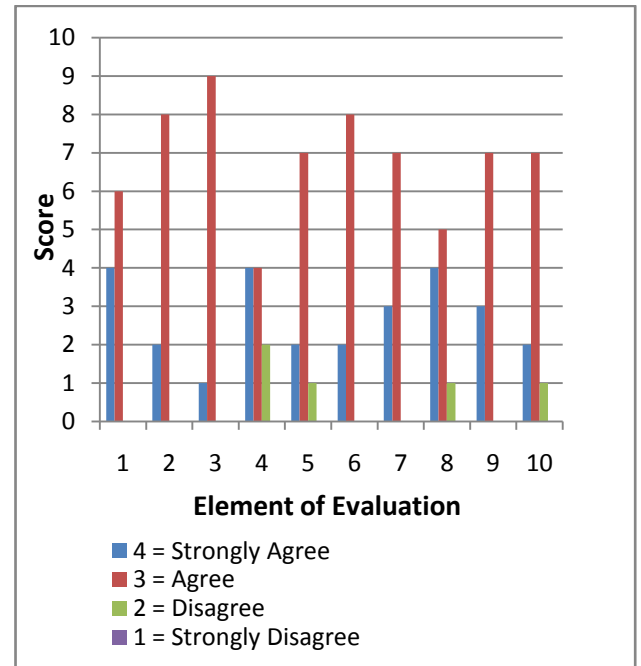


Figure 3. Graphic of Respond of Volunteer

The table was contained by some questions about the system and the score of the answer was chosen by the volunteer. The figure is a graph that displays the level of the value of each element of valuation.

The table and figure describe that the system has been running well. This system is expected to provide the benefits, one of it is facilitating staff to manage inventory in the computer laboratory. This is proven by the number of volunteers who agree about this system.

Almost of volunteer agreed with the system, in other word, the system received many positive

feedback from the volunteer that have been tried the system. Based on data from the table 4.13 and figure 4.28, comparison between the volunteer who agreed and disagreed with the system is very significant. There is no volunteer who choose strongly disagree and there is 5 point for disagree total point. The total of disagreement opposite to the total of the agreement, 27 point for strongly agree and the agree statement has 68 point. This total value indicates that functionally, the system is proper to implemented in the computer laboratory to secure the inventory of laboratory.

## 5.2 Discussion

This inventory control uses RFID as an object detector. Some benefits of RFID are (1) detects tag that can be embedded inside the inventory, (2) reader easy to read the id number of inventory without directly contact and it does not need to be aligned with the field of ID number, (3) a reading of RFID can go through the solid material.

The object to be identified is laboratory inventory such as a set of computer, access point and router. A tag is embedded inside each item as

the identification number of item. This ID number needs to be registered to database and complete its information as displayed on the block of data entry in application program.

A Subscriber is a student that wants to borrow the laboratory inventory and it must be registered, because the data is needed in transaction data management. Rental transaction is an activity in which a subscriber may borrow inventory that available in the computer laboratory. The transaction will records student ID number, name of student and inventory ID number, name, type and price for rent of inventory, duration of borrowing, date and time of borrowing and returning of inventory.

In the design, the author gets some constraints that affect the results and performance of the system. There are some advantages and disadvantages of this system.

### 1. Advantage

- a. This system is more effective and efficient to identify the inventory, because RFID tag is inputted inside every devices, so people would not

think that the devices has been recorded. It still efficient if the tag is inputted inside devices that has cheapest price on the laboratory such as headset or mouse, because the price of tag is cheaper than both.

- b. This system can detect the inventory that is brought in and out automatically. So, the administrator or head of laboratory can monitor the activity of inventory usage easily.
- c. The administrator or head of laboratory knows about list of data inventory, data of subscriber and data of rental transaction easily.
- d. Transaction is simple and more accurate, because the administrator no longer need to record data manually on registration book, but just detects the inventory ID and student ID and submit to database. This all ID number is stores about information of each items and students.
- e. Easier to find the data inventory, subscriber and transaction, because this

system is equipped by search function.

- f. The system is equipped with a function to print data report that facilitates the administrator to create a written report.

## 2. Disadvantage

- a. This system is more effective from the previous system, but still not efficient yet, because it need two computers or more for transmit the information to database, so it spends a lot of electrical power to detect inventory.
- b. This system is only focused on function of RFID to detect, data or information saving and data accessing, so there are many functions that have not been optimized such as security for program application and application appearance.
- c. Appearance of application program is not responsive design, this is proven when the application is displayed on screen that has aspect ratio 4:3, because this application is designed with a screen 16:9 for its aspect ratio.

d. RFID technology is a difficult technology that to be found at the free market, especially in Indonesia. RFID device for this research is ordered from the big town and it is the cheapest one, so that the RFID reader is still less qualified yet, because it scan the ID number with one by one step. Actually, the main power of RFID reader is reading or scanning more than one or two the ID number on single detection.

## **6. CONCLUSION**

- a. System that has been built in this research can help laboratory staff to secure and control the inventory in the computer laboratory.
- b. System facilitates the staff for managing data of inventory, subscriber and rental transaction
- c. System provides the accurate data because every data of inventory, subscriber and rental transaction is recorded clearly and it is displayed on monitor directly.

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