DEVELOPMENT AND DESIGNING PAYMENT SYSTEM ON A RADIO FREQUENCY INDENTIFICATION (RFID) BASIS AT SMK NEGERI RAJAPOLAH AREA

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ABSTRACT

SMK Negeri Rajapolah is one of the Vocational High Schools located in Tasikmalaya Regency, West Java. This vocational high school has proper facilities of which one of them is a *Koperasi*. It is a kind of shop that sells any students' requirements for school. The Koperasi is under a production unit of Accounting Study Program and managed by their teachers. There is a problem which comes up in this *Koperasi*. The *Koperasi* Officer is difficult in serving the buyers (in this case are the students), which usually caused by the endless queuing of students. It happens because of payment process which takes long time. One of the solutions to overcome this problem is by developing a payment system on a Radio Frequency Identification basis, called RFID. This system is built to make the *Koperasi* Officer easier in giving service to the students, while the RFID system is used to minimize the long queuing. Based on the results of *Black Box* and *Beta* tests, it can be concluded that the implementation of RFID system in the Koperasi simplifies the service and makes less queuing.

Keywords : Payment System, Radio Frequency Identification, RFID.

1. INTRODUCTION

1.1 Background

Vocational High School is prepared to graduate a qualified student in its specific major and teaches them to be ready in facing work environment. The school is also takes an important role in educating the students to have good behaviour, knowledge and be skilfulness. SMK Negeri Rajapolah, which is located in Tasikmalaya Regency- West Java, has a proper facilities; such as, a *Koperasi*. It is a kind of shop that sells any students' requirements for school. The *Koperasi* is under a production unit of Accounting study program and managed by their teachers.

According to the interview with Ms. Reni Dirgahari, S.Pd –the Head of Accounting Study Program—the Koperasi of SMK Negeri Rajapolah is always crowded by students who want to buy their study requirements especially in a new school year. That crowded situation makes the Koperasi officers difficult in serving them.

Moreover, a problem that appears in the Koperasi of SMK Negeri Rajapolah is on its payment system. It happened when the students are going to pay, the Koperasi officer takes much times in calculating their total purchased items since it is done manually. This condition impacts to the payment process that takes too much time and the queuing that becomes much longer.

Nowadays the technology is much more sophisticated then the above problem is really possible to be solved. One of the solutions is by implementing a technology that has two-way interaction between the electronic equipment, which called Radio Frequency Identification (RFID) technology. Radio Frequency Identification (RFID) is an identification process of an object automatically using a radio frequency [1]. RFID technology gives some significant advantages; such as users are possible to do self-service, time efficiency, and minimize the queuing [2].

Based on the background that has been explained above, the researcher is interested in developing a smart card technology by implementing Radio Frequency Identification (RFID) which would improve the service standard and simplify the business process in SMK Negeri Rajapolah. The result would be expressed in a final project report entitled "**Developing and Designing Payment System on A Radio Frequency Identification (RFID) Basis at SMK Negeri Rajapolah Area**".

1.2 Problem Identification

Based on the background that has been explained above, here are the problem identifications which are considered in this research:

1. In a new school year, the Koperasi is always crowded by students buying their study requirements and that causes the Koperasi officer difficult in serving them.
2. Too much time of payment process and long queuing are happened since the Koperasi officer calculates total price of purchased items manually.

1.3 Purpose and Aims

The purpose of this research is to develop a payment system in an integrated system by implementing RFID (Radio Frequency Identification) in SMK Negeri Rajapolah. Meanwhile, the aims of this research are as follows:

1. The Koperasi officer will be easier in serving the students who buy their study requirements.
2. Decreasing the time of payment process and the long queuing at the Koperasi.

1.4 Research Methodology

A research methodology is a process used to overcome problems logically which needs some data to support the research. One of the research methods that are used in this research is called descriptive analysis method. It describes some facts and information of current situation systematically, factually and accurately. This method consists of two steps which are collecting data and developing hardware and software.

1.4.1 Collecting Data Method

Here are some methods of collecting data for this research:

1. Literature Study

Literature study is an activity where a researcher does library study, searches and collects some related data such as from books, articles, journals and final project reports that have been done before.

2. Interview

This is an activity where a researcher does a questions and answers session directly to the main source of information at SMK Negeri Rajapolah about the problem being researched.

3. Observation

Observation is done by directly observe and watch the business process activity (in this case the *Koperasi*) at SMK Negeri Rajapolah to get clear information of the object being researched.

1.4.2 Developing Sofware Method

In developing software, this research is referred to waterfall method. Here are some phases of developing process contains in waterfall method :

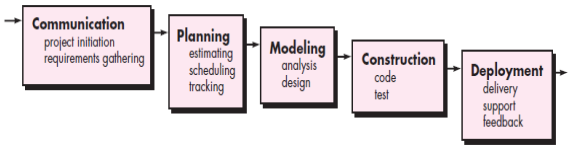


Figure 1 Waterfall Method [3]

The detail explanation of each phases of waterfall method would be described as follows:

1. Communication

Communication phase is a process of collecting data which is done by interviewing related parties, collecting documents to support the system requirements. After that, all of the collected data are analysed and defined as the requirements that have to be fulfilled by the program being developed.

2. Planning

This is a continuation phase of the communication phase. This phase would result in user requirement document or as a data that is related to user needs in developing software including plans to do.

3. Modelling

This phase would express the requirement to be a software design which could be estimated before the coding is made. This process is focused on data structure design, software architecture, interface representation, and detail procedural.

4. Construction

This phase is a process of creating codes. Coding process is translating the design into a language that can be recognized by a computer. This is the important step in developing software and it means the use of a computer would be maximized. After the coding process has been done, the next step is testing the system that has been created. The aim of the test is to find errors in the system, so that it can be fixed immediately.

5. Deployment

This is the final step in developing software or a system. After analysing, designing, and coding process then the system would be used by the user. Therefore, the software that has been developed must be maintained periodically.

2. RESEARCH CONTENTs

2.1 Theories

2.1.1 Electronic Payment System

Electronic payment system is a payment device that using a card, a transfer form (bilyet giro), a monetary draft (cek), debet note and electronic money. Electronic money is a payment device usually in a form of cards which known as

e-money. The card contains amount of money in form of stored-value owned by the consumer. One of the characteristics that must be own by an e-money is that able to save and take money anytime and to be useful in payment process [4].

2.1.2 *Radio Frequency Identification* (RFID)

Radio Frequency Identification or known as RFID is an identification method using a label or transponder to save and take data from afar. The label in a RFID is a component being inserted into a thing, a product, even human and an organism as like animal. It is used as an identification tool that uses a radio wave. That RFID label contains informations which is saved and read electronically as far as some meters. RFID system does not required to make a direct contact as a barcode does [2]. The RFID consists of 3 label, as follows:

1. An active RFID label is a label that uses power source. The active RFID label is usually more accurate in transmitting signal as it has a more powerful signal. However, this RFID label has bigger size and it is more expensive [2].
2. A passive RFID label is a label that uses a small electric current since it depends on the RFID reader. The passive RFID label is usually used in a place that has a rare disturbance with a shorter distance. This RFID label has smaller size and it is cheapest [2].
3. Semi-passive RFID is a label that almost similar as the active RFID label. This RFID label does not transmit the signal before the signal transmitted it first [2].

Moreover, here are the RFID's ways of working:

1. RFID label tag that does not has an antenna is used to determine the resources of which it is used to send data inside the RFID label tag [2].
2. After the RFID label tag sending the data, that data will be received by a reader and will be forwarded to a computer host. The data having been sent is usually in a form of serial number [2].
3. The serial number is processed inside a computer host to save and to call for data on the data base [2].

The RFID's ways of working is shown at the following picture.

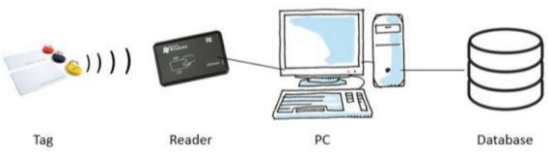


Figure 2 RFID Schema [2]

2.1.3 SMS Gateway Technology

Short Message Service, commonly known and abreviated as SMS, is a technology that is used to send and receive a message from a handphone to others. SMS Gateway is a tool used to send, receive and process sms message through a computer software. Sending sms mechanism is divided into 3; sending sms to the same operator, sending sms to different operator and sending sms to the overseas operator [5].

The SMS Gateway's ways of working is shown at the following picture.

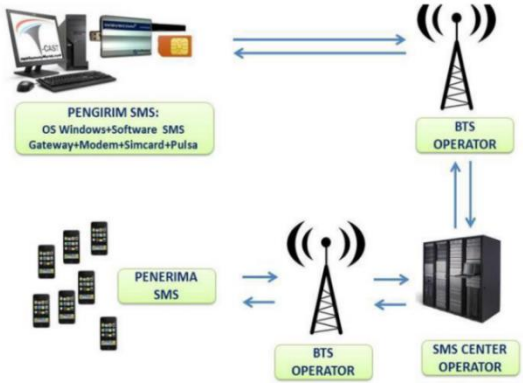


Figure 3 SMS Gateway Schema [5]

2.2 System Analysis

2.2.1 System Architecture

The system architecture that would be developed are shown at the Figure 4 as follow.

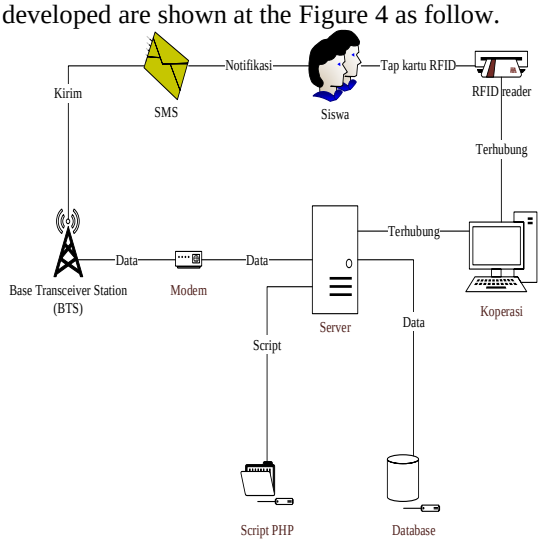


Figure 4 Architecture System

2.2.2 Network Architecture

Here is the network architecture which will be developed so that the system would be well working.

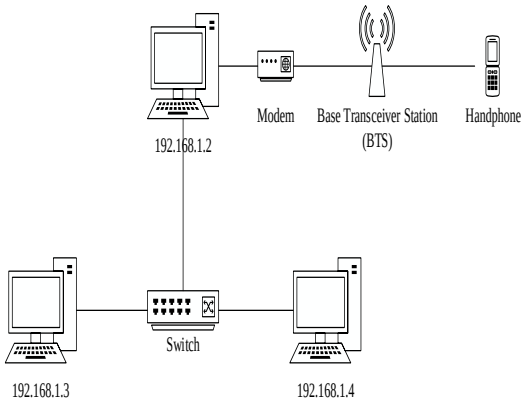


Figure 5 Network Architecture

2.2.3 Database

Basis data analysis is one of the important saving data media that supports the applications of developing Payment System on a Radio Frequency Identification (RFID) Basis at SMK Negeri Rajapolah area. It explains about basis data designing which is displayed using ERD (Entity Relationship Diagram).

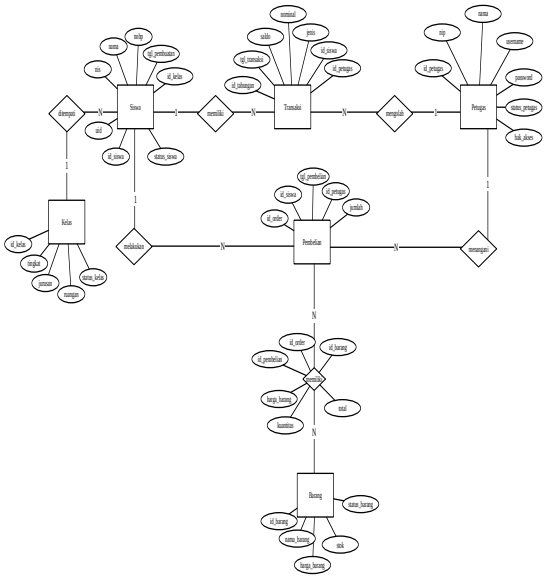


Figure 6 Entity Relationship Diagram

2.2.4 Context Diagram

Context diagram is a drawing pattern of a process and it illustrates a range of a system.

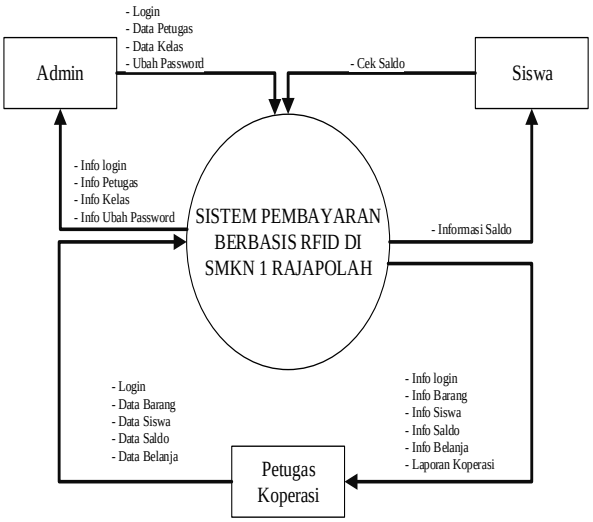


Figure 7 Context Diagram

2.2.5 DFD Level 1

DFD level 1 explains that the user of this application can access the application by choosing the menu on the system as an administrator, a *Koperasi* officer and a student.

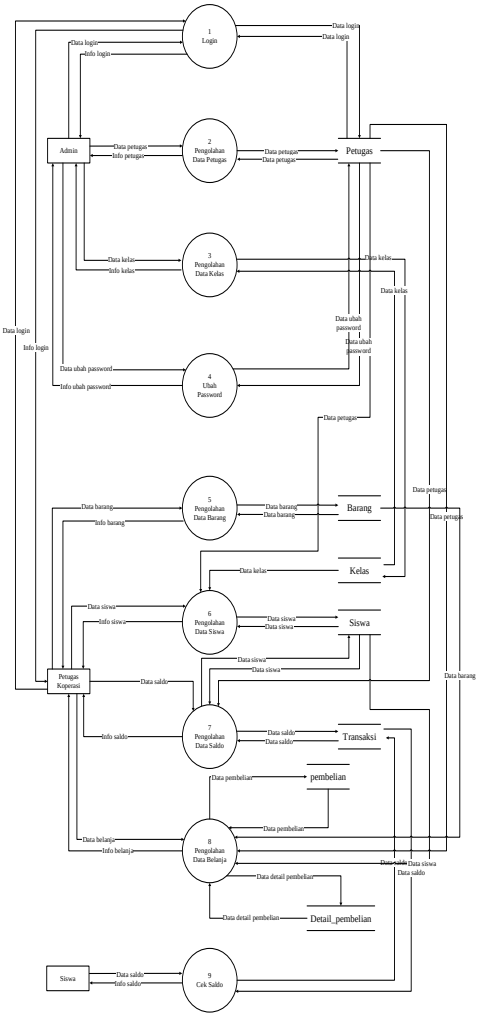


Figure 8 DFD Level 1

2.3 Designing

2.3.1 Relation Schema

Relation scheme is a relationship or connection between tables which are involved in the system. They are displayed in a diagram.

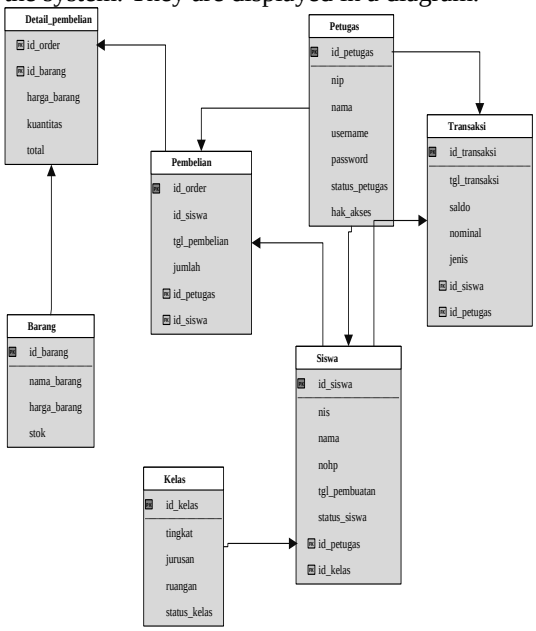


Figure 9 Relation Schema

2.3.2 Structure of the Menu

Designing the structure of the menu is used to describe some functions that would be used in the Payment System on Radio Frequency Identification (RFID) Basis at SMK Negeri Rajapolah area. The design is created compliance with the users' access right on the system. For the detail explanation, see the picture below.

1. Admin Menu

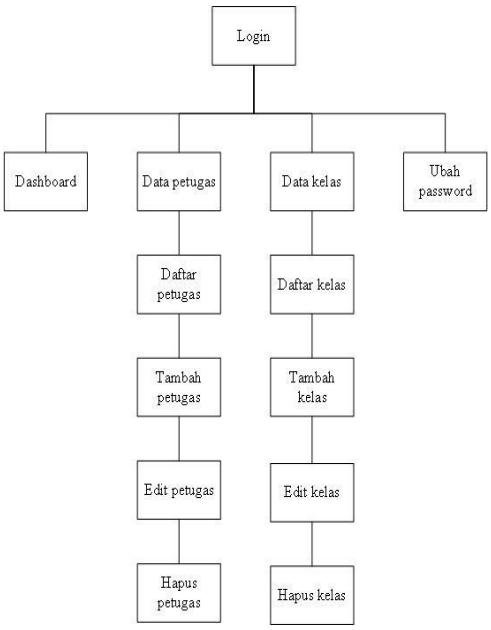


Figure 10 Structure of Admin Menu

2. Koperasi Menu

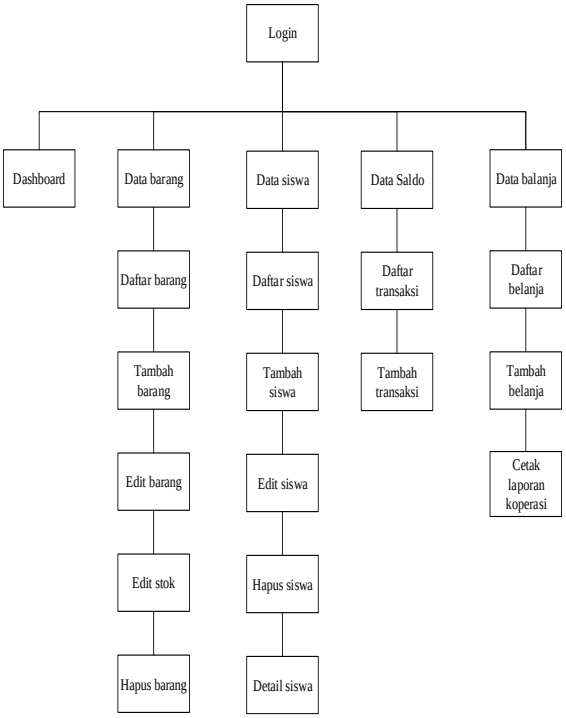


Figure 11 Structure of Koperasi Menu

Gambar 1 Struktur Menu Koperasi

2.3.3 Semantics Network

Semantics network describes the graphic knowledge that shows interconnected relation between objects. Here is the semantics network in an interface design.

1. Semantic Admin Network

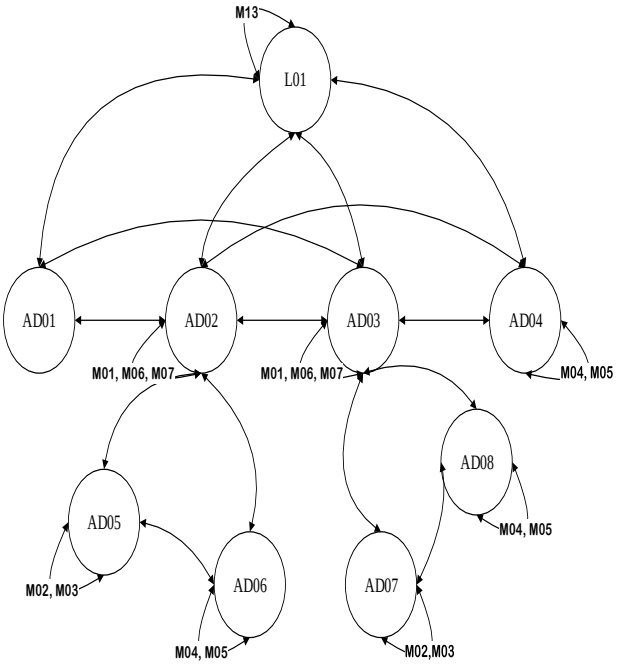


Figure 12 Semantic Admin Network

2. Semantic Koperasi Network

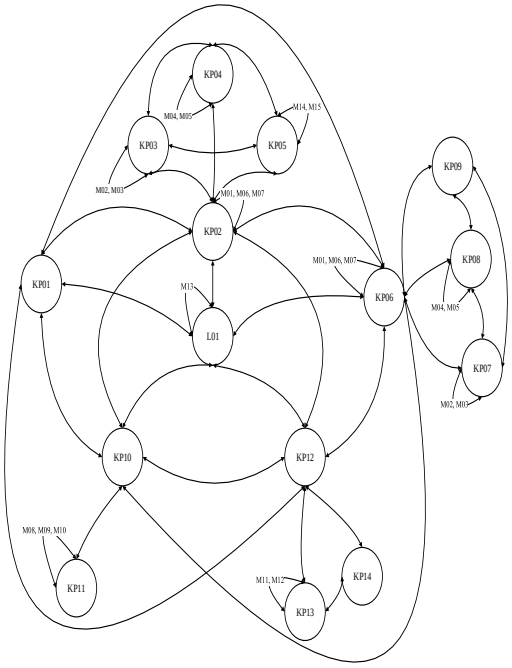


Figure 13 Semantic Koperasi Network

2.3.4 The Screen-shot of Program

Here are some screen-shoots which are taken when the program is running.

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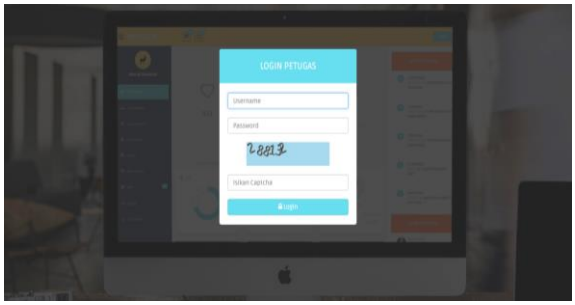


Figure 14 Login Page

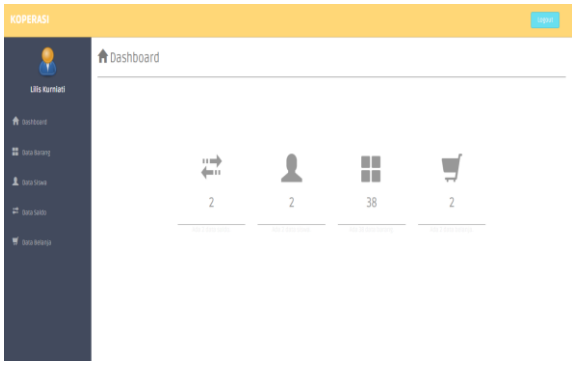


Figure 15 Main Page

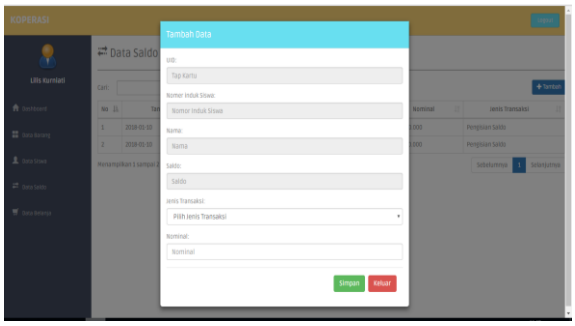


Figure 16 Saldo Transaction Page

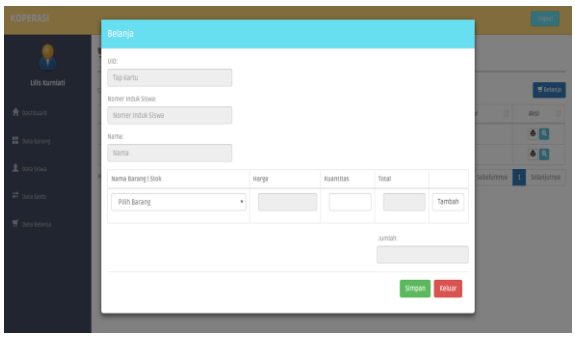


Figure 17 Shopping Page

2.4 System Testing

Testing of software is a step to present the main study of the specification, designing, and coding. The testing to examine the developing system of Payment System on Radio Frequency Identification (RFID) in SMK Negeri Rajapolah area is held by implementing 2 steps; such as, black box testing and beta testing.

Table 1 Testing Black Box Scenarios

Kasus Uji	Detail Pengujian	Jenis Pengujian
Login	Login User	*Black Box*
Data Petugas	Tambah Data Petugas Ubah Data Petugas Hapus Data Petugas Cari Data Petugas	*Black Box*
Data Kelas	Tambah Data Kelas Ubah Data Kelas Hapus Data Kelas Cari Data Kelas	*Black Box*
Ubah Password	Ubah Password	*Black Box*
Data Barang	Tambah Data Barang Ubah Data Barang Hapus Data Barang Cari Data Barang	*Black Box*

Data Siswa	Tambah Data Siswa Ubah Data Siswa Hapus Data Siswa Cari Data Siswa	*Black Box*
Data Saldo	Penambahan Saldo Pencairan Saldo	*Black Box*
Data Belanja	Tambah Data Belanja	*Black Box*
Cek Saldo	Cek Saldo	*Black Box*

Based on the results of testing a Black Box has done it can be concluded that in the overal functinality of the process on the payment system based Radio Frequency Identification at SMK Negeri Rajapolah has been working as desired.

3. CLOSING

3.1 Conclusion

According to the research having been held concerning the usage of RFID as a payment system, it can be concluded that:

1. By developing the payment system based on RFID, the payment system of students' purchased items at the Koperasi becomes more systematic. It is due to the students who do not need to pay in cash, so that the Koperasi officer is easier in calculating the total price of the purchased items and it will be automatically recorded on the system.
2. By developing the payment system based on RFID, the long queuing that happened when payment process at the Koperasi decreases since the payment process becomes faster.

3.2 Suggestion

In order for the utilization of RFID as a student card is the better for the future, then there is some suggestion the the tagline is done in the text research, including :

1. Expand the payment system not only in the cooperative. The payment system could be extend to payments in the foodcourt of the school and the production units of each department.
2. RFID can be used for card members the library, borrowing transactions and returns the book independently.

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