IMPLEMENTATION OF STUDENT SMART CARDS BASED ON RADIO FREQUENCY IDENTIFICATION (RFID) IN THE ACADEMIC PROCESS IN SMKS RIYADLUT TAUHID

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ABSTRACT

SMKS Riyadlut Tauhid is a vocational high school located in Tasikmalaya district. The problems faced in this school, namely on the process of absenteeism that is ongoing is still done by the way the teacher calls the names of students one by one or by giving attendance papers and students sign in turns. The recapitulation process was carried out by picket teachers who went around each class and saw attendance data held by class secretaries. The process of filling out the data on borrowing books in the library is still done manually, which results in frequent errors in filling out the borrower's student data . The lack of delivery of student attendance information to parents, which results in parents not knowing that their children always go to school or not. The solution to the problem that has been described is by applying smart cards students use Radio Frequency Identification (RFID). Radio Frequency Identification Technology (RFID) is a method of identification using RFID tags to store and retrieve data remotely, RFID technology will be used in the form of cards and doubles as a student card making it easy to carry and use. Based on the results of black box and beta testing , it can be concluded that with the presence of RFID-based student smart cards, it is easier for students and schools to solve existing problems.

Keywords : radio frequency identification , student smart card, library, attendance.

1. INTRODUCTION

is one of the private vocational high schools located in Rancapaku Village, Padakembang District, Tasikmalaya Regency. Riyadlut Tauhid PRIVATE VOCATIONAL SCHOOL has an increasing number of students from the previous school year, so the quality and quality of this school must continue to be improved. Riyadlut Tauhid PRIVATE VOCATIONAL SCHOOL has several problems, including the attendance data filling process, attendance data recapitulation process, filling in student data for borrowing books at the library, and lack of information provided by the school about violations of attendance to parents.

Based on the first interview, Mr. Munandar SH, S.Pd.I. as the Deputy Head of Student Affairs said that the attendance process that is currently running, is still done by the way the teacher calls the names of students one by one or gives attendance papers and students sign in turns. This makes students who have signed absences to do permission to leave and not return to class. The other problem is in the process of daily attendance recapitulation carried out by picket teachers, who go around seeing and recording class attendance books filled by students who serve as class secretaries. This can be easily manipulated because the attendance is absent by the class secretary, which causes the attendance data obtained is not in accordance with the fact that students who leave the class or school in class still have a perfect attendance value.

Based on the second interview conducted to Mr. Oman as the Library Officer said that the process of recording loan data and returns is still done manually. This often leads to errors in filling student data in the process of borrowing books by library officers and librarians having difficulty when searching for data when students make a return.

Based on the third interview, it was conducted to Ms. Desy Yulianti S.Pd. as part of BP / BK said that the lack of delivery of information on student attendance data to parents, which resulted in parents unable to know that their children always go to school or not. The school gives warnings to students verbally to students who commit violations twice or not, then for violations of absenteeism 3 times the school provides a notice and summons to the parents of students to reach the student and BP / BK section. This does not make students deterred because in reality many students repeat violations committed even students do not submit a notice to parents. That way the parents do not know their child's attendance data regularly, the school also needs a lot of time to register and report it to the parents of students.

Based on the background described by the school, it requires a student smart card based on Radio Frequency Identification (RFID) as a solution for filling in attendance data, home attendance, recapitulation of attendance data that has been done when attendance and attendance attendance, filling in student data in the process of borrowing books, and for submitting information on violations of student absences to parents. According to Hesty Lestari in his research, it was explained that the superiority of RFID technology is in the process of reading and writing data from RFID tags without direct contact with these tags and has the ability to send the data received is the same until the maximum reading distance (accurate) [1]. According to Eko Budi Setiawan and Bobi Kurniawan in their research, it was explained that by using RFID the attendance process became more effective and efficient, as well as supporting the smooth process in the lecture process [2]. According to Yuda Edi Purnomo and Heru Supriyono in his research explained that using RFID cards in the process of borrowing books in the library is very effective and efficient and in the process of making reports can help officers become easier [3].

The purpose of this research is how to make RFID-based smart card students more maximal in applying it so that the academic process in Riyadlut Tauhid SMKS can be even better .

2. THEORY BASIS

2.1 IoT (Internet of Things)

IoT (Internet of Thing) is a concept whose main purpose is to expand from the benefits of internet connectivity that will be continuously connected. The ability of IoT is in data sharing, remote control , etc. [4] .

2.2 RFID

RFID (Radio Frequency Identification) is a technology that uses radio frequency waves to identify an object. Radio frequency will be used for the process of reading information in the form of a code from an RFID tag. In RFID tags, there is a chip that can be detected from a predetermined distance from each frequency used without direct contact, a tool for reading RFID tags is an RFID reader [5] [6] .

2.3 RFID Reader

An RFID reader is a radio wave tranceiver, whose main function is to transmit and receive electromagnetic waves according to the power of its range. When the tag enters the coverage area of the RFID reader, the tag will get power to transmit data contained in the tag and received by the RFID reader [5] [6].
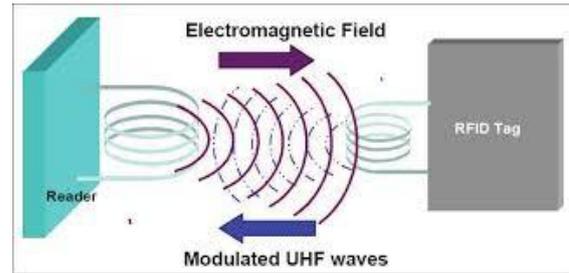

Figure 1. *RFID reader work system [7]*

2.4 NodeMCU

NodeMCU is a microcontroller developed from ESP8266 using e-Lua based firmware. In addition to the Lua language, NodeMCU also supports Arduino IDE software by making slight changes to the board manager on the Arduino IDE [8].

3. RESEARCH METHODS

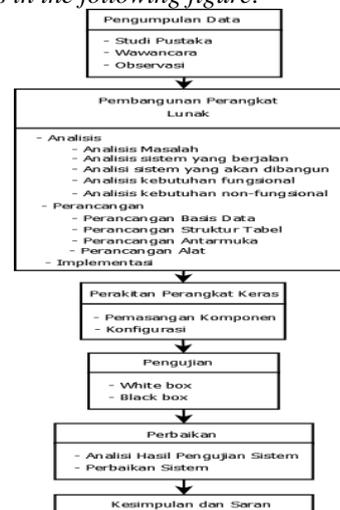*The research methodology used by the author is in the following figure:*

Figure 2. *Research Methodology*

3.1 Data Collection Method

1. *Literature review*

The method of research is done by collecting data relating to the title of the research by finding and studying reference books, research journals, theses and other readings.

2. *Observation*

This data collection technique is carried out by conducting direct research on the problems taken by Riyadlut Tauhid SMKS.

3. *Interview*

The interview is a method of data collection that is carried out by holding question and answer directly to the teacher, at the Riyadlut Tawheed National High School.

3.2 Software Development Methods

The method used in the software development stage is the waterfall model. The following are the stages of the development process contained in the waterfall model [9]:
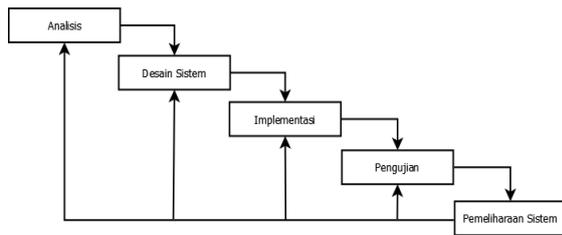
Figure 2. *Waterfall model [10]*

The following is an explanation of the phases contained in the waterfall method:

a. Analysis

The stages of gathering needs as software requirements, this stage will be carried out description and identification of software to be built.

b. System Design

At this stage the design is done after the needs are completely defined. System design is a system design that is carried out based on the data that has been collected in the previous stage.

c. Implementation

At this stage is where a code is arranged based on the previous stages into an application.

d. Testing

At this stage testing will be carried out on the system that has been built.

e. System Maintenance

Maintenance is the overall implementation accompanied by maintenance if there is a change in structure both in terms of software and hardware.

4. RESEARCH CONTENT

4.1 System Analysis

System analysis can be defined as the decomposition of a complete information system into its component parts in order to identify and evaluate problems .

4.1. 1 Analysis of procedures to be proposed

The analysis of the procedure that will be proposed is a new regulatory requirement that has not been carried out at this time in SMKS Riyadlut Tauhid. Analysis of the procedures to be proposed are as follows:

4.1.1 .1 Card Making Procedure

The procedure for making cards on the system to be built is as follows:
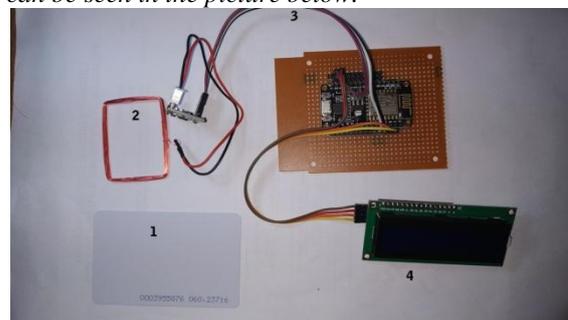
1. Students come to the admin and provide information on student data.
2. Admin searches student data and enters RFID data then stores the data.
3. Admin submits RFID cards to students.
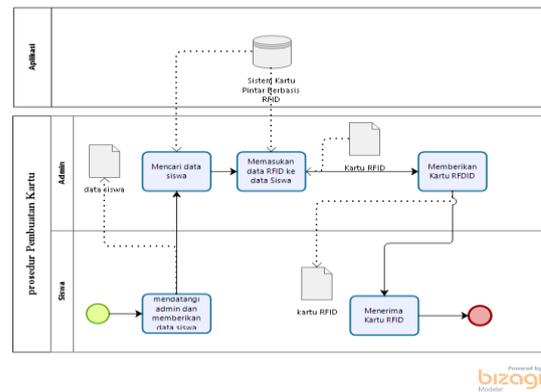
Figure 3 . *Card Discharge Procedure*

4.1.2 Analysis of the Design of the Tool Series

Analysis of the design of the set of tools built can be seen in the picture below:

Figure 4 . *Design of a series of tools*

Explanation of how the tools that have been assembled are as follows:

1. An RFID card with a frequency of 145Khz serves to store student identity codes.
2. The RFID card is attached to the RDM6300 module, where this module will read the code in the RFID card that will be sent to the microcontroller. This module reads RFID cards that have a frequency of 145Khz.
3. The NodeMCU microcontroller receives RFID code data from the RDM6300 module, and checks the data into the database. After the data is checked the Microcontroller will send message data to the LCD, and save data to the database if the data is there.
4. The LCD will display the message data sent by the NodeMCU Microcontroller.

4.1. 3 Analysis of how the tool works
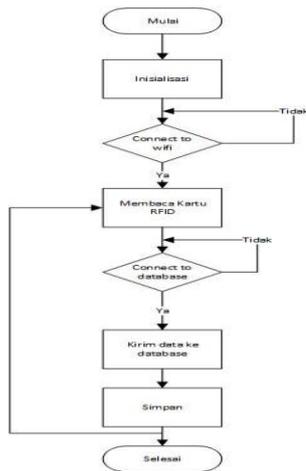
Here is how the tool built works

Figure 5 . *How it works*

Here is a description of how the tool works:
1. Initialization, initialization is the initial value given when the declaration of the ID on the rfid smart card.
2. Connect to wifi, where if after the microcontroller initialization is not connected to wifi there will be a loop to be able to connect to wifi, if the microcontroller is connected to wifi it will proceed to the next process.
3. Reading an RFID card, is the stage where the RFID card can be read by the microcontroller via the rfid reader rdm6300 module .
4. Connected to the database, at this stage the microcontroller will connect to the database server. If it is not connected, it will continue to loop and look for the IP address of the database server, if connected, it will continue to the next process.
5. Sending data to the database, where data that has been read by the rfid reader module will be sent by the microcontroller to the database through the database server's IP address.
6. Save data to the database.
7. After data storage is complete, the tool can read the rfid card again.

4.1. 4 Analysis of System Architecture

System architecture analysis aims to identify the architecture to be built based on the system, so that the system to be built follows the system architecture reference that has been designed, following the architecture of the application system for RFID-based student smart cards :
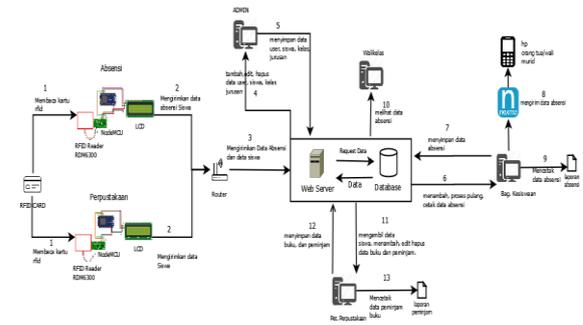

Figure 6 . *System Architecture*

4.1.5 Functional Needs Analysis

4.1.5 .1 ERD

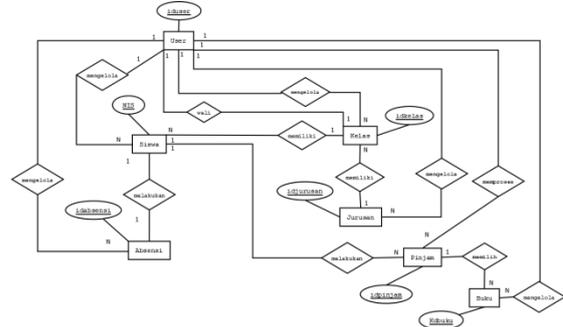The following is an explanation of the ERD of the system to be built:

Figure 7 . *ERD*

4.1.5 .2 Context Diagrams

The following is an explanation of the Context Diagram of the system to be built:
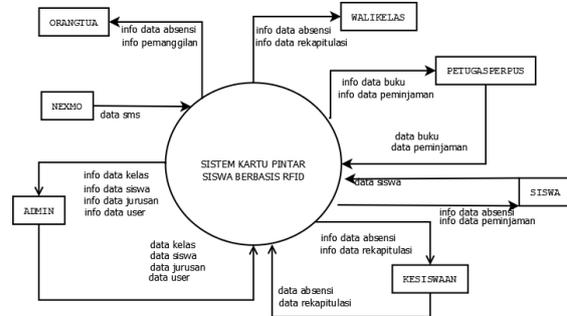

Figure 8 . *Context Diagram*

4.1.5 . 3 Relationship Schemes

The following is an explanation of Skemas Relation of the system to be built:
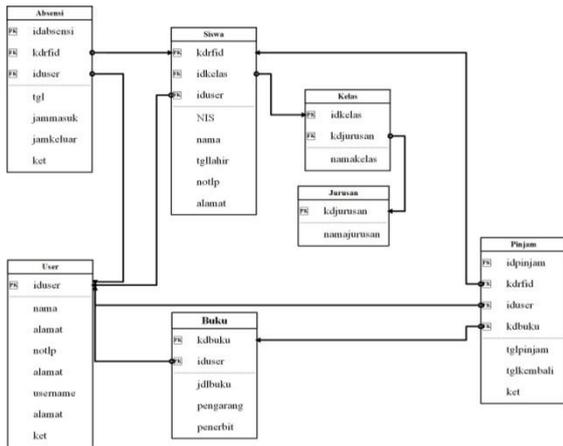
Figure 9 . *Relationship Scheme*

4.1.5 . 4 Designing Tools

The design of a tool consists of a series of components that can read an RFID card and send data to the system. The following is a picture of a series of components and how to assemble them in the Application of RFID-Based Smart Student Cards in the Academic Process at Riyadlut Tauhid SMKS:
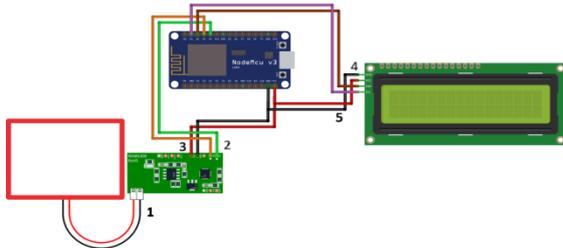

Figure 10 . *Tool Design*

The description of the components of the design of the tool are as follows:

1. Pair the red and black cables from the antenna to the antenna pins found on the RDM6300 board.
2. Pair the TX green cable and the RX original cable from RDM6300 to pin D4 and D3 contained in the NodeMCU microcontroller.
3. Pair the GND black cable and the red V5 cable from RDM6300 to the GND and V5 pins found in the NodeMCU microcontroller.
4. Pair the GND black cable and the red V5 cable from the LCD to the GND and V5 pins found in the NodeMCU microcontroller.
5. Pair the purple SCL cable and SDL brown cable from the LCD to pins D1 and D2 found in the NodeMCU microcontroller.

4.1. 6 Implementation and Testing

4.1. 6.1 Interface Implementation

The following is an implementation of the design that was made before .

1. Login page
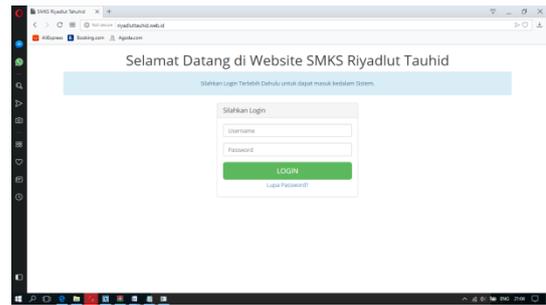
Figure 13 shows the user login page views s i stem.

Figure 11 . *Login page*

2. Admin page

Next is the display from the Admin page.
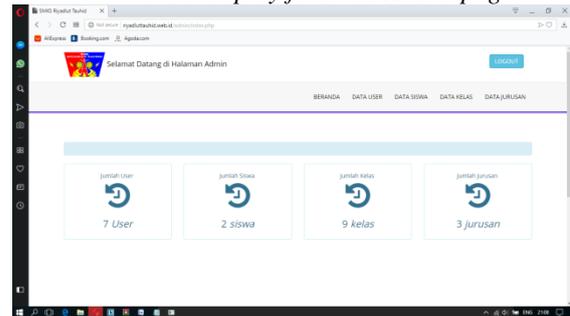
Figure 12. *Admin Home*

3. Student Page

Next is the display of the Student page .
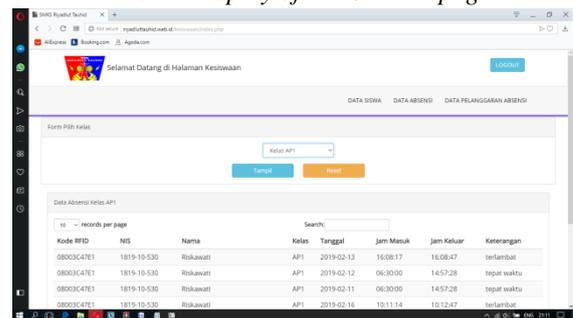
Figure 13. *Attendance Data*

4. Library page

Next is the display of the Library page .

Figure 14 . *Library Home*

4.1. 6.2 Testing of Tools

Testing Tool to test the functionality of the NodeMCU microcontroller in storing and managing all supporting modules with language c .

Table 1 . *NodeMCU Testing*

Cases and Test Results (Normal Conditions)			
Yang	*Which*	*Observation*	*Conclusi*

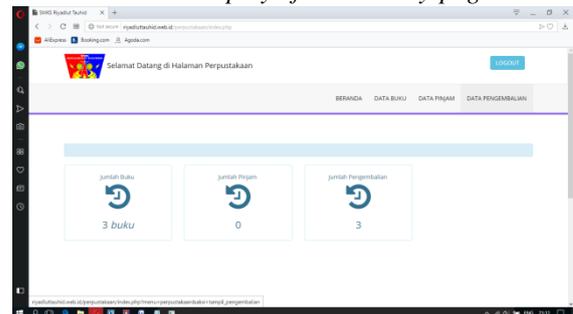| hardware Tested	are expected		on
NodeMCU	Can save and manage all modules with language c	The microcontroller nodemcu can store and manage all modules usingn languages c	[✓] is accepted [ ]rejected
Case and Test Results (Abnormal Condition)			
Yang hardware Tested	Which are expected	Observation	Conclusion
NodeMCU	Can save and manage all modules with language c	The microcontroller nodemcu cannot store and manage all modules using language c	[✓] is accepted [ ]rejected

4.1.6.3 System Testing

System testing is to test the functionality of software that has been fulfilled or not. The results of the test can be seen in Table 2 .

Table 2 . *Login Testing*

Input Data	Which are expected	Observation	Conclusion
Cases and Test Results (Correct Data)			
username: sunandar Password: admin	The username and password data fields have been filled and then go to the main page according to the access rights	The username and password data fields have been filled and then go to the main page according to the access rights	[✓] is accepted [ ]rejected
Cases and Test Results (False Data)			
Input Data	Which are expected	Observation	Conclusion
username: asdekgj Password: 12345 Incorrect username or password (not in the database)	Display the message "username / password is wrong"	Display the message "username / password is wrong"	[✓] is accepted [ ]rejected
Cases and Test Results (Blank Data)			
Masuka data n	Which are expected	Observation	Conclusion
username: Password: 12345	Displaying the message "Usernam / password must be filled"	Displaying the message "Usernam / password must be filled"	[✓] is accepted [ ]r

4.1. 6.4 Beta Testing

Beta testing is a test conducted objectively which is tested directly to the field, namely the agency concerned about user satisfaction with the content of points, namely fulfilling the needs of the initial purpose of developing a rfid-based student smart card in Riyadlut Tauhif Public School and the interface of the system that has been created .

Table 3. *Interpretation of Calculation Result Scores*

Percentage Value	Information
0% - 20%	Strongly Disagree
21% -40%	Disagree
41% -60%	Ordinary
61% -80%	Agree
81% -100%	Strongly agree

Here are 3 questions given to students to fill out the questionnaire:

1. Are the students' smart card tools and systems built easy to use?
2. Does the smart card help you do attendance?
3. Does the smart card help you in the process of lending books in the library?

4.1. 6.4 .1 Beta Test Results

1. Question 1

Here are the results of the calculation of question 1, Is the student smart card system built easy to use?

Table 4. *1st Question Calculation*

Information	Score	Respondents	Total score
Very Stuju	5	15	75
Agree	4	8	32
Ordinary	3	9	27
Disagree	2	0	0
Strongly Disagree	1	0	0
Total Score		32	134

P = Total Skor / Y x 100
P = (134/160)x100
P = 83.75%

2. Question 2

Here are the results of the calculation of question 2, Does the smart card help you in doing attendance?

Table 4.48 2nd Question Calculation

Information	Score	Respondents	Total score
Very Stuju	5	12	60
Agree	4	9	36
Ordinary	3	11	33
Disagree	2	0	0
Strongly Disagree	1	0	0
total		32	129

P = Total Skor / Y x 100
P = (129/160)x100
P = 80.63%

3. Question 3

Here are the results of the calculation of the third question, Does the smart card help you in the process of borrowing library books?

Table 4.49 3rd Question Calculation

Information	Score	Respondents	Total score
Very Stuju	5	14	70
Agree	4	11	44
Ordinary	3	7	21
Disagree	2	0	0
Strongly Disagree	1	0	0
total		32	135

P = Total Skor / Y x 100
P = (135/160)x100
P = 84.38%

4.1. 6 . 4. 2 Conclusions on Beta Testing

Based on the results of testing conducted with questionnaires to Riyadlut Tawheed SMKS students to the tools for attendance and tools for library, conclusions can be drawn as follows:

1. Students state strongly agree that tools and systems built for students' smart cards are easy to use.
2. Students stated strongly agree that smart cards can help in the attendance and attendance attendance process.
3. Students stated strongly agree that smart cards can help in the process of lending books in the library.

5. COVER

5.1 Conclusions

Based on the research that has been done regarding the use of RFID as a smart student card, Based on the comparison between the objectives of software development with the results of implementation and testing, it can be concluded that:

1. Smart card based on rfid students can help the attendance process by way of attaching the rfid card to the rfid reader and the system will record the data according to the code of the rfid card.

2. Rfid-based student smart card application designed to process student attendance recapitulation after students attend the attendance process, but for the process of sending messages the delay in attendance to parents is still under consideration because of cost issues.

3. RFID-based student smart card applications designed to assist in the process of lending and returning library books, by way of students attaching an RFID card to the rfid reader to fill the borrower's data and to make a return.

4. RFID-based student smart card application designed to send attendance information to parents when students experience delays in filling attendance in the form of sms that will be sent automatically if students experience delays.

5.2 Suggestions

In order for the use of RFID as a smart card for students, the better for the future, there are some suggestions that need to be done in the next research, including:

1. Integrate students' smart card systems with academic systems that already exist in schools.
2. The application interface that is built is very simple, so it can be developed to have a more attractive appearance.
3. The tool used uses the lowest frequency , if needed can use high frequency bands in order to better respond.

BIBLIOGRAPHY

[1] Lestari, Hesty "Perancangan Sistem Absensi dengan RFID Menggunakan Custom RFID Reader" https://repository.unikom.ac.id/8819/,2010.

[2] Setiawan, Eko Budi dan Bobi Kurniawan "Perancangan Sistem Absensi Kehadiran Perkuliahan dengan Menggunakan Radio Frequency Identification (RFID)", Jurnal CoreIT, Vol.1, No.2, Desember 2015.

[3] Purnomo, Yuda Edi & Heru Supriyono, ST. Msc. Phd "Sistem Peminjaman Buku Berbasis Rfid". http://eprints.ums.ac.id/id/eprint/49216, 2017.

[4] Andrianto, Heri & Aan Darmawan. "Arduino Belajar Cepat dan Pemograman". Bandung, Informatika, 2016.

[5] RFID. Penjelasan Sederhana Tentang RFID. http://forum.kompas.com /sains/210878-penjelasan-sederhana-tentang-rfid.html.[Diakses 10 Oktober

2018].

[6] I. P. A. EkaPratama, "RFID (Radio Frequency IDentification)," dalam Smart City Beserta Cloud Computing Dan Teknologi-teknologi Pendukung Lainnya, Bandung, Informatika, 2014.

[7] J. Chamberlain, IBM WebSphere RFID Handbook A Solution Guide, 2nd ed., New York: RedBooks, 2010

[8] Wicaksono, M. FajardanHidayat. "Mudah Belajar Mikrokontroler Arduino". Bandung, Informatika, 2017.

[9] Y. Bassil, "A Simulation Model for the Waterfall Software Development Life Cycle," vol. 2, p. 2, 2012.

[10] G. W. Sasmito, "Penerapan Metode Waterfall Pada Desain," Jurnal Informatika:Jurnal Pengembangan IT (JPIT) ,, vol. 2, no. 1, 2017.

[1] *Lestari, Hesty "Design of RFID Attendance Systems Using Custom RFID Reader" https://repository.unikom.ac.id/8819/,2010.*

[2] *Setiawan, Eko Budi and Bobi Kurniawan" Design of Attendance Attendance System Design by Using Radio Frequency Identification (RFID) ", CoreIT Journal, Vol.1, No.2, December 2015 .*

[3] *Purnomo, Yuda Edi & Heru Supriyono, ST. MSc. Phd "Rfid Based Book Loan System".http://eprints.ums.ac.id/id/eprint/4 9216, 2017.*

[4] *Andrianto, Heri & Aan Darmawan."Arduino Fast Learning and Programming". Bandung, Informatika,*

2016.

[5] *RFID. Simple explanation about RFID.http://forum.kompas.com/sain s/210878-penjelasan-sederhana-tentang-rfid.html.[Please access October 10, 2018].*

[6] *EkaPratama's IPA, "RFID (Radio Frequency IDentification)," in Smart City and Cloud Computing and Technologies Supporter Others, Bandung, Informatika, 2014 .*

[7] *J. Chamberlain, IBM WebSphere RFID Handbook A Solution Guide, 2nd ed., New York: RedBooks, 2010*

[8] *Wicaksono, M. Fajardan Hidayat."Easy to Learn Arduino Microcontrollers". Bandung, Informatics, 2017.*

[9] *Y. Bassil, "A Simulation Model for the Waterfall Software Development Life Cycle," vol. 2, p. 2, 2012.*

[10] *GW Sasmito, "Application of the Waterfall Method to Design," Journal of Informatics: Journal of IT Development (JPIT) ,, vol. 2, no. 1, 2017.*