Design and Development Of Lecturer Attendance System Using Radio Frequency Identification (RFID)

I Gede Sujana Eka Putra, Anthony Lee, I Made Tirta Mahayana, I Gede Agung Wicaksono Dharmayasa

Informatics Engineering Department, STMIK STIKOM Indonesia, Denpasar - Bali, Indonesia sujanaekaputra@stiki-indonesia.ac.id, anthonyleembahmo@gmail.com dedetirtamahayana@gmail.com, wicaksonomm1@gmail.com

Abstract — Lecturer attendance record is required by the university to know the presence of lecturers in teaching in class. In general condition, lecturer attendance is recorded on the attendance sheet, or input to web application accessed on a class computer. However, there are some problems in its implementation so that at the end, lecturer presence is carried out using a manual form where the academic staff needs to reenter the lecturer attendance data into the applications. Based on the above, the authors designed and developed a lecturer attendance information system to record lecturers' attendance using radio frequency identification technology by implementing a near field communication card (NFC Card). The device used to record and read presence data during lectures, by tapping an Mi-fare NFC card to an NFC reader / writer device. The flow of this research method begins with a literature study of NFC card, observe the flow of lecture attendance process and data recorded into lecturer attendance sheet, analyzing the database design, the system design which has compatible with NFC reader and writer devices, designed system interface and continue to develop system. The result is system consists of master data, system attendance, verification and reporting module. The results show that NFC card implementation is more practical for lecturers in conducting lecture attendance and NFC card could be tapped out into an NFC device at a maximum distance up to 7 cm with the reading angle relative to NFC reader/writer with range 0º until 30º can read NFC Card.

Keywords - Lecturer Attendance Information System; NFC Card; RFID; Presence; Administration

I. INTRODUCTION

The application of information technology helps facilitate automatic data processing. Information systems assist in the implementation of automatic administration, thereby increasing accuracy and speed in data recording. Lecturer attendance in lectures is required by the university in recording the administration of lecturer attendance in class. Generally, the presence of lecturers during lectures is recorded on the attendance sheet, or input from the web attendance application which is accessed on the computer in the classroom. However, in terms of implementation, lecturers often encounter problems to use web applications for presence, so at the end lecturer attendance is done manually by signing in attendance using a web application is quite effective, but sometimes there are problems with access to the application server experiencing problems, so that the lecturer does attendance by manually on the lecture attendance sheet. Based on the above background, the authors designed a lecturer attendance information system to record the attendance of lecturers with radio frequency identification technology using a near field communication card (NFC Card).



Figure 1. Near Field Communication Card Reader / Writer



Figure 2. Near Field Communication Card

RFID (radio frequency identification) is a technology that combines the functions of electromagnetic or electrostatic coupling at the radio frequency of the electromagnetic spectrum, to identify an object. RFID is used as a tool to automatically control a chain of activities. RFID is a card (card) that can only be read (read only) or can be read and written (read/write), does not require direct contact or light paths to operate, can function in a variety of environmental conditions, and provides a level of data integrity high, and difficult to forge, so that RFID can provide a high level of security[1]. Radio frequency identification system (RFID) is an automatic technology and aids machines or computers to identify objects, record metadata or control individual target through radio waves. Connecting RFID reader to the terminal of Internet, the readers can identify, track and monitor the objects attached with tags globally, automatically, and in real time, if needed. This is the so-called Internet of Things (IoT). RFID is often seen as a prerequisite for the IoT [2].

The advantage of using an NFC card for lecturer attendance is more practical and easy to use, time in and time out are stored on the card by tapping into the lecturer attendance information system. The device used is the Mi-Fare NFC card along with an NFC reader / writer (Near Field Communication) tool to record and read lecturer data on the card, where during lectures, only by tapping the NFC card to the NFC reader/writer device to record time attendance of lecturers into the attendance information system. The purpose of this study is to determine the stages of designing and building a lecturer attendance system using NFC Card, as an alternative practical solution to record time attendance. The flow of this research method begins with literature studies related to how the NFC card works, how to store and read data into an NFC card. In addition, observing the lecture attendance process flow of lectures in the class. Next stage is data collection to find out the components of attendance data that need to be filled in on the lecturer attendance sheet. The next stage is system analysis to determine the programming language used, compatible and integrated with NFC reader and writer devices, designing an attendance system. The results of the analysis and design of the system and database are then used for the development of the attendance system, and system testing is carried out to find out whether the system can run well, and the data recorded is correct.

II. RELATED WORK

Eka Putra, et al (2019) presented The Design And Development Of an E-Ticketing Information System For Vehicle Parking Using an NFC Card. The ticketing system, which uses parking tickets, has weaknesses such as, tickets can be lost and can also be damaged / torn or tucked / lost and the identity of the vehicle does not match the parking ticket and is easily faked. This information system is designed by applying a card as a vehicle ticket for parking with data input in the form of a vehicle number stored on the RFID card. The system output information is in the form of an RFID card which shows the recorded motor vehicle number and driver's name. The system provides daily parking recapitulation reports and monthly vehicle parking data summaries[3].

Eka Putra, et al (2019) presented Design and Development of Login Security System Using Radio Frequency Identification. System security is important in information systems to prevent unauthorized users from accessing data. Login system applies security using encrypted passwords stored on RFID cards. This research designed login security system storing encrypted password using MD5 encryption into the Mifare Tag RFID card and equipped NFC reader to read data from RFID Card. By storing encrypted password characters on RFID cards, login system security is stronger and cannot be traced by unauthorized parties to log into systems. Some stage of system design is through study of literature, designing process flow, system algorithms, designing encryption methods and system interfaces, writing card module coding, card reading module coding, implementation, and system testing. The system login applied by scanning RFID card on the NFC reader, if the password on RFID matches then the user successfully logs into the system. Based on the testing of RFID Tag readings, the maximum distance from the reading of RFID Tag cards is up to 7 cm with a reading range of 0⁰ to 30⁰ with a success rate of 100% authentication. By using RFID Tag cards, increase security for logging into the system, because user cannot log in without having a card with the appropriate password[4].

Adhitama, M, et al (2019) presented Analysis of Reading and Writing Book Data Using Mifare RC-522 RFID for Libraries. Modern libraries need a system for identifying books with one another. Currently, the library automation system has implemented a barcode identification system. However, this technology requires direct or visible contact for the system to read. An alternative technology that can be used is RFID. The advantage of RFID is that it does not require direct contact (contactless) with a low error rate and data that can be written repeatedly. The research method used is a waterfall. The components used in this system are the RFID Tag / Transponder (Mifare Classic 1K), the RFID Interrogator Module (Mifare RC-522) coupled with the Arduino Uno R3 which is connected to a computer. In the test results, it was found that this system can read data on the tag with a recommended reading distance of under 3.5 cm (has an accuracy rate above 80%) and write data on the tag with a recommended writing distance of under 2.5 cm (has an accuracy rate above 80 %)[5].

S. Santoso, et al (2017) presented The Development of Student Attendance Applications Using Smart Cards For The Development of Smart Campuses. One of the campus activities is learning and teaching, when students enter the class filling out attendance on paper, activities require more time and paper. This application records attendance data to a database. Applications created are able to store attendance data when in the classroom. Using a smartcard that has Radio Frequency Identification (RFID) on the card, the application data is stored in a database system, for easy reporting, applications are built to provide activity reports, and reports can be printed. Based on the measurement of the RFID card and reader, the reading ability of the RFID card is about ± 2 seconds, with an accuracy rate of 98 percent[6].

C. Costa, et al (2013), presented Radio Frequency Identification (RFID) as a technology to improve the management of information flows in the supply chain and food security in the agricultural sector. RFID technology is capable of presenting great opportunities for the agricultural sector and there are several obstacles slowing down its implementation. The survey provides an overview of the opportunities and constraints for widespread adoption of RFID. The aim of the research is to provide an updated analysis of current developments in RFID technology for different product typologies in the food agribusiness industry, addressing at the same time its potential in technology and logistics development regarding different production / distribution sectors[7].

Yee-Loong Chong, et al. (2015), presented predicting RFID adoption in the health care supply chain from a user perspective. The research carried out integrates the integrated theory of acceptance and use of UTAUT technology, namely performance expectations, effort expectations, facilitation conditions, social influence) and individual differences, namely personality (neuroticism, awareness, openness to experience, friendliness and extraversion) and demographic characteristics (i.e. age and gender) to predict RFID adoption in the health care supply chain. Of the 252 doctors and nurses who were studied using 11 variables proposed in an effort to predict the adoption of RFID by doctors and nurses, it was found that individual differences were able to predict RFID adoption better than the variables originating from UTAUT[8].

Mohandes (2017) presented Class Attendance Management System Using Near Field Communication Mobile Devices. This study developed a Class Attendance Management System (CAMS) prototype that has been developed and evaluated using NFC-enabled mobile devices and NFC (or RFID) tags / cards. Faculty can monitor student attendance during the academic period, issue alerts, and request resignation of students due to poor attendance in accordance with institution policies. The app on NFC-enabled phones reads student IDs by simply tapping it on the NFC student ID card and gets positive responses from universities[9].

Kaur M, et.al (2011) presented RFID Technology Principles, Advantages, Limitations & Its Applications. This study gives an overview of the current state of radio frequency identification (RFID) technology. Aside from a brief introduction to the principles of the technology, major current and envisaged fields of application, as well as advantages, and limitations of use are discussed. Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It's grouped under the broad category of automatic identification technologies. RFID is increasingly used with biometric technologies for security[10].

LakshmiSudha, K. et al (2015) Barcode based Student Attendance System. This study presenting student attendance play significant role in order to justify academic outcome of a student and college as overall. Unfortunately, there is no automated attendance record keeping application available in colleges. There is a need for a tool to systematically keep the student's attendance record due to increasing number of college students The project that we are going to make is to help the teachers in our college to avoid maintaining the registry book. This project uses a barcode scanner. B.B.S.A.S uses Barcode scanner to take the attendance of students entering the lab. Each student's ID card will have a barcode at the back side of it. This barcode contains unique data of the student such as roll number, branch and year. Etc. Student will scan their barcode at the end so that the student can't cheat. The display screen will show the attendance of the particular student after scanning his/her barcode. Teachers and administrator will only have access to the system with their respective login ID's and passwords[11].

Mohamed, B.et al (2012) Fingerprint attendance system for classroom needs. Fingerprint attendance system aims to automate the attendance procedure of an educational institution using biometric technology. This will save time wasted on calling out names and it gives a fool-proof method of attendance marking. A hand-held device is used to mark the attendance without the intervention of teacher. The device can be passed and students can mark attendance during the lecture time. Students would be made to place their finger over the sensor so as to mark their presence in the class. It can communicate with a host computer using its USB interface. This device operates from a rechargeable battery. GUI application in host computer helps the teacher to manage the device and attendance[12]

Shoewu, O. et al (2012) Development of Attendance Management System using Biometrics. The development of an attendance management system using biometrics is proposed. Managing student attendance during lecture periods has become a difficult challenge. The ability to compute the attendance percentage becomes a major task as manual computation produces errors, and also wastes a lot of time. For the stated reason, an efficient attendance management system using biometrics is designed. This system takes attendance electronically with the help of a finger print device and the records of the attendance are stored in a database. Attendance is marked after student identification. For student identification, a biometric (fingerprint) identification based system is used. This process however, eliminates the need for stationary materials and personnel for the keeping of records. Eighty candidates were used to test the system and success rate of 94% was recorded. The manual attendance system average execution time for eighty students was 17.83 seconds while it was 3.79 seconds for the automatic attendance management system. Attendance is marked after student identification for eighty students was after student identification for the keeping biometrics. The results showed improved performance over manual attendance management system. Attendance is marked after student identification[13].

III. METHODOLOGY

A. Research Flow

The research flow begins with direct observation of the flow process of lecturer attendance process once teaching in classroom. Direct observation analyzes the attendance sheet of the lecturer on the lecturer attendance list to find out what data is entered when the lecturer records attendance on the academic attendance sheet. This is done to suit the type of data recorded in the lecturer attendance system. Next stage of research is to do literature studies related to how NFC cards work, practice making programs / coding on how to save data into an NFC card and how to read data from an NFC card. The next stage is data collection of attendance data on the lecture attendance sheet. Next stage of research is to design general flow system and data flow diagrams, design database and system user interface. The final stage is developing lecturer attendance information system. The general flow of research can be seen in Fig. 3.



Figure 3. Research Flow

B. Research Location and Time

This research conducted in one of IT campus in Denpasar area, Bali, Indonesia which was carried out in 2020 within a period of 1 year.

C. Research Object

The research object is lecturer, and time attendance sheet and time attendance of lecturing. Furthermore, when lecture start lecturing, time in is recorded once at the end of lecturing, time out was also recorded.

D. Flow of Lecturer Attendance System

The general flow of lecturer attendance system can be seen in Fig. 4.



Figure 4. General Flow of Lecturer Attendance System

In Fig. 4 explains general flow of lecturer attendance system starts from entry lecturer data and record the data into NFC Card. Lecturer data has been available in NFC Card. Then staff entering the lecturing schedule into system. Once lecturer start lecturing then they should do time in by tapping NFC Card into NFC read/write device connected to lecturer attendance system. System match the time in with the lecturing schedule which has been input previously. Then time in stored into lecturer attendance system. Once lecturer finish lecturing then they should do time out by tapping NFC Card into NFC read/write device.

In Fig. 5 explains general description of lecturer attendance system starts from entry lecturer data and record the data into NFC Card. Then staff entering the lecturing schedule into system. Once lecturer start lecturing then they should do time in by tapping NFC Card into NFC read/write device connected to lecturer attendance system. System match the time in with the lecturing schedule which has been input previously. Then time in stored into lecturer attendance system. Once lecturer finish lecturing then they should do time out by tapping NFC Card into NFC read/write device on the should do time out by tapping NFC Card into NFC read/write device system. Then time in stored into lecturer attendance system. Once lecturer finish lecturing then they should do time out by tapping NFC Card into NFC read/write device. The final step is lecturing system provide attendance reporting recapitulation for academic administrations.



Figure 5. General Description Of Lecturer Attendance System

E. Manual Time Sheet

At Fig. 6 presented manual timesheet used for time attendance by manually, which is lecturer to put time sheet into manual time attendance once they start lecturing in the class. While finished then this time sheet to be given to academic staff to enter time sheet into attendance applications.



Figure 6. Manual Time Sheet

F. Technology Used.

The design and development of traceability system uses the Visual C # programming language with MySQL database, and utilizes with Near Field Communication device for tapping the card to records and read attendance data.

IV. SYSTEM DESIGN

A. User Interface Design

The design of the Lecturer Data user interface can be seen in Fig. 7. This module store lecturer data into system and also into NFC Card. This card brought by lecturer once they give lectures.



Figure 7. Lecturer Data User Interface Design

The design of the Lectures Schedule User Interface can be seen in Fig. 8. This module store lecturer schedule data into system. The system will match this schedule with the time once lecturer tapping NFC Card for giving lectures.



Figure 8. Lectures Schedule User Interface Design

The design of the Lectures Attendance User Interface can be seen in Fig. 9. This module store time in and time out of lecturer data into system once card tapped into NFC device. Duration time of lectures also presented in this module as time difference between time out and time in of lectures.



Figure 9. Lectures Attendance User Interface Design

The design of the Lectures Attendance Verification Interface can be seen in Fig. 10. This module used to display attendance data once tapping the card into NFC device. This module check the data stored into card by tapping into NFC device.



Figure 10. Lectures Attendance Verification Interface Design

B. Contex Diagram and Data Flow Diagram Design

Design of context diagram can be seen in Fig. 11.



Figure 11. Context Diagram Design of Traceability System

A context diagram is a top level (also known as level 0) data flow diagram. It only contains one process node that generalizes the function of the entire system in relationship to external entities. Context diagram above is composed of 3 external entities, 1 process, and 4 data stores. The entities are lecturer, courses, lectures schedule. The arrow represents data flow into system or out from system, where each data flow is shown in the Fig. 11. Traceability system as the process of this design, and the data store consist of master lecturer, master courses, schedule and attendance database. Master lecturer is used to save lecturer data, and master courses is used to save courses data. Schedule data source is used to save schedule data and attendance is used to save data lecture attendance during give lectures. Meanwhile data flow diagram (DFD) is a much more complex representation of a context diagram. DFD show a further level of detail not shown in the context diagram. The Data Flow Diagram (DFD) shows the data flow between the processes within a system. Data flow diagram shown in Fig. 12.



Figure 12. Data Flow Diagram Level 1 Lecturer Attendance System

Context diagram in Fig. 11 is spitted into 2 process to be data flow diagram consist of master data module and lecturer attendance system. Master data is used to manage master data, while lecturer attendance is used to manage all transaction data related to attendance during lecturing process. There are 4 entities, 4 data store and 2 process. The arrows represent data flow from entity to process or data store, shown in Fig. 12.

C. Hardware and Software Requirements

The hardware requirements to implement this traceability system can be seen in Table I.

| TADIE | | WADE | REOUR | EMENT | I IST |
|----------|---------|------|--------|-------|-------|
| I ABLE I | I. ПАКD | WARE | REQUIR | EMENI | LISI |

| Туре | Specification | Used For | | |
|-----------------|---|--------------------------------------|--|--|
| Server Computer | Server using Windows Operating System | Store transactions in the database | | |
| Laptop | RAM minimum 4 GB, Windows Operating System | Entry transaction data on each stage | | |
| NFC Device | Mi-Fare ACR 122U | To read and write data into NFC Card | | |
| NFC Card | NFC Card Mi-Fare 1K | Card for store attendance data | | |

Table I outline the hardware requirements for lecturer attendance system. While the software requirements are described in Table II.

| Software Type | Specification | Used For | | |
|-------------------------|---|---|--|--|
| Web and database server | Apache and MySQL Server | To store lecturer attendance data into local database | | |
| Cloud Server | Cloud server with enough storage space, at least 4 GB | To store lecturer attendance data into cloud server | | |

V. SYSTEM RESULT AND DISCUSSION

A. System Result

This lecturer attendance system consists of user interface of master data module and lecturer attendance and verification module. Main menu lecturer attendance system consists of submenu master lecturer, master lecturing schedule, attendance and verification. Lecturer main menu could be seen in Fig.13

| 💀 Menu | – 🗆 X |
|-----------------------------|---|
| G Master Lecturer | Sistem Informasi Absensi Dosen |
| C Master Lecturing Schedule | ONLINE RFID HI (ENDANCE STSIEM |
| O Input Lecturer Attendance | Database |
| Q Verification Card | RFID Reader |
| Reporting | RFID Tags |
| | Arduino UNO Processing installed on localhost |

Figure 13. User Interface of Lecturer Main Menu

Lecturer main menu consists of sub menu master lecturer, master lecturing schedule, input lecturer attendance, verification card and reporting sub menu. The master data module user interface can be seen in Fig. 14.

| 🛃 Master Dosen | | | - | | × | | | |
|---|---------------------------------------|-----------------------|---|--|---|--|--|--|
| | | | | | | | | |
| Tanggal : 2020-10-30 Kampus : STMIK STIKON | 1 INDONESIA | Card Status : - | | | | | | |
| NIDN Dosen : Nama Dosen : | 0816077801 I Gede Sujana Eka Putra | | | | | | | |
| Program Studi : | Teknik Informatika | 🚰 Simpan Data Ke Card | | | | | | |
| | | | | | | | | |

Figure 14. User Interface of Lecturer Master Data

Lecturer master data module is a module to input lecturer data such as lecturer registration number and lecturer name and program.

| 🛃 Master Jadwal | | | | | | | | | | | - 0 | Х |
|------------------|-------------------------|----|---------|-----------------------|-------|--------|--------|--------|-----------------------|------|--------|---|
| | | | | | | | | | | | | |
| Kode Mata Kuliah | 1001 | No | Kode MK | Mata Kuliah | Kelae | Hari | Waktu1 | Waktu2 | Dosen | Edit | Delete | - |
| Kelas : | A | 1 | 1001 | Algoritma Pemrograman | A | Rabu | 11:00 | 15:30 | I GEDE SUJANA EKA PUT | Z | 8 | |
| Hari: Waktu: | Rabu ~ | 2 | 1001 | Algoritma Pemrograman | A | Selasa | 10:12 | 11:30 | I GEDE SUJANA EKA PUT | 2 | 8 | |
| Dosen : | I GEDE SUJANA EKA PUTRA | 3 | 1001 | Algoritma Pemrograman | D | Senin | 17:20 | 20:00 | I GEDE SUJANA EKA PUT | 0 | • | |
| | Save Cancel | 4 | 1002 | Basis Data | A | Minggu | 18:00 | 20:00 | I GEDE SUJANA EKA PUT | 0 | 8 | |
| | | 5 | 1001 | Algoritma Pemrograman | В | Selasa | 15:00 | 17:30 | I GEDE SUJANA EKA PUT | 7 | 8 | |
| | | 6 | 1003 | Pengantar Akuntansi | A | Jumat | 21:30 | 22:30 | I GEDE SUJANA EKA PUT | 7 | 8 | |
| | | - | | | | | | | | / | • | |
| | | | | | | | | | | | | |

Figure 15. User Interface of Lecturing Schedule

Lecturing schedule module could be seen in Fig.15 which is used to input lecturing schedule which is consist of courses code, class, day, time, lecture name. System will have matched this schedule time with attendance of lecturer once start lecturing in class.

| 💀 Attendance | | - | | × |
|--|--|------|-------|-----|
| ID Jadwal : 6 | | | 10:24 | :04 |
| Date : Courses Code Courses : Lec. Reg No : | 2020-10-31 Day : Sabtu Card Status : 1001 Hour : 10:12 - 11:30 Algoritma Pemrograman Class : A 0816077801 Lecturer Name : I GEDE SUJANA EK I GEDE SUJANA EK I GEDE SUJANA EK | Read | Card | |
| | | | | |
| | Time IN : 09:00 Time OUT : 10:24 Duration : 1:24 | | | |

Figure 16. User Interface of Lecturer Attendance

Lecturer attendance module is shown in Fig.16 and is used to record time in and time out for lecturer to give lectures in classroom. By tapping NFC Card into NFC device, then it matched with current lecturing schedule and recorded the time in and time out of attendance. There have also time duration which is difference between time in and time out of attendance.

| 🛃 Verification | | - | х |
|---------------------------------|------------------------------------|-----|---|
| | Verification Lecturer Attendance | | |
| Date : 2020-10-31 | Date : Sabtu Card Status : Read C | ard | |
| Courses Code 1001 | IN: 09:00 OUT: 10:24 | | |
| Courses : Algoritma Pemrograman | Reg No: 0816077801 | | |
| Class : A | Lecturer : I GEDE SUJANA EKA PUTRA | | |
| | | | |
| | | | |
| | | | |
| | | | |

Figure 17. User Interface of Verification of Attendance

Verification attendance module is shown in Fig.17 and is used to verify and show content of Card data stored in the NFC Card. By tapping NFC Card into NFC device, then it shows content of Card data into the module, so lecturer knows about what subject has been lectured and what duration time of lecturing process. And then Fig.18 shows about the attendance report recapitulation of lecturer has fulfil the lecturing process. From the report, it shows about courses, registration number of lecturer, lecturer name, class, day, time in and time out and time duration.

| | LECTURER ATTENDANCE RECAPITULATION | | | | | | | | | |
|----|--|-------------|-----------------------|---------------------------|-------|-------|------------|---------|---------------|--------------|
| | | | | | | | | | | |
| No | Courses | | Reg No | Lecturer | Class | Day | Date | Time IN | Time Out | Duration (m) |
| 1 | Date : Kamis Basis Data | 2020 | -09-10 0816077801 | 1 I GEDE SUJANA EKA PUTRA | с | Kamis | 2020-09-10 | 09:00 | 10:20 | 80 |
| 2 | Date : Jumat Pengantar Akuntansi | 2020 | 0-09-12 0816077801 | 1 I GEDE SUJANA EKA PUTRA | с | Jumat | 2020-09-12 | 12:30 | 1 3:50 | 80 |
| 3 | Date: Jumat Pengantar Akuntansi | 2020 | -10-30 0816077801 | I I GEDE SUJANA EKA PUTRA | A | Jumat | 2020-10-30 | 22:18 | 22:24 | 6 |
| 4 | Date : Sabtu Algoritma Pemrograr | 2020 nan | -10-31 0816077801 | 1 I GEDE SUJANA EKA PUTRA | A | Sabtu | 2020-10-31 | 09:00 | 10:24 | 84 |
| | | | | | | | | | | |
| | | | | | | | | | | |

Figure 18. Example of Recapitulation Report of Lecturer Attendance

B. Discussion

Based on testing result, we found that NFC Card have maximum distance to read /write data from NFC device. NFC device could read NFC Card at a maximum distance of 7 cm in an upright position and could not read in the sideway position. The testing results of the read/write NFC Card into NFC device are shown in Table III.

| Tapping distance (cm) | Position | Can Be Read? | Can Be Write? |
|-----------------------|---------------------|--------------|---------------|
| 0 cm | Stick to NFC device | Yes | Yes |
| 1 cm | Upright | Yes | Yes |
| 2 cm | Upright | Yes | Yes |
| 3 cm | Upright | Yes | Yes |
| 4 cm | Upright | Yes | Yes |
| 5 cm | Upright | Yes | Yes |
| 6 cm | Upright | Yes | Yes |
| 7 cm | Upright | Yes | Yes |
| 8 cm | Upright | No | No |
| 1 cm | Sideway | No | No |
| 7 cm | Sideway | No | No |

TABLE III. TESTING RESULT OF TAPPING NFC CARD INTO NFC DEVICE

Based on the test results from Table III, it can be observed that the NFC Card could be read/write at least at 7 cm distance from NFC reader/writer device in the upright position. While in the sideway position, NFC Card could not be read/write by NFC reader/writer.

| Tapping Angle | Frequency | | | | | |
|----------------------------------|-----------|-----------|-----------|--|--|--|
| Relative To NFC Reader/Writer | Testing 1 | Testing 2 | Testing 3 | | | |
| 50 | Can read | Can read | Can read | | | |
| 10 ⁰ | Can read | Can read | Can read | | | |
| 15 ⁰ | Can read | Can read | Can read | | | |
| 20^{0} | Can read | Can read | Can read | | | |
| 25 ⁰ | Can read | Can read | Can read | | | |
| 30 ⁰ | Can read | Can read | Can read | | | |
| 350 | _ | - | - | | | |

TABLE IV. TESTING RESULT TAPPING ANGLE NFC CARD RELATIVE TO NFC READER/WRITER

Based on the test results from Table IV, it can be observed that the NFC Card could be read/write at tapping angle position from 0⁰ until maximum 30⁰ relative to NFC Reader/Writer. By using NFC Card implemented in attendance system, more practical for lecturers in conducting lecture attendance.

VI. CONCLUSION

The conclusion of this research is system design stages consist of direct observation, literature study, data collection, system analysis and hardware requirements, database and user interface design, system development, and system testing. Testing the system by tapping an NFC Card (RFID) on a NFC Card reader/writer, obtained the results of testing the maximum distance from the reading of the NFC Tag card is up to 7 cm with the reading angle relative to NFC reader/writer with range 0^0 until 30^0 can read NFC Card. By using an NFC card implemented in attendance system, more practical for lecturers in conducting lecture attendance.

REFERENCES

- [1] F. E. Christanto and R. Candra, "Implementasi Kartu Untuk Transaksi Basis Data Digital," J. Teknol. Rekayasa, 2017.
- [2] X. Jia, Q. Feng, T. Fan, and Q. Lei, "RFID technology and its applications in Internet of Things (IoT)," 2012, doi: 10.1109/CECNet.2012.6201508.
- [3] I. G. S. Eka Putra, "Rancang Bangun Sistem Informasi E Ticketing Parkir Kendaraan Menggunakan NFC Card," J. Teknol. Inf. dan Komput., 2019, doi: 10.36002/jutik.v5i3.799.
- [4] I. G. Sujana Eka Putra and N. L. P. Labasariyani, "Design and Development of Login Security System Using Radio Frequency Identification," Log. J. Ranc. Bangun dan Teknol., 2019, doi: 10.31940/logic.v19i1.1301.
- [5] M. R. Adhitama and I. G. E. W. Putra, "Analisis Pembacaan dan Penulisan Data Buku Menggunakan RFID Mifare RC-522 untuk Perpustakaan," J. Sist. dan Inform., 2019, doi: 10.30864/jsi.v14i1.228.
- [6] S. Santoso and R. Nurmalina, "Perencanaan dan Pengembangan Aplikasi Absensi Mahasiswa Menggunakan Smart Card Guna Pengembangan Kampus Cerdas (Studi Kasus Politeknik Negeri Tanah Laut)," J. Integr., 2017.
- [7] C. Costa, F. Antonucci, F. Pallottino, J. Aguzzi, D. Sarriá, and P. Menesatti, "A Review on Agri-food Supply Chain Traceability by Means of RFID Technology," Food and Bioprocess Technology. 2013, doi: 10.1007/s11947-012-0958-7.

- [8] A. Yee-Loong Chong, M. J. Liu, J. Luo, and O. Keng-Boon, "Predicting RFID adoption in healthcare supply chain from the perspectives of users," Int. J. Prod. Econ., 2015, doi: 10.1016/j.ijpe.2014.09.034.
- [9] M. A. Mohandes, "Class Attendance Management System Using NFC Mobile Devices," Intell. Autom. Soft Comput., 2017, doi: 10.1080/10798587.2016.1204749.
- [10] M. Kaur, M. Sandhu, N. Mohan, and P. S. Sandhu, "RFID Technology Principles, Advantages, Limitations & Its Applications," Int. J. Comput. Electr. Eng., 2011, doi: 10.7763/ijcee.2011.v3.306.
- [11] K. LakshmiSudha, S. Shinde, T. Thomas, and A. Abdugani, "Barcode based Student Attendance System," Int. J. Comput. Appl., 2015, doi: 10.5120/21036-3147.
- [12] B. K. P. Mohamed and C. V. Raghu, "Fingerprint attendance system for classroom needs," 2012, doi: 10.1109/INDCON.2012.6420657.
- [13] O. Shoewu and O. a. Idowu, "Development of Attendance Management System using Biometrics.," Pacific J. Sci. Technol., 2012.