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Prototype of NFC Reader as a Attendance Sign at The Presence System

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Abstract. Presence processes to mark the attendance of an individual in an activity can be manipulated in various ways. Many of researches have been done to overcome the problem including the use of Student Identity Card (KTM), barcode, fingerprint, Near Field Communication (NFC) and biometric. Implementation of those technologies requires customization of a running system or creating a new system. This research will make NFC Reader connected to a computer via USB without having to change the running system. The research method uses prototyping to produce a system that suits the needs and desires of the user. This research produced some prototype results from previous repair process. The microcontroller needed is one that supports USB-Hosts such as Arduino Duemilanove, Leonardo or Micro. Tools can work as expected after using an alternative library. The test results show the NFC Reader prototype can read NFC tag in less than 1 second with various types of laptops. The hardware specification and type of laptop operating system has no significant effect on the performance of NFC Reader with an average start up time of about 17 seconds before it is ready to use.

1. Introduction

Presence is the process of marking/recording someone's attendance in an activity. At a university the attendance system can be done using signatures at the lecture attendance sheet. This system allows students to manipulate their presence.

The presence system using a student sign card [1], barcode [2] or fingerprints [3] can overcome the problem but those system can still be cheated by entrusting student cards or by fake fingerprint.

Those problems can be solved with biometric systems such as face recognition [4] or retina scanners [5]. This system is difficult to be cheated because scanning has to be done by the person themselves, because everyone's face and retina are different. The main obstacle in implementing this system is the expensive cost of procuring equipment.

A lot of research about presence system using Near Field Communication (NFC) technology has actually been held such as by [6], [7], [8], [9]. This system uses Android application with an NFC feature as a card reader. The application of this system must use an Android device that supports NFC.

The application of technology in the above research requires adjustment to an ongoing system or even requires creating a new system. This study will make a tool to read NFC tags (NFC Reader) that can be connected to another computer or laptop via USB without having to change the system that already running. NFC Reader being used as a presence marker through the presence system application that is being run. The application of NFC reader does not need change in the information system that already being used. E-KTP card or smartphone that supports NFC can be used as a presence tool by bringing it closer to the NFC Reader that is connected to a computer or laptop that is accessing the Presence System in the Academic Information System.

2. Experimental

This research applies the Prototyping method, which is the process of building experimental systems quickly and low cost. The interaction process with the prototype allows users to get a better idea to determine information needs [10]. This method will produce a system that suits the needs and desires of the user.

Academic information system refers to the presence system [11] with the design in figure 1 and ERD in figure 2.
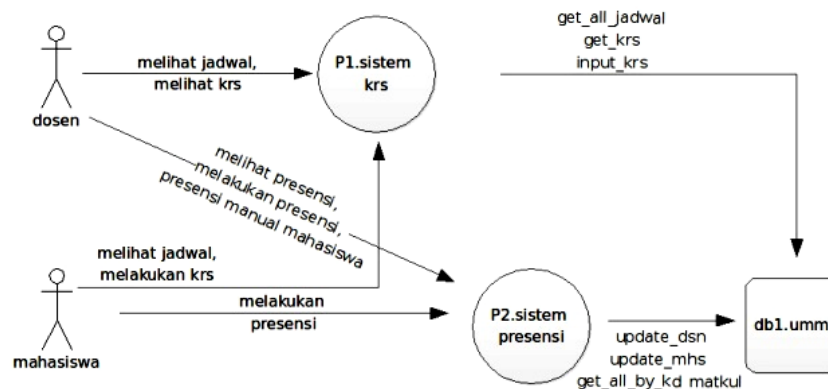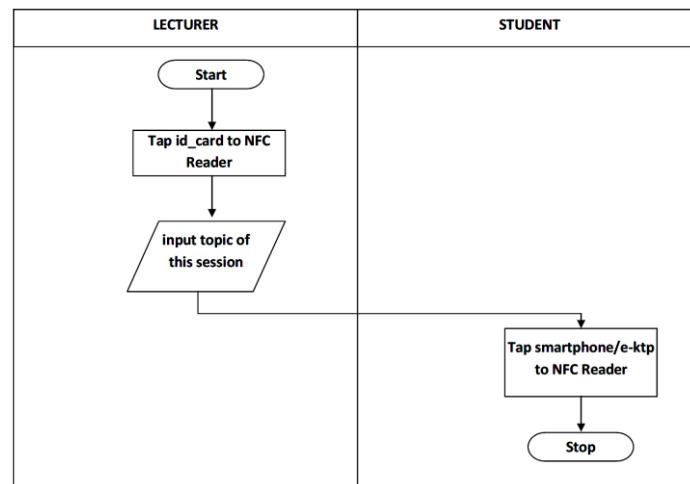

Figure 1. Presence System Design
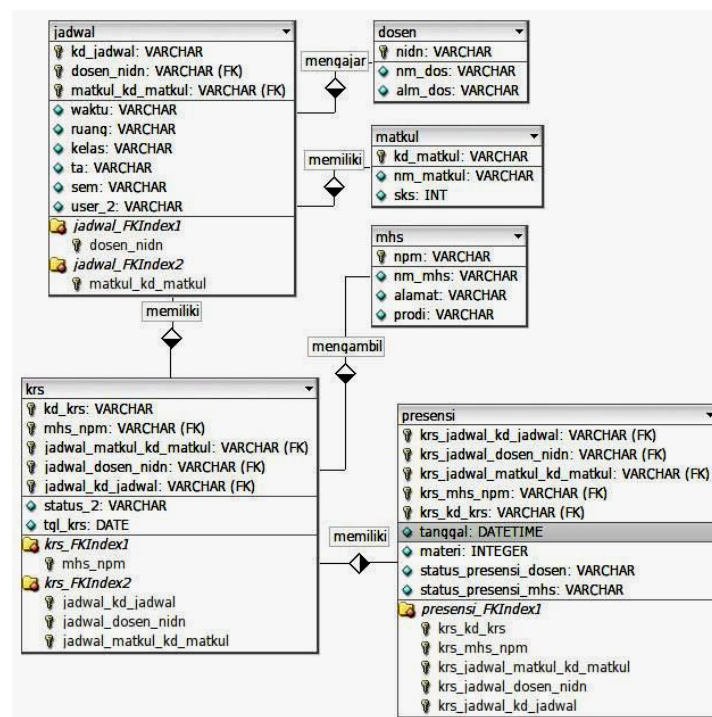
Figure 2. ERD Presence System

The design of interaction between lecturers, students and academic information systems is presented in the form of flowchart figure 3

Figure 3. Flowchart of Presence Process

When the lecturer enters the class, the ID Card is brought closer to the NFC Reader to enter the system, then the system will display the course schedule that was taught by the lecturer that day. Lecturers choose subjects and input material data to be delivered, then students, by carrying a smartphone that has an NFC feature or which has been affixed with NFC stickers, brings it closer to NFC Reader for the process of attendance to the system.

NFC Reader will replace the presence process by typing keyboard ID numbers such as NIDN for lecturers and NIM / NPM for students or through reading barcode scanners or magnetic card readers. Lecturers and students do presence by bringing the ID Card to NFC reader, which is shaped like a card, key chain, and in the form of an NFC sticker attached to a smartphone to be used as a sign of attendance.

The description of the NFC reader working system is if the NFC Smartphone or e-ID card is brought closer to the NFC reader, the NFC module (PN532) and the microcontroller (Arduino) will read the data and print it in the active cursor position, then the data will be sent by the computer to the Academic Information System as shown in Figure 4.
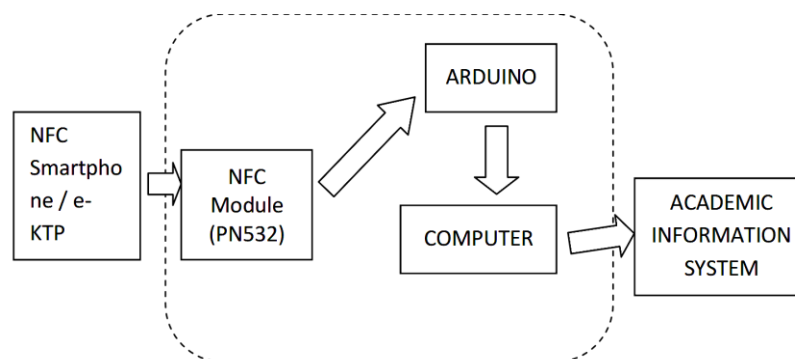
Figure 4. Block Diagram of System Design

NFC Reader that is needed is the one that does not change the existing system, but only change the presence process. Search results from various references, especially from the official website www.arduino.cc shows that to be able to work plug & play requires a microcontroller that has USB-Host features such as Arduino Duemilanove, Leonardo or Micro that uses ATmega32u4 chip.

The first NFC Reader prototype uses Arduino Leonardo, NFC Module V3 (PN532) product of Elechouse and only need the power from the USB cable that is attached to the laptop. Arduino IDE 1.8.3

used to programme microcontroller (Figure 6). The result is NFC can read NFC tags well after waiting for the start up process for more than 12 seconds.

Problem founded when NFC Reader is removed from the laptop or the laptop is turned off. The USB port must be reset using the Arduino IDE to be reused. To overcome the problem then the microcontroller is replaced by Arduino Micro, which uses ATMega32u4, but the problem remains. Another test is conducted by replacing the NFC Module with a PN532 product from Deek-Robot that uses chips from NXP Semiconductors. The results are still the same (Table 1).

Table 1. Library and Module Testing

Arduino	NFC Module	Library	Mode	Result
Leonardo/ Micro	Module V3/PN-532 (Elechouse)	https://github.com/elechouse/PN532	HSU I2C SPI	it's works but after the usb port unplugged the device doesn't work
	Module V3/PN-532 (Elechouse)	https://github.com/adafruit/Adafruit-PN532-RFID-NFC-Shield	HSU I2C SPI	it's works well
Leonardo/ Micro	NXP PN-532 (Deek-Robot)	https://github.com/elechouse/PN532	HSU I2C SPI	it's works but after the usb port unplugged the device doesn't work (HSU is fail)
	NXP PN-532 (Deek-Robot)	https://github.com/adafruit/Adafruit-PN532-RFID-NFC-Shield	HSU I2C SPI	it's works well (HSU is fail)

The next experiment is to replace the NFC library, which previously uses default product from Elechouse (https://github.com/elechouse/PN532), with a library from Adafruit (https://github.com/adafruit/Adafruit-PN532-RFID-NFC-Shield). Although the NFC module used is a product from Elechouse, it works using the library from Adafruit. The result is the second NFC Reader prototype can work in accordance with the design that has been made.

3. Results and Discussion
NFC Reader prototype can run well after the start up process without requiring a manual installation process. NFC tag reading process runs well with less than 1 second delay. Next testing of the NFC Reader prototype carried out by installing in a USB port of various laptops and computers in the field randomly. The purpose of this test is to ensure the NFC Reader can work properly without going through the installation process.

NFC Reader is installed to the laptop to open the Academic Information System (http://192.168.42.87) which is connected via a wifi network. The lecturer taps the ID Card to NFC Reader and types password. Students can presence process after the lecturer types the topic of this session (figure 5). The process of attendance to Academic Information System is running well using NFC Reader.
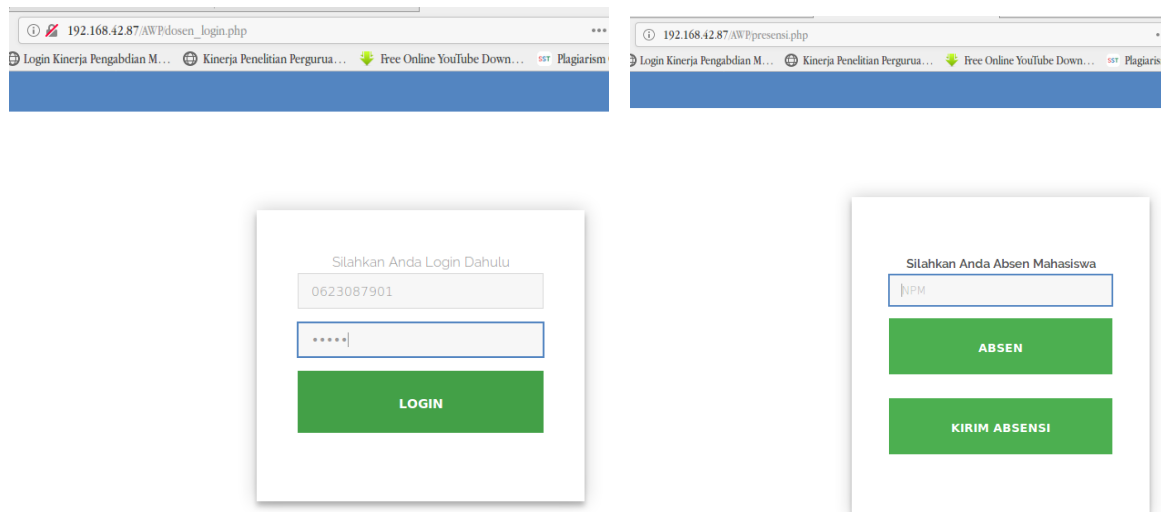
Figure 5. The presence process into Academic Information System using NFC Reader

Test results shows that the laptop hardware specifications and the type of operating system do not have much effect on start up time. The difference in the type of processor and RAM capacity also does not affect the initial response of the NFC Reader prototype. Test results on various types of hardware and Operating System presented in table 2.

Table 2. NFC Reader Testing

Hardware	Operating system	Average Start up time (second)
Intel Core i5 2,9 GHz RAM 8 GB	Mac OS Sierra 10.12.5	17
AMD APU A9-9400 3.2 Ghz RAM 8 GB	Linux Ubuntu 16.04	17
AMD APU A6-5400 3.6 Ghz RAM 2 GB	Win 7 Ultimate SP1	17
AMD APU A9-9400 3.2 Ghz RAM 4 GB	Win 10.1	18
Intel Celeron 1007U 1,5GHz RAM 2 GB	Linux Ubuntu 12.04	17
Intel Core i5 2,3 GHz RAM 4 GB	Mac OS X Yosemite	18
Intel E2160 1,8 GHz RAM 2GB	Win XP SP2	17
AMD E1-Series 1.4GHz RAM 2GB	Win 8	17
AMD A8-Series 3.1GHz RAM 4 GB	Win 8	18
Intel Core i3 2.30 GHz RAM 4 GB	Win 10.1	17

4. Conclusion

This research produces NFC Reader prototype for attendance marking process in the presence system without requiring changes to the existing system. NFC Reader prototype works like keyboard by read NFC tag less than 1 second . The device can run well on a laptop or computer with a variety of specifications and operating systems with an average start up time of around 17 seconds before it is

ready to use. Specifications of laptop hardware and operating systems have no significant effect on NFC Reader performance

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