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IOT-based lecture room monitoring information system

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.

Abstract

Improvement amount student Which significant every year need monitoring management room studying Which more efficient . Research This aiming For to design And develop system monitoring room studying based on Near Field Communication (NFC) And Internet of Things (IoT) in University Country Surabaya. This monitoring system utilizes technology NFC And IoT with use Arduino ESP32 as main microcontroller, as well as the NFC RC522 module for reading identity student through e-ID card. Data Which obtained Then processed And sent to server through connection Internet, Where application web based on framework Laravel used For display information in a way real time. This application can be accessed by administrative officers, lecturers, and student For monitor presence And use room studying. The system development method used is Rapid Application Development (RAD) applied in development system This For allow iteration fast And repair sustainable based on bait come back users. Results test try show that this system is able to manage student attendance data with high accuracy and provide accurate information about utilization room studying, so that support management Which more Good And increase efficiency operational in the environment Faculty.

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KEYWORDS:

Monitoring room studying, Near Field Communication (NFC), Internet of Things (IoT), Arduino ESP32, Rapid Application Development (RAD), Faculty, lecture room management, system information.

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Introduction

Improvement amount student Of course need better management of faculty assets, including space studying, Which become important point in create academic environment Which effective And productive. In a number of year final, development technology and the evolution of learning patterns has brought new challenges in management room studying. The emergence learning hybrid that combines online and face-to-face learning advance has become standard in Lots university. Based on news from detik.com in the odd semester of 2021/2022, many campus in Indonesia apply lectures hybrid. This phenomenon creates a mismatch between the capacities lecture halls and the number of students actually present, pose a challenge effectiveness.

Improvement amount student every the year, especially in Major Technique Informatics University Country Surabaya (Unesa), add complexity in management room studying. Growth quota student Which rapid become a major concern, causing potential overcrowding problems in room studying. Effectiveness in management room studying participate influence experience Study student And quality learning. Access Which easy to information about availability room studying And borrowing room Which accurate become the more crucial.

Study Library

Near Field Communication (NFC) is an innovative technology based on Radio Frequency Identification (RFID) Which allow device electronic communicate in distance near use induction Medan magnets. NFC Work with to form transformer core air through induction Medan magnet And can operate in mode reader/writer, peer- to-peer, or card emulation. This technology facilitates exchange information in a way contactless or touch, provide convenience for users. Transfer speed data NFC varies between 106 Kbps, 212 Kbps, And 424 Kbps, in accordance need application [1].

ESP32 is a microcontroller that is often used in automated control and Internet of Things (IoT) applications. With a dual core processor, integrated Wi-Fi and Bluetooth, ESP32 become choice ideal For device IoT. Feature Its wireless connectivity allows devices to connect to Internet And communicate with device other, providing flexibility in automated solutions and applications IoT [3].

Mifare RC522 RFID Reader Module is a module based on Philips MFRC522 IC which enables RFID reading with easy And price affordable. Module This Already equipped with the components necessary to function as RFID Reader [4].

Rapid Application Development or RAD is a Model process device soft Which emphasize on cycle short development and rapid adaptation of the method Waterfall by using construction component [5].

Research Method

A. Research Stages

This research follows several systematic stages. starting from identifying needs, designing, developing, to system testing and evaluation. The research stages that adopted in project This is as follows.

1) Identification need: Identifying need user and functionality main system.

2) System design: Designing a good system architecture device hard and also software.

3) Development system: Develop And integrate device hard And device soft.

4) Testing system: Do testing For ensure the system runs according to specifications set.

5) Evaluation and improvement: Evaluate system performance and do repair If required.

B. Method of collecting data

Method collection data Which used in study This covers.

1) Observation: Observing interaction user with system And response device hard to card NFC.

2) Interview: Get input from user potential about need And hope they related system.

3) Documentation: Collecting data from literature to understand the technology that used And theories related.

C. Method Development Application

In the development of a room-based monitoring system NFC And IoT, used method Rapid Application Development (RAD) For ensure development system Which efficient And adaptive. Method RAD chosen Because enables an iterative and rapid development process, as well as easy adapt with change need users.

In lower This is diagram from system monitoring NFC and IoT based lecture rooms to be developed. Block diagram the show that system This consists of from two part main namely device hard (hardware) Anddevice soft (software).

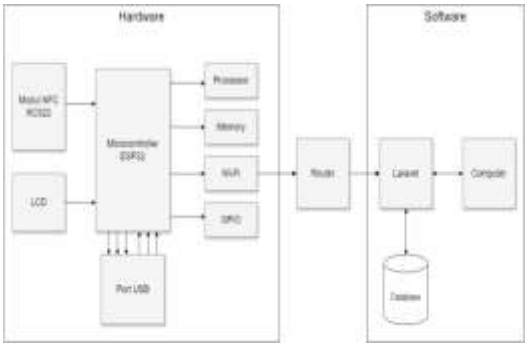

Figure 1 description system

1) *Hardware:* System hardwaremonitoring room studying based on NFC And IoT consists of fromArduino ESP32, NFC Reader RC522, LCD, USB Port and Wifi. Arduino ESP32 is a microcontroller board that can used For make various type deviceelectronic. In system This, ESP32 used For processing data from NFC RC522. NFC RC522 is device Which can read data from card RFID, likee-ktp. In this system, NFC RC522 acts as a toolscan e-ktp. LCD is used to display the text fromoutput system. Port USB can used For connecting the ESP32 to a computer for programming or debugging. ESP32 own driver USB Which allows it to connect to the computer as a device serial.

2) *Software:* System software NFC and IoT based lecture room monitoring consists offirmware And application web. Firmware used For control device hard system. In system This, The firmware will be used to read data from NFC RC522 And send data the to application web. Web applications are used to display data from the system. In system This, application web will display data about students Which entered into room studying.

3) *Method Work System:* Student put e-ID card they are near NFC RC522 in How the monitoring system works room studying based on NFC And IoT involving a series step Which efficient. First of all, studentneed put e-ID card they in near device NFCRC522 which has been installed at the entrance of the lecture room. The NFC RC522 then reads the data from the e- the student's ID card. After successfully reading the e-data ktp, NFC RC522 sends the information contained in the e-KTP to the ESP32 module. The ESP32

module, which act as connector between NFC RC522 And application web, accept And processing data the. Furthermore, ESP32 send information Which has processed to the prepared web application. Web applicationIt plays a key role in presenting data to users. With use interface Which easily accessible.

Hardware Design

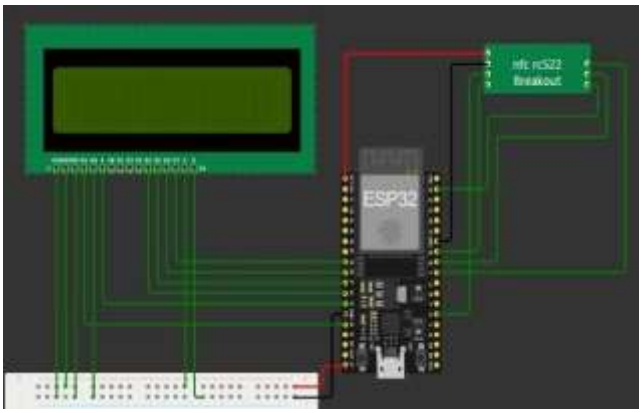

Figure 2 Hardware design

In Figure 2, the ESP 32 and RC 522 are already connected to each other.

Table II. RC 522 Pin Relationships

No	ESP32 Pin	RC522 Pin	Function
1	3.3V	VCC	Connected to source voltage 3.3V.
2	G0	RST	Used For reset module RC522.
3	GND	GND	Connect to ground For reference voltage.
4	G19	MISO	Terminal go out data from module RC522.
5	G23	MOTION	Terminal Enter data to module RC522.
6	G18	SCK	Terminal clock serial For communication SPI.
7	G5	SS/SDA	Slave selector terminal or data serial For communication SPI.

Connection between ESP32 And RC522 can implemented with use cable jumpers, ensure that every pin Which connected in accordance withtable connection Which has determined. Compliance This veryit is important to ensure stable and efficient communication between second device, Which is base from functionmonitoring system lecture room based on NFC and IoT.

Design Devices Soft

Software design must integrate NFC technology And IoT with synergy Which Good, so that canoptimize process collection And exchange data between system components. The success of the software does not only depends on his ability control device hard, but Also on his skills in understand, analyze, And respond information Which accepted from device hard the. This is it Which will determine level effectiveness And reliability system this monitoring.

With the integration of NFC and IoT technology, the system monitoring This become more advanced And responsive. Ability device soft in communicate withdevice hard through NFC, as well as manage And analyze data through connectivity IoT, give additional advantages in the efficiency and accuracy of this system in monitor room studying.

1. Use Case Diagram

There are 3 actors in the use case , including: Students, Administration Officers and Lecturers.

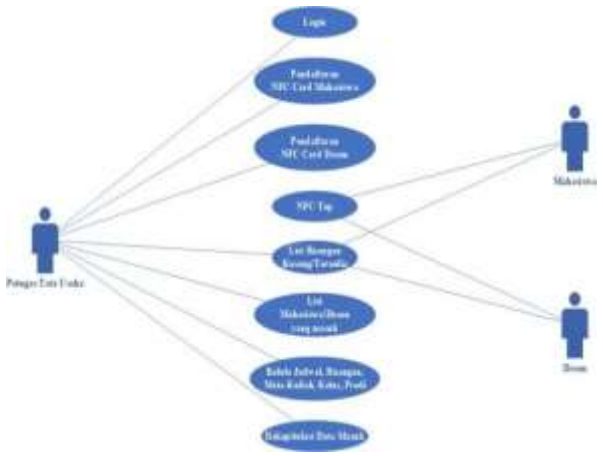

Figure 3 Use Case Diagram

Explanation for use case diagram as in the following table

Table III. Use case explanation

Use Case	Actor	Description
Login	Administrative OfficerBusiness	Officer Layout Business enterusername And password Which valid to enter into system.
Registration NFC Card Student	Administrative OfficerBusiness	Administrative Officer cando registration NFC Card owned by students add Name And class_id on table student.
Registration NFC Card Lecturer	Administrative OfficerBusiness	Officer Layout Business can perform NFC Card registrationowned by student with add Name on table lecturer
NFC Tap	Student& Lecturer	Student or Lecturer dotapping card NFC (E-KTP). Card NFC will keep data presence student or lecturer.
List Room	Administrative OfficerBusiness, Student & Lecturer	Officer Layout Business, StudentAnd Lecturer can see list which rooms are available or Which full. They Also cansee How many amount person in room along with quota maximum room.

List Student /Lecturer Which Enter	Administrative OfficerBusiness	The Administrative Officer can seeanyone who has done Tap NFC in every room Which There is.
Manage Timetable, Room, Eye Studying, Class, And Study Program	Administrative OfficerBusiness	Officer Layout Business can add, change, ordelete schedule, room, eyesstudying, class, and study program.

2. *Database*

The database used has several tables including users, students, classes, study programs , student course entry history , rooms, course schedules, student course mapping.

Figure 5. Database

3) *Application Menu*

Here are some images of the room monitoring information system application menu, including:

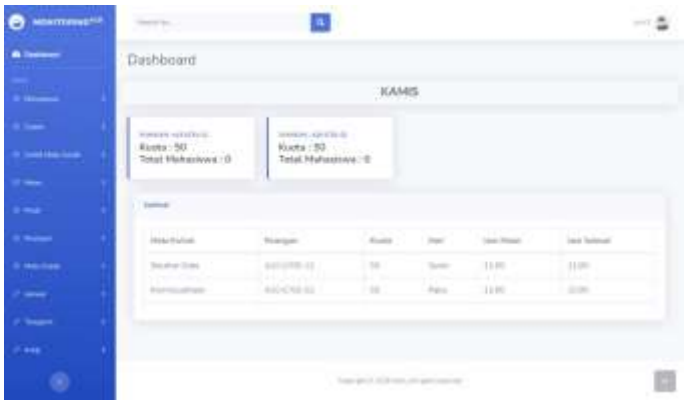

Figure 6. Main View

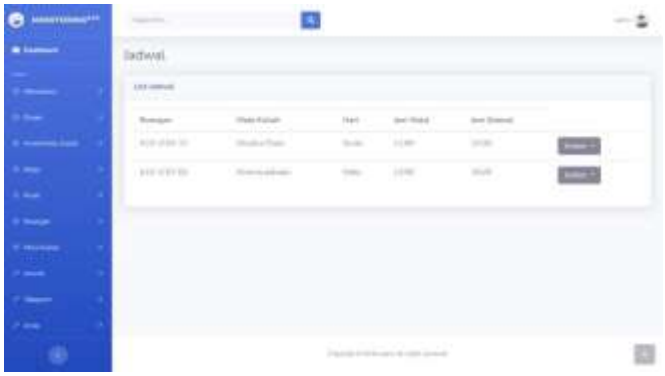

Figure 7. Schedule Form

Black Box Testing

Method This chosen For evaluate in a way comprehensive functionality system without need understanding deep about implementation internal code. With Using Black Box Testing, the author will focus on system interface testing, response to input data from device NFC, And integration with platform IoT. Objective This Black Box Testing is to identify potential failure or error that may arise in a given situation practical, including evaluation of software capabilities inmonitor presence student And lecturer on room effectively [7]. Through this approach, the author hopes to be able to ensure reliability and optimal performance of the solution proposed in context

monitoring presence on environment lectures .

Conclusion

Study This succeed to design And develop system monitoring room studying based on Near Field Communication (NFC) And Internet of Things (IoT) in State University of Surabaya. This system uses Arduino ESP32 as the main microcontroller and NFC module RC522 For read identity student through e-ID card. Data Which obtained then processed and sent to the server via connection Internet, with application web based on framework Laravel which displays information in a way real time.

Implementation method Rapid Application Development (RAD) enables rapid and efficient system development. responsive to bait come back users. Results test try show that system This capable manage data presence student with accuracy tall, give accurate information regarding the use of lecture rooms, as well as support management Which more Good And increase efficiency operational in environment university. This system provides an effective solution to the problem management room studying Which complex, especially with improvement amount student every the year. With the presence of NFC and IoT technology, monitoring of attendance and use of space becomes more efficient And integrated, so that create environment academic Which more productive .

Conflicts of Interest

The authors have disclosed no conflicts of interest.

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