Implementation of Web & 13.56 MHz RFID Card based Attendance System (Case Study : ITB Attendance System)

Adi Purnama
Teknik Informatika
Institut Teknologi Bandung
Bandung, Indonesia
adipurnama@s.itb.ac.id

***Abstract* – Attendance system is one important of an event, whether it is eventual or routine. Therefore , we need a system that can manage the attendance data effectively and efficiently. In this paper, the author proposes Web & 13.56 MHz RFID Card based attendance system. There are two objective of this system, which is to accelerate the time required by the participants to perform absenteeism and the ability to make an automatic attendance report to the event commitee. 13.56 MHz RFID card was chosen because in this case study (ITB people) , its official identity card is using this kind of card.**

Keyword – Attendance System, RFID, Web Application

I. INTRODUCTION

Attendance system is one of the important aspect in an event, whether it is eventual or routine event. In routine activities, such as recording of employee attendance, this information is one of the important factors in human resource management. This information can be derived to determine work performance, salary, productivity level, and progress of an organization in general. [1]

Meanwhile, in eventual activities, this attendance information is useful as an evaluation of the overall activity. If integrated into the attendance confirmation system (such as RSPV handling), this information is also useful for estimating the required budget based on the number of attendees present. With this information, the expected budget for organizing an activity can be allocated more efficiently.

In this paper, the author propose a Web & 13.56 MHz based attendance system. There are 2 goals to be achieved by this system, namely :

1. Optimization of the duration of time required by the participants to *check in* into the attendance system. With a fast system, the queue at the attendence post can be quickly parsed.
2. The ability of the system to generate attendance reports automatically. With this capability, the activity committe does not need to spend more resources to do manual recording of attendance data.

II. BASIC THEORY

A. The Existing Attendance System

Here is an explanation and analysis of some existing attendance systems which the author classifies.

1. Empty Table Attendance System

In this attendance system, the commitee simply defines the table header that explains what information should be filled by the participants of the activity. Then, the participant writes his personal infomation (which is asked by the commitee) on that empty table.

TABLE I
DESCRIPTION OF EMPTY TABLE ATTENDANCE SYSTEM

No.	Factor	Description
1.	The *check in* process by participants.	Wrtie the participant's personal information on the table
2.	The preparation process	Setting up an empty table, with predefined table headers.
3.	Reports generation	Created manually, with the risk of participants'unreadable handwriting .
4.	Supporting infrastructure	Paper, stationery

The advantages of this attendance system are simple and easy to prepare, but the drawbacks are as follows:

1. Potentialy causes a queue in the attendence post. It takes some time to write all the required personal information on the table.
2. The reports generations process is difficult and takes a long time. There is risk of participants' unreadable handwriting.
3. There is a risk for attendance cheating by the participants. Need direct supervision to prevent this.
.

2. Filled Table Attendance System

In this system , the committee prepared a table that already contains the required personal information of all participants

who will attend. Participants simply look for his name in the table , then put his signature on the provided table cell.

TABLE 2
DESCIPTION OF FILLED TABLE ATTENDANCE SYSTEM

No.	Factors	Description
1.	The *check in* process by participants.	Search for a name in the table, then put a signature
2.	The preparation process	Prepare a table that contains the participants' personal information
3.	Reports generation	Created manually.
4.	Supporting infrastructure	Paper, stationery

This system is an improvement from the previous system. Some of the advantages of this system are as follows:

1. All the required participant's personal information is already listed in the table. Participants no longer need to write down their personal infomation. In this way, the *check in* process can be done faster when compared to the empty table attendance system.
2. There is no more risk of unreadable handwriting

However, there are some of these system deficiencies :

1. If the number of participants is quite a lot, the searching process of the participant's name can take a long time. This may result in a queue at the attendance post.
2. It requires the process of collecting required personal information of all participants of the activity.
3. There is a risk for attendance cheating by the participants. Need direct supervision to prevent this.
   .

3. Fingerprint based Attendance System

In this attendance system, participants simply touch their fingerprint on the available fingerprint devices which is already prepared by the commitee.

TABLE 3
DESCRIPTION OF FINGERPRINT BASED ATTENDANCE SYSTEM

No.	Factors	Deskripsi
1.	The *check in* process by participants.	Put fingerprints on the fingerprint device.
2.	The preparation process	Collect fingerprint data for all participants
3.	Reports generation	Automated , by the system
4.	Supporting infrastructure	Fingerprint device

Some of the advantages of this system are as follows:

1. Automatic report generation process.
2. The time of *check in* process can be done quickly.
3. Able to reduce the potential of attendance cheating by participants

The downside of this system is as follows:

1. Requires the process of collectiong fingerprint data of all participants.
2. There is a possibility of fingerprint reading error. If this happens, the participant must repeat the process of absenteeism several times until the fingerprint is recognized by the system. This issue may cause a queue at the attendance post.
3. Require additional cost of purchasing fingerprint detection machine and system installations. Tend to be more expensive than previous attendance system

4. Web Based Attendance System

In this system, participants simply enter his identity code (which is predefined by the commitees) into the web system.

TABLE 4
DESCRIPTIONS OF WEB BASED ATTENDANCE SYSTEM

No.	Factors	Description
1.	The *check in* process by participants.	Input the identity code to the web system
2.	The preparation process	Prepare identity codes for each participant
3.	Reports generation	Automatically performed by the system
4.	Supporting infrastructure	Web server, device that can access the web (PC/ smartphone /tablet)

Some of the advantages of this systems are as follows:

1. Can be utilized for attendance confirmation system (online RSPV). The attendance confirmation link can be distributed to participants prior the D day of execution.
2. Mobile system, if this system is accessed by using mobile device.
3. The attendance reports are accessible in realtime, anytime and anywhere.

Meanwhile, the disadvantages of this system are as follows:

1. For some users, especially those not familiars with computer, the input process will take a long time. This can cause a queue in the attendance post.
2. There is a risk for attendance cheating by the participants. Need direct supervision to prevent this.
   .

5. RFID Card based Attendance System

In this system, users simply touch the RFID card on the RFID reader device available.

TABLE 4
DESCRIPTION OF RFID CARD BASED ATTENDANCE SYSTEM

No.	Factors	Descriptions
1.	The *check in* process by participants.	Touching the RFID card on the RFID reader device.
2.	The preparation process	Prepare RFID cards for the participants
3.	Reports generation	Automated by the system
4.	Supporting infrastructure	Computer, RFID reader device

Some of the advantages of this system are as follows:

1. The *check in* process can be done quickly.
2. Automatic reports generation.

Meanwhile, there is a risk for attendance cheating by the participants. Need direct supervision to prevent this.

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B. Technology Used in Web & 13.56 MHz RFID Card based Attendance System

Web & 13.56 MHz RFID Card based attendance system is a hybrid attendance system, a combination of web-based attendance system and RFID card based attendance system. Combining these two systems aims to combine the two advantages prosessed by each system and overcome the weaknesses of both system. Some of technologies used in this system include the following :

1. RFID

Radio frequency identification (RFID) is a technology for identifying objects using radio waves [2]. This technology uses radio waves to transfer data from RFID tags inserted on an object to an RFID reader [3].

RFID system consist of two components, namely transponder (radio frequency tag) and transceiver (radio frequency tag reader). RFID reader *interrogates* RFID tag contents by broadcasting radio frequency signals. The RFID tag will respond by transmitting a reply message, in the form of data contained by the RFID tag. There are two types of data that 13.56 MHz RFID tags can have. The first is data stored in the RFID tags (this data can be changed by the RFID reader), and serial number of RFID tags [4].

2. Arduino

Arduino is an opensoruce electronic platform. Arduino is a development of Wiring electronic platform. At first, this platform aims to facilitate people who have no electronis and programming background to create prototype of electronics products [5]. In this attendance system, arduino is used to communicate with RFID module.

3. Web based applications

Web apps are apps that run with web browsers using the Internet. Since the Internet is already publicly accessible , web-based applications are becoming the platform of choice in creating applications [6]. The web has evolved from a static web repository to a platform for application development.

One of the most frequently used web application development models is the LAMP stack with a three-tiered architecture [6]. The components include :

1. Linux as the operating system within the server.
2. Apache as web server.
3. MySQL as database server.
4. PHP as a programming language run on the server (server side scripting)

The architecture is consists of three layers, namely client layer (web browser accessed by the client), middle tier (application server), and database layer (managed by DBMS like MySQL). This attendance system also use LAMP stack and three-tiered architecture..

III. SYSTEM IMPLEMENTATION

This system consists of several components, namely:

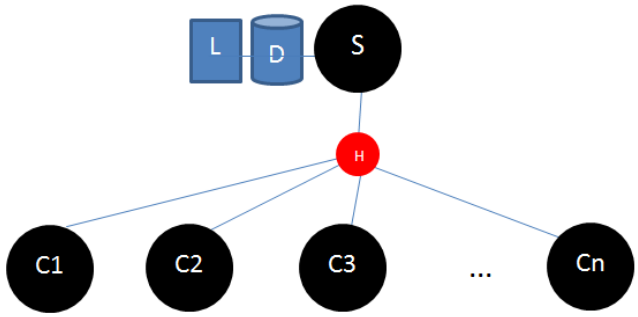

Fig. 1 The System Architecture

1. Server components. It consists of an API server to communicate with clients (C) , database (D) to store participant's personal information and attendance data. This component is also capable of generating attendance report (L) from the collected data.
2. Client component. Consists of n pieces of client computer (C1, C2, ... , Cn). Each client can function as an attendance post.
3. Network (H) connecting server components and client components.

Meanwhile, the client component consists of several subcomponents, that is :

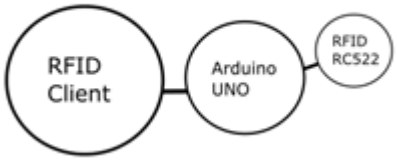

Fig. 2 The Client Component Architecture

1. RFID-RC522. An arduino component that can read an write RFID tags with a frequency of 13.56 MHz.
2. Arduino. Microcontroller that serves to control RFID-RC522 module and send the results of RFID readings to client computer by using serial communication.
3. RFID Client. The program installed on the client to read the RFID value from arduino, and send it to the server.

Here is an explanation of each component.

1. Arduino

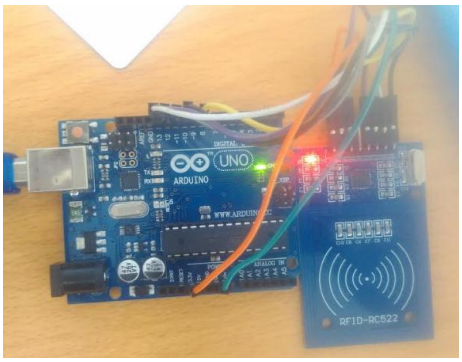

Fig. 3 The Arduino Component

Arduino works to read RFID tag and send it to the RFID client via serial communication. Arduino uses RFID-RC522 component as RFID reader, with pin configuration as follows :

Reset	: Digital pin 8
Serial Data (SDA)	: Digital pin 10
Master Out Slave In	: Digital pin 11
Master In Slave Out	: Digital pin 12
Serial Clock (SCK)	: Digital pin 13

Arduino will communicate with the computer via serial port with a frequency of 115200 baud. When first run, the arduino checks whether all RFID pin configuration connections are correct. If true, arduino will send an “OK” serial message. After that, whenever arduino *senses* an RFID-tag, arduino will send the code to the serial port. RFID code is represented in 5 byte values. The code format used in this system is H1H2H3H4H5, where H1 is the first byte of RFID code, represented in 2 digit hexadecimal notation.

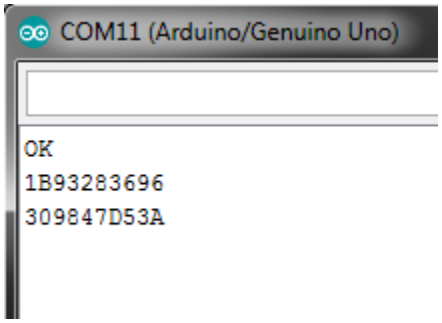

Fig. 4 The Generated Serial Output by Arduino

Here is the arduino soruce code

```
#include <SPI.h>
#include <MFRC522.h>
#define SDAPIN 10
#define RESETPIN 8

byte FoundTag;
byte ReadTag;
byte TagData[MAX_LEN];
byte TagSerialNumber[5];
MFRC522 nfc(SDAPIN,RESETPIN);

void setup() {
  SPI.begin();
  Serial.begin(115200);
  nfc.begin();
  byte version = nfc.getFirmwareVersion();
  if(!version) {
    Serial.print("Didn't find RC522 board.");
  }
  else {
    Serial.println("OK");
  }
}

void loop() {
  delay(450);
  FoundTag     =     nfc.requestTag(MF1_REQIDL,
TagData);
  if (FoundTag == MI_OK){
    char dataString[10];
    ReadTag = nfc.antiCollision(TagData);
    memcpy(TagSerialNumber, TagData, 5);

sprintf(dataString,"%02X%02X%02X%02X%02X",TagS
erialNumber[0],TagSerialNumber[1],TagSerialNum
ber[2],TagSerialNumber[3],TagSerialNumber[4]);
    Serial.println(dataString);
  }
}
```

2. RFID Client

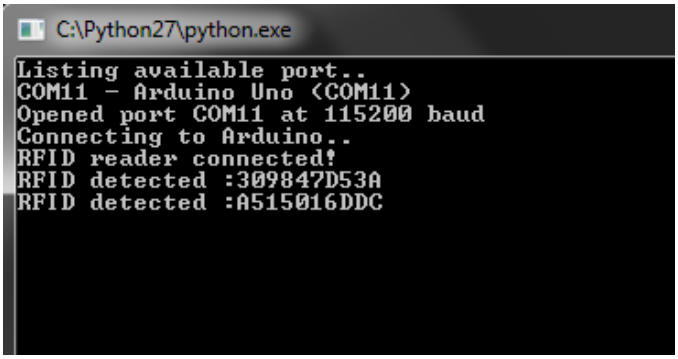

Fig. 5 RFID Client Program

This component is a program used to read RFID codes sent by arduino through serial communication. After reading the RFID code, the program will send the code through HTTP GET request to the server, indicating that the user associated with the code that has been sent.

This program does a continuous poll to get data from the serial port sent by arduino. Messages from the serial port will be read every one byte, to be temporarily collected into the buffer. When the buffer has reached 10 bytes (indicating a complete RFID code has been placed into the buffer), this program will send the HTTP GET request to the server. Then the buffer will be emptied.

Here is the source code of RFID Client. This program is written in python programming language..

```
portname = "COM11"
portbaud = "115200"
ser = serial.Serial(portname,portbaud,timeout=0)
print "Opened port " + portname + " at " + str(portbaud) +  " baud"
sys.stdout.flush()
hw = HW_Interface(ser,0.1)
hw.reset()
print("Connecting to Arduino.. ")
while(1):
  hw.getRFIDValue()
```

3. Server

The server component functions to receive the RFID code that is sent by the RFID client and put the code into the database. The RFID code is sent in HTTPGET request parameter. This component uses PHP as the programming language and MySQL as the database.

The database schema for storing attendance is as follows:

Absensi = <ID, EventID, RFID, Timestamp>

The event ID is the ID of a particular activity. This component is a foreign key to antother table that stores detailed information about the event. RFID is a 10 digit RFID code owned by the participant , this component is also a foreign key to another table that has the detailed information about the participants of the activity. Meanwhile, timestamp is the time when then INSERT query is executed in the server. The timestamp and ID values are auto-filled by MySQL.

Here is the source code used. This program is written in PHP.
.

```
<?php
$servername = "localhost";
$db_username = "root";
$db_password = "root";

$conn = new mysqli($servername, $db_username, $db_password, "db");
if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}

$rfid = $_GET["rfid"];
$nama = $_GET["id"];
$sql = "INSERT INTO rfid_x (idkegiatan, rfid) VALUES ('$idkegiatan', '$rfid')";

if(mysqli_query($conn, $sql)){
    echo "Success!";
} else {
}
?>
```

IV. TESTING

Fig. 6 The 13.56 MHz RFID card used for testing purpose.

The test ws conducted by using several types of 13.56 MHz RFID card owned by ITB academic community. Among them :

1. ITB Student Identity Card (Kartu Tanda Mahasiswa)
2. ITB Special Identity Card.

The test is performed with hardware & software specification as follows

1. Arduino UNO
2. RFID-RC522
3. Client : PC , Windows 7 Ultimate 32 bit, Intel Celeron 1,80 GHz, RAM 4 GB.
4. Python 2.7.12
5. Arduino IDE 1.6.9
6. PHP 5.5.35
7. Server : Linux

The step of the test is done as follows

1. Attach the Arduino to the USB port
2. Run the RFID Client program, make sure it is properly connected with the Arduino port.
3. Bring the card to the RFID reader.
4. Check the database on the server, whether the RFID data has been successfully saved.

Based on testing, this system has successfully read & storing RFID code from both cards.

nama	rfid	timestamp
Adi Purnama (KIP)	D4F96AC681	2017-05-05 07:21:39
Adi Purnama	1B93283696	2017-05-05 06:40:05

Gambar. 7 The system successfully reads and stores both test cards

V. Conclusion

This system successfully stores attendance information using 13.56MHz RFID card. This type of card is chose because most of ITB academic community has it, namely lecturer (KIP card), employee (KIP card) ,contract employee (Special identity card), and student (KTM card). This system can be used by every member of ITB academic community for various purposes.

Acknowledgement

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For the reader who have interest in continuing and developing this system, all source code used in this paper is freely available at https://github.com/adipurnama141/AbsensiRFID

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Statement

I hereby declare that the paper I write are my own, not adaptations, or tranlations of other people's paper and not plagiarism

Bandung, 5 May 2017

Adi Purnama