Design information seating chart system in classroom with wireless sensor network

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Abstract. The seating chart created in the classroom is one way for teachers in the class to remember students’ names one by one and by remembering students' names, it means there is a teacher concern [4][5]. In addition it becomes the basis for developing sense of community in classroom [4][5]. In this paper discusses combination of computers and wireless sensors to make information seating chart system digitally in classroom. The system will be updated automatically if a student sits down a seat. Sensor section was placed to the student's seat and server section was used to display seating chart to teacher. It was working as planned. This was evidenced by the stored data (the seat’s number and RFID code of the student's card) into the MySQL database on the server. The future work will create a Graphical User Interface to be installed the server, so that teacher will use it easy.

1. Introduction
The seating chart system is representation of the seat location in classroom [4]. Generally, it is presented on paper or cartoon, and in it there is arrangement of students’ photo and their names are adjusted to the actual location [4]. Making of seating chart system according to paper’s title “Learning Student Name” by Simon Handy and paper’s title “The Importance of Learning Students Name” by Tamara Glenx purpose to help teacher to learn and one of methods to remember student’s name, so it's meaning teacher's concern of students [4][5]. Then be basically to develop sense of community in classroom [4][5]. This condition is applied if the classroom is used only for a group of student. How do if some group of student use classroom alternately or some students are not matched to sit down with present seating chart system? That is one of problem use conventional seating chart system to help teacher learning student's name. This paper proposed design information seating chart system in classroom using computer and wireless sensor.

The seating chart system planning is divided to two sections, first section is receiver system installed on teacher’s computer and second section is transmitter system installed on student’s seating and communicate between sections with wireless.

2. Literature Review
Wireless sensor network (WSN) is group of many sensors distributed in the particular region, so establish a network and it functions to collect data [1][3]. In processing, WSN has content two parts,
the first part is server node and the second part is sensor node [2]. While network classification of WSN is centralized and distributed.

![Figure 1. Centralized](image)

The server node functions as data warehouse and process something as expected, so produce useful information. The sensor node is as data collection. To implement as sensor node, they use Arduino and nRF24L01(+) [6], use Arduino and Xbee [7][8][12] and now use Arduino and ESP8266 [10][13]. ESP8266 device is Wi-Fi embedded and it can connect to access point. It introduce at the end of 2014 years.

Smart classroom concept has been studied by Prof. Rohini Temkar et al. Their paper explain about Internet of Things (IOT) is applied into classroom and function to monitor behavior students in classroom [9]. The sensor used have content PIR sensor is used to monitor students motion, microphone sensor is used to monitor students noise, camera sensor is used to monitor activity students level and voice sensor is used to monitor sound level from students [9].

The other paper explains about smart chair concept by Jing (Selena) et al. That concept study about ordinary chair will connect to internet and then identity who occupies the chair will send to ThingsSpeak cloud [3]. The hardware used has content Arduino Yun (included Wi-Fi module), pressure sensor and RFID reader [3]. Initial processing is student’s RFID card touch the chair (it has been installed RFID reader) because student sit down that chair, so RFID read produce unique code from student’s RFID card and send to Arduino Yun. After that Arduino Yun with Wi-Fi module send unique code to ThingSpeak cloud and with JSON format can make display ready to be used.

3. Proposed System

System planning is begin by determining the sequence of process and be described like figure 2.

![Figure 2. Sequence of process](image)
Figure 3. Seating chart model in classroom

The eight chairs in figure 3 are student’s seat. They will change student’s photo and its name if that chair is occupied by each student. To be easy discussed this problem, it is divided two parts, i.e. discuss about hardware and discuss about software.

3.1. Hardware used

Hardware used reference is diagram block in figure 2. Sensor block has consist of pressure sensor device and RFID Reader device. Pressure sensor used is FSR (Force Sensitive Resistor) sensor. This sensor can only detect physical pressure. In this paper, pressure sensor functions to know the chair what is occupied or not.

Type of RFID reader used is ID-12. Its specification is dimension 25x26 mm, 2.8-5 VDC supply, 125 kHz read frequency, EM4001 64-bit RFID tag compatible, 9600 bps TTL and RS232 output [11]. RFID reader function is as card tag reader. The card tag has unique code. Later on card tag will be brought by student.

Figure 4. Arduino Nano

At processor block in figure 2 is Arduino Nano device (like figure 4). Its specification is dimension 1.7x0.73 inches, 5 VDC supply. Wi-Fi block in figure 2 is ESP8266 device. It connects to Arduino Nano and connects to Access point as wireless infrastructure service. ESP8266 specification is 802.11 b/g/n protocol, integrated TCP/IP protocol stack, integrated TR switch, balun, LNA, power amplifier and matching network, WPA/WPA2 PSK, and WPS driver, 3.3 VDC supply, UART interface. The following complete block diagram scheme is like figure 5.

At Arduino Nano input is from pressure sensor via pin A0 and other input is from RFID via pin D4. RFID uses asynchronous serial communication to communicate with Arduino Nano. Whereas Arduino Nano output connect to ESP8266 via pin D2 and pin D3. Communicate between them use asynchronous serial communication with series of program difference.
3.2. Software used
Making software is divided into 2 parts, part 1 about making Arduino Nano software (sensor node) is used by Basic Compiler and part 2 about making server software (server node) at computer is used by PHP, MySQL and APACHE. Server software is function to display information (position of student every time in classroom) to teacher, like figure 6.

Planning information display at figure 6 is about student’s photo and its name to inform to teacher about student’s location in classroom. Student’s photo and its name will appear if students are present e.g. A, B, C, D, E and F at figure 6. At the same time chair 2 and chair 4 at figure 6 explain about students not present. To seeing this information is required web browser software. Arduino Nano need series of program so that it work. The series of program is make with Basic Compiler AVR (Bascom AVR) and server software use PHP, MySQL and Apache.

4. Ongoing work
Flowchart is designed that first time before starting create series of program for Arduino Nano, like figure 7. From figure 7 can be created series of program one by one. It is begun with introducing Arduino’s pin to connect pressure sensor, connect to RFID reader with asynchronous serial communication and connect to ESP 8266.
Initial Pin for Pressure Sensor, RFID, ESP8266

Pressure Sensor = 1

RFID Reader collect identity code from Student's Card

ESP8266 send identity and chair's number

Figure 7. Flowchart design for Arduino Nano

The following is series of program to activate asynchronous serial communication in figure 8

```plaintext
Config Portc.0=Input
Open "comd.4:9600,8,n,1" For Input As #1
Open "comd.3:9600,8,n,1" For Output As #2
Open "comd.2:9600,8,n,1" For Input As #3
```

Figure 8. Program listing for serial communication

The following is series of program to active RFID reader in figure 9.

```plaintext
Dim Y As String*20
Dim Id1 As String*20
Y=Inkey(#1)
Input #1,Y Noecho
Id1=Mid(y,7,7)
```

Figure 9. Program listing for RFID

The following is series of program to active ESP8266 device in figure 10.
seat=1
Const Ssid="seating chart"
Const Pass="12345678"
Const Ip="192.168.0.1"
Print
#2,"AT+CWJAP=";Chr(34);Ssid;Chr(34);Chr(44)_;Chr(34);Pass;Chr(34)
Print #2,"AT+CIPMUX=1"
Print
#2,"AT+CIPSTART=4";Chr(44);Chr(34);"TCP";Chr(34)_
;Chr(44);Ip;Chr(34);Chr(44);"80"
Print #2,"AT+CIPSEND=4,48"
Print
#2,"GET";"/insert.php?value1=";seat;"&value2=";_Id1
Print #2,"HTTP/1.1\r\n"

5. Future work
The next project create graphical user interface (GUI) like figure 6 so the teacher can see it. The program list created will be installed to server computer at classroom and it is consists of two menus.
The first is admin menu. It functions to save student’s identity, e.g., student’s photo, student’s name and student’s code. The other function saves password to access seating chart system. The second is display menu. It functions to display seating chart like figure 6. Later the function of program list is to matching between RFID code and identities’ student (like photo and name). Then display the results of the process. All of menu are created with PHP and connect to MySQL as database. To be accessible through web browser software then use Apache software as web server.

6. Conclusion
Arduino Nano can communicate with ESP8266 device and RFID Reader device using asynchronous serial communication. Chair’s number and RFID code that is received from Arduino Nano are stored in MySQL software. Wireless sensor network (WSN) classification used is centralized or infrastructure. The sensor node at student’s seat work well. It is evident with save data in MySQL.

7. References
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