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The Implementation of Distributed System Application on Periodic Attendance of the Faculty

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Abstract**—** *This paper presented an implementation of distributed system application on periodic attendance records of the faculty monitoring of school colleges and universities' frequent class schedule checking. Hence, the researchers had developed a client RF-ID-based device installed near the classroom for easy access by the faculty. Also, the HR department installed the server with a middleware running and database to store data. Each faculty subject/load will be entered and stored into the server's database at the beginning of each semester as the basis to compute the salary for every payoff. The methodology used is deductive because it is development and design. Finally, the researchers designed a distributed system application utilizing the microcontroller of every client. They created a middleware application software to cater the transmitted data from all installed RF-ID readers or clients to the server and vice versa. The researchers concluded that the study had shown that the distributed system application is a beneficial solution to most schools, colleges, and university faculty attendance monitoring.*

Keywords— *Distributed Systems; Embedded Systems; Microcontroller; RF-ID Reader; Serial Communication.*

I. INTRODUCTION

Most colleges and universities' faculty attendance were primarily monitored manually [1][2][6][7] by a checker assigned by the Human Resource department for a periodic class schedule as the basis for the salary computations [8], even if there were biometric machines at the schools, colleges, and university entrance [6] [13]. The biometric finger scanning [2][19] does not include periodic faculty attendance checking, only the eight hours rendered in each employee daily. Moreover, faculty attendance is based on the subject load [6] assigned to them for the whole semester. Therefore, the absenteeism of a faculty per class hour is not monitored accurately by this setup.

This study's primary concern is the faculty attendance problem [4][6] because the management hires a checker to check the faculty's whereabouts. Since most universities and colleges have a more prominent and wider area, many checkers review each department's faculty attendance.

Thus, hiring personnel will work only for an 8-hour service in a day. Two personnel will engage to accommodate the checking of the faculty attendance from 7:30 A.M. to 9:30 P.M. The faculty's manual checking accuracy is not reliable [4] and valuable for immediate reports as needed by the management [5]. It is sometimes the cause of trouble between the faculty and the checker.

Some universities ' current system is the checker route the login device to the faculty's respective/assigned rooms and entering the class period if the faculty attended their class [4]. The other checker was manually logging in to the logbook.[10] Therefore, the concept of automation is not applied because they are carrying a very confidential device for the faculty [4].

In this scenario, the researcher developed a distributed system application [25] using an RFID device [6] that serves as a client installed in the most accessible areas, particularly near the classrooms. Multiple client devices will install so that the faculty can log in and log out conveniently per class period and directly record it to the management department, wherein the server is installed [18]. A server carries the information sent from the client devices. In addition, a server has a database using MYSQL to store the transmitted data and middleware software running, allowing the operating system to communicate client and server heterogeneity.

Conceptual Background

As presented and mentioned earlier, the study is shown in Figure 1. It shows the implementation of distributed system applications [17][25] since most colleges and universities consist of many colleges and departments. The device is installed in the whole campus with a classroom to quickly or conveniently utilize to log in or log out to the device. This distributed system application uses the RS-232 standard communication channel [21]. Based on the average of RS 232, 50 feet is the ideal distance; beyond that limitation, the user's risk of data loss will occur. However, each client is equipped with a signal booster/amplifier to extend the length of the transmission signal.

The distributed model to accommodate the clients based on a multi-port serial controller or amplifier is part of the system's development to accommodate the whole campus application.

Objective of the Study

The study's main objective is to design, develop, and implement the system to solve the problem of most colleges and universities. Aims explicitly to develop the following:

1. Design and develop system hardware for the client and server for login and logout devices of the faculty using Microcontroller.
2. Develop a database and middleware software to cater to the activity of the distributed system.
3. Testing its functionality for the heterogeneity of the developed device.

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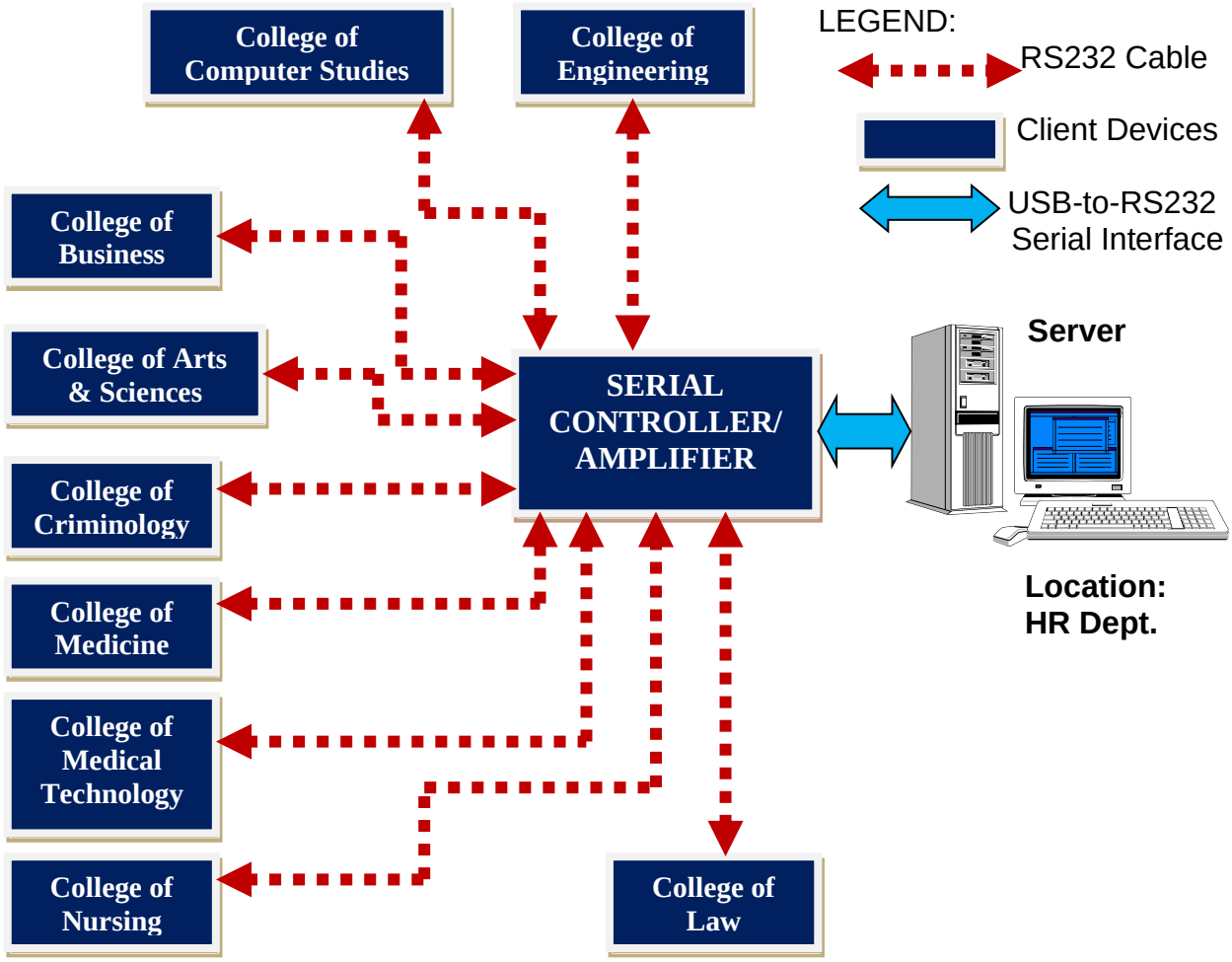

Fig. 1. System Implementation of a Distributed Systems Application

II. METHODOLOGY

The method used in this study is deductive because it is experimental based on Plan-Do-Check-Act criteria. See Figure 2 for the schema of the study. It shows the gradual unfolding from involved in a simple implementation of the system from general to specific.

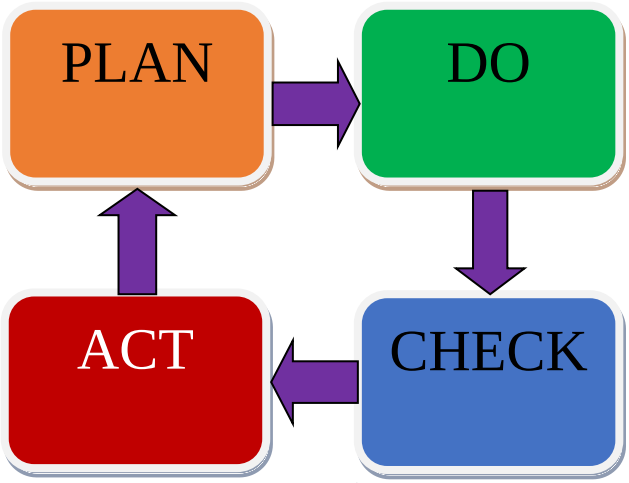

Fig. 2. Schema of the Study

A. Plan

Design

The researcher gathered information about the faculty's regular or periodic attendance and formulated a possible hardware design, especially in acquiring the RF-ID reader [22]. During designing, Cadence OrCAD 16.6 makes a circuit diagram a more concise view.

RF-ID Interface to Microcontroller

RF-ID reader has many formats, so the researcher must identify which will use the RFID reader. After having the RF-ID reader, the researcher created a Microcontroller interface to the RFID module [13] circuit diagram. Figure 3 shows the schematic diagram of the system.

RS232 Controller/Amplifier

The RS232[21] controller is needed to amplify and isolate to avoid interferences because the data captured from the RF-ID is essential. Figure 4 shows the RS232 isolation and amplification circuit that uses optocouplers components.

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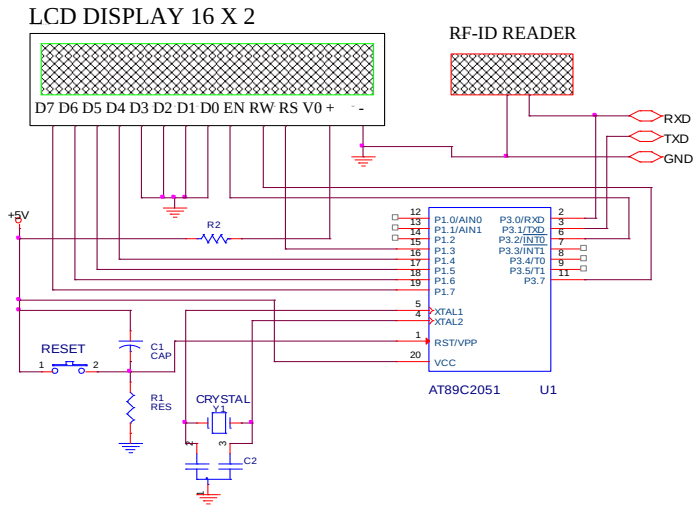

Fig. 3. Schematic Diagram of MCU & RF-ID

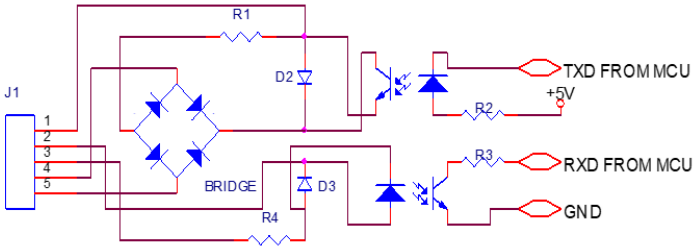

Fig. 4. RS232 Controller/Amplifier

This distributed systems application [17][25] is based on a ring topology wherein a network configuration where device connections create a circular data path.

In this study, each device is a program to receive a pocket acquired by an RF-ID reader and transmitted to the server that contains the information. The server also programs to receive and send it back to the transmitting clients for confirmation. At the same time, other terminals/clients are waiting for their turns to receive data from the RF-ID reader and then transmit it to the server and back. The programming language used in controlling the distributed system application for clients' hardware design is based on the assembly language using the instruction sets of MCS51. While in the middleware on the server-side is the Visual Studio with MSSQL database server-Heterogeneity is being applied in this system because it attests that a hi-speed server interfaces to low-speed clients seamlessly. Based on the distributed system models as shown in Figure 5 below [25].

The distribution of the roles implies asymmetry in the distributed execution of the application. For example, the server offers a service where more clients access the request and reply roles, shown in Figure 5.

Furthermore, in this study, Figure 6 below applied to the development of the system to accommodate the full campus setup implementation and design. All devices were connected, including the server in a ring connection.

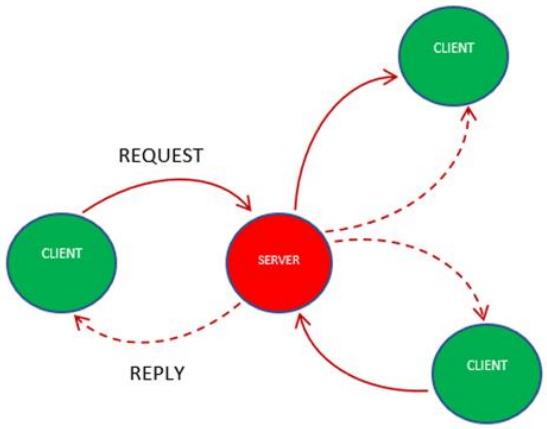

Fig. 5. Distributed Systems Model

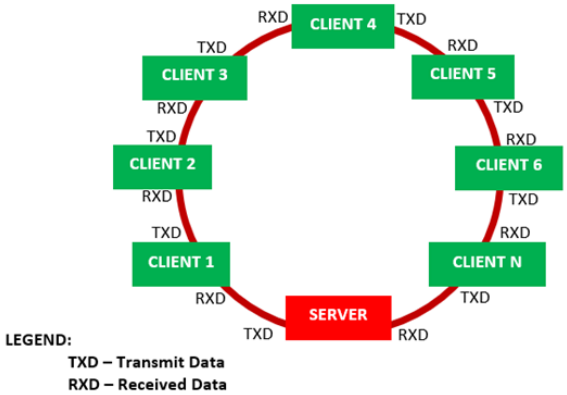

Fig. 6. Distributed System Concepts

Power Supply

The power supply module consisting +5 volts, +12 volts with regulated output that uses IC regulator components. Figure 7 shows the power supply module.

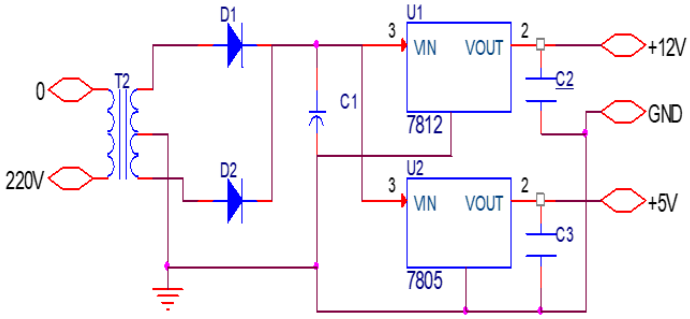

Fig. 7. Power Supply Module

B. Do

A circuit diagram is translated into a permanent circuit board (PCB) to implement the system hardware. Next, the researcher ran Simulation software to check its integrity before making the system board. Next, a firmware code is developed to test its functionality and simulate it before embedding it into the microcontroller. Figure 8 shows the mainboard layout, and Figure 9 shows the mainboard soler side.

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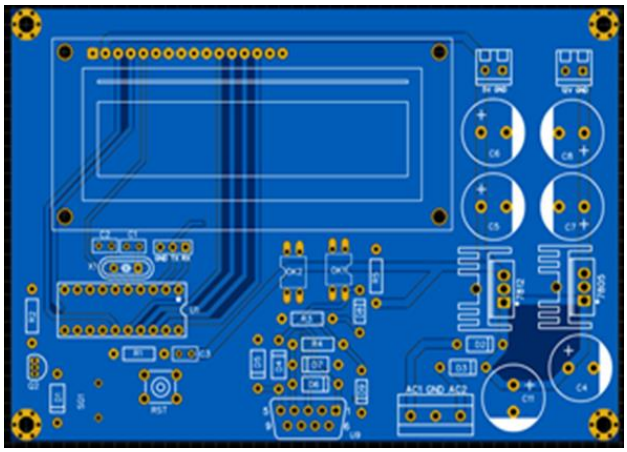

Fig. 8. Mainboard Component Side Layout

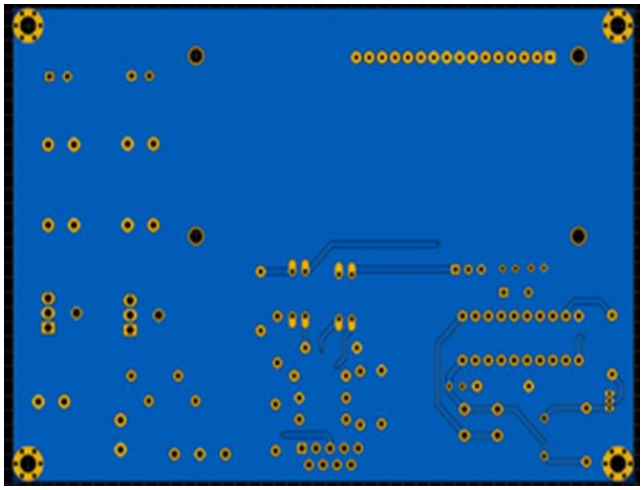

Fig. 9. Mainboard Solder Side Layout

C. Check

In this stage of developing a system, the researcher placed the parts to the printed circuit board (PCB) for the system's initial testing after ultimately placing all the required components. And the microcontroller is already embedded with firmware to activate when the system is powered. Figure 10 shows the parts placement of the main system board and power supply modules.

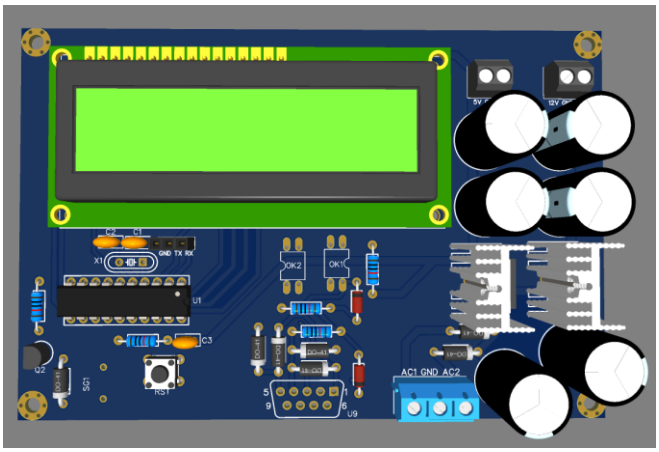

Fig. 10. Parts Placement Mainboard

D. Act

Testing and Implementation

After placing all the components on the respective board. Figure 11 shows the finished product, and it is now ready to test its functionality. A simple program code to transmit data is a routine shown below based on the assembly language of the AT89C2051 Microcontroller. This routine code is generic for sharing information.

```
;;;;;;;;;;;;;TRASMIT DATA ROUTINE;;;;;;;;;;;;;;;;;;
TRANSMIT:
          MOV   SBUF,A      ;REG A DATA STORE TO SBUF WAIT FOR TI
PROCEED:
          JNB   TI,PROCEED  ;CHECK IF TI READY
          CLR   TI          ;CLEAR TI READY FOR NEXT CHAT TXD
          RET
          END
```

Another essential routine is to receive data from the buffer to complete the entire system in full-duplex transmission mode, as shown below. Again, this routine is vital in a whole system set up and present for the firmware codes.

```
;;;;;;;;;;;;RECEIVED ROUTINE;;;;;;;;;;;;;;;;;
RXD_DATA:
          JNB   RI,$        ;RECEIVING DATA READY
          MOV   A,SBUF      ;DATA IN BUFFER
          MOV   P1,A        ;SEND TRANSMITTED DATA TO PORT1
          CLR   RI          ;CLEAR RI READY FOR NEXT SIGNAL
          SJMP  RXD_DATA    ;RECEIVED ANOTHER CHAR
          END
```

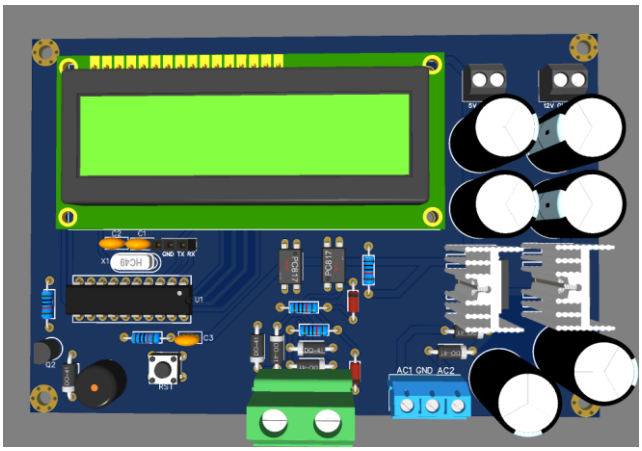

Fig. 11. Ready for Testing

The system is now ready to test its functionality by applying power to the circuit. Figure 12 shows the running RFID reader device displays in the LCD the caption *"Swipe your ID:"* This will show that the system is running at its desired output based on the stated application embedded into its Microcontroller Flash Read-Only-Memory (ROM).

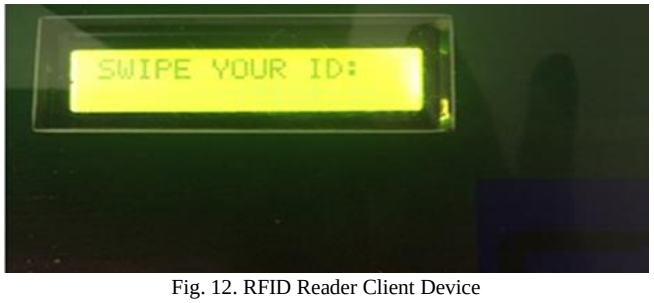

Fig. 12. RFID Reader Client Device

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The researchers developed a simple distributed application in a wired channel wherein the primary communication medium is serial communication. They were testing the transmission if the system module can receive and transmit transmitted data from the client to the server and back.

When all hardware system is set, middleware software is also developed to allow the operating system to communicate the server and the client's heterogeneity issues.

III. Results and Discussion

As the researcher tries to test the study results, let us now enter into showing how the whole system works. Figure 13 shows the gradual unfolding of the middleware main screen. Below is the entire process:

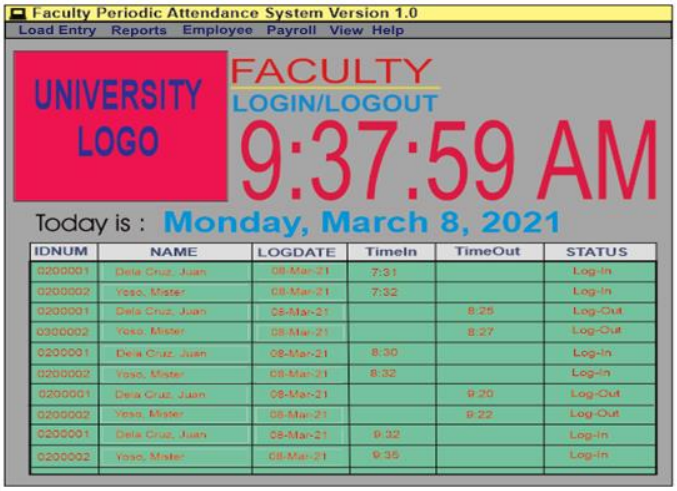

Fig. 13. Middleware GUI Interface

The researcher finally presents the middleware Graphical User Interface (GUI) running in the server, as shown in Figure 13. The Load Entry menu bar contains an entry of the faculty loading per semester as the basis of the number of logins and logout in a day. It will also include the computations of the remuneration.

Start and end of the class period, the faculty can log in and logout. If a faculty member has 8-subject loads, he/she will log in eight (8) times and log out eight (8) times daily. Thus, the hourly attendance of faculty in every class schedule was recorded correctly.

TABLE 1. Table for login and logout time set in the computer

Schedule	Time-In	Time-Out
1st period	7:30 – 7:45	8:15 – 8:29
2nd period	8:30 – 8:45	9:15 – 9:29
3rd period	9:30 – 9:45	10:15 – 10:29
4th period	10:30 – 10:45	11:15 – 11:29
5th period	11:30 – 11:45	12:15 – 12:29
6th period	12:30 – 12:45	1:15 – 1:29
7th period	2:30 – 2:45	2:15 – 2:29
8th period	3:30 – 3:45	4:15 – 4:29
9th period	4:30 – 4:45	5:15 – 5:29
10th period	5:30 – 5:45	6:15 – 6:29
11th period	6:30 – 6:45	7:15 – 7:29
12th period	7:30 – 7:45	8:15 – 8:29
Last period	8:30 – 8:45	9:15 - 9:30

This one-of-a-kind digital system is a time-bounded device that automatically blocks login activity after fifteen (15) minutes of regulation time of a teacher's delinquency per class hour. Still, it will allow logout fifteen (15) minutes before the time. See Table 1.

The researchers conducted several trials to test the time consume per faculty to complete login/logout transactions. The login time takes an average of 3 to 4 minutes for every 20 faculty; refers to Table 2.

TABLE 2. Login/logout trials and time elapsed.

# of Faculty login/logout	Time Start	Time End	Time Elapse in sec
1	1:07:05	1:07:08	3
2	1:07:20	1:07:23	3
3	1:07:30	1:07:33	3
4	1:07:40	1:07:43	3
5	1:07:50	1:07:53	3
6	1:08:01	1:08:04	3
7	1:08:07	1:08:10	3
8	1:08:12	1:08:15	3
9	1:08:20	1:08:23	3
10	1:08:30	1:08:33	3
11	1:08:38	1:08:41	3
12	1:08:57	1:09:00	3
13	1:09:10	1:09:13	3
14	1:09:20	1:09:23	3
15	1:09:30	1:09:33	3
16	1:09:40	1:09:43	3
17	1:10:03	1:10:06	3
18	1:10:15	1:10:18	3
19	1:10:30	1:10:33	3
20	1:10:40	1:10:43	3

For every faculty, the average login time is approximately 3 seconds and based on 20 faculties logging in, it consumes only 3.38 minutes.

In Table 3, the HR department can immediately see the faculty who logs-in and logs-out. The screen shows the vast array of present and absent faculty, especially in the column of status. As stated earlier in this paper, it takes more days to collate the status of the faculty. This Table 3 shows that just in a second, you see and print immediately.

TABLE 3. Middleware Screen, showing faculty attendance

ID #	Name	Log Date	In	Out	Status
200001	Dela Cruz, Juan	08-Mar-2021	7:30AM		Login
200002	Yoso, Mister Alfredo	08-Mar-2021	7:31AM		Login
200001	Dela Cruz, Juan	08-Mar-2021		8:25AM	Logout
200002	Yoso, Mister	08-Mar-2021		8:28AM	Logout
200001	Dela Cruz, Juan	08-Mar-2021	8:31AM		Login
200002	Yoso, Mister	08-Mar-2021	8:32AM		Login
200001	Dela Cruz, Juan	08-Mar-2021		9:21AM	Logout
200002	Yoso, Mister	08-Mar-2021		9:28AM	Logout
200001	Dela Cruz, Juan	08-Mar-2021	9:35AM		Login
200002	Yoso, Mister	08-Mar-2021	9:37AM		Login

As a result, the researcher developed a simple distributed application as a solution to the stated problem pointed out in

Teleron, Jerry I., "The Implementation of Distributed System Application on Periodic Attendance of the Faculty," *International Research Journal of Advanced Engineering and Science*, Volume 7, Issue 1, pp. 196-202, 2022.

this study. It follows the concept of distributed application wherein a middleware software controls the communication as facilitator of the client and the server as shown in Figure 14 below.

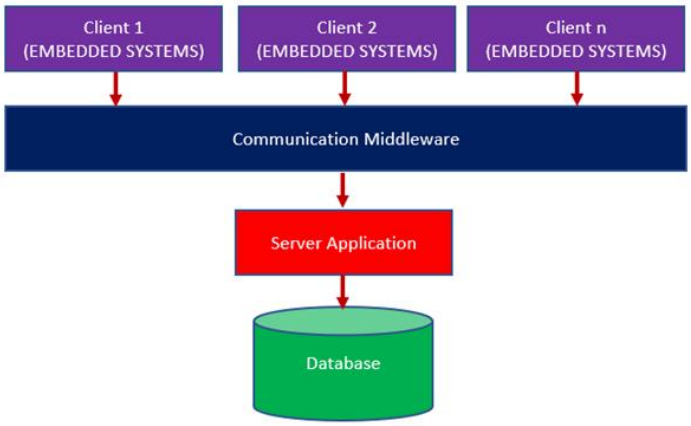

Fig. 14. Middleware as Communication Facilitator

Most schools, colleges, and universities periodic faculty attendance records answered through a developed distributed system application. It is thru implementing a distributed system application using an RFID reader as a client and a server to store the acquired frequent attendance records of remote locations. The HR department can easily monitor their faculty attendance every class period using the middleware software running on the server.

IV. Conclusion

Therefore, the author concluded that the distributed system application had shown a solution to most schools, colleges, and university faculty attendance records. Before this study, monitoring can collate for a week.

After the gadgets are made, the implementation takes place. The system shows how the management department can monitor it in seconds and instantly produce accurate computations of the faculty's salary.

Recommendation

For this study's future improvement, the researchers suggest that instead of using RFID. Instead, it recommends using a distributed application using a mobile application installed in the faculty's smartphone and taking the picture in the classroom periodically using digital image processing. Then, the image detection technique is applied for the integrity of the captured image to avoid cheating. At the same time, the management department equips with a middleware web-based application to cater the system automation. With this, if implemented the system, the researchers can say that the problem is ultimately solved.

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References

[1] A. Puckdeevongs, N. K. Tripathi, A. Witayangkurn, and P. Saengudomlert, "Classroom attendance systems based on bluetooth low energy indoor positioning technology for smart campus," *Inf.*, vol. 11, no. 6, 2020

[2] A. Mishra, R. Kamble, V. Pare, and R. Sahu, "Multimodal Biometric Attendance System," *SSRN Electron. J.*, no. Icicc, 2020

[3] J. I. Teleron, "Fabrication of Fuzzy Logic Controller on Speech Laboratory System using AT89C2051 Microcontroller," *Int. J. Adv. Sci. Converg.*, vol. 2, no. 2, pp. 15–23, 2020.

[4] N. Edna Elizabeth, T. K. Gowthaman, J. Joannes Sam Mertens, and P. Likhitta Dugar, "Intelligent Counter System for Generating Attendance," *Lect. Notes Electr. Eng.*, vol. 471, pp. 11–22, 2018

[5] H. D. Rjeib, N. S. Ali, A. Al Farawn, B. Al-Sadawi, and H. Alsharqi, "Attendance and information system using RFID and web-based application for academic sector," *Int. J. Adv. Comput. Sci. Appl.*, vol. 9, no. 1, pp. 266–274, 2018

[6] E. O. Mati Jr., M. M. . Muji, and Y. M. P. Quintela, "Faculty Attendance Monitoring Using Rfid with Overload Computation And Email Notification For City College Of Calamba," no. April, 2017.

[7] S. Bharambe, S. Patil, O. Dixit, V. V. Singh, and S. Gudadhe, "Survey - Student Attendance Management System," no. 2, pp. 2395–4396, 2017

[8] V. P. and I. A. R. H. Rathod, Y. Ware, S. Sane, S. Raulo, "Automated attendance system using machine learning approach," in *," 2017 International Conference on Nascent Technologies in Engineering (ICNTE)*, 2017

[9] D. Y. and T. M. Z. Ling-ling, L. Liang, L. Meng, "Underground wireless attendance realized by wireless sensor network and radio frequency identification," in *2017 7th IEEE International Conference on Electronics Information and Emergency Communication (ICEIEC)*, 2017

[10] M. Smith and W. Griffin, "'Office Hours are Kind of Weird': Reclaiming a Resource to Foster Student-Faculty Interaction," *InSight A J. Sch. Teach.*, vol. 12, pp. 14–29, 2017

[11] N. K. J. and S. Borra, "Attendance management system using hybrid face recognition techniques," in *2016 Conference on Advances in Signal Processing (CASP)*, 2016

[12] N. M. I. and S. S. N. Arbain, N. F. Nordin, "LAS: Web-based laboratory attendance system by integrating RFID-ARDUINO technology." IEEE, Kuala Lumpur, Malaysia, pp. 89–94, 2015

[13] M. Z. H. N. and S. A. C. A. A. A. Sulaiman, M. S. A. Bakar, "Easy Access Attendance Management System (EAMS)," in *2014 IEEE 6th Conference on Engineering Education (ICEED)*, 2014

[14] T. B. T. and M. D. M. A. Abas, "Attendance Management System (AMS) with fast track analysis," in *2014 International Conference on Computer, Control, Informatics and Its Applications (IC3INA)*, 2014

[15] U. A. Patel, "Computer Science and Management Studies Development of a Student Attendance Management System Using RFID and Face Recognition: A Review," *Int. J. Adv. Res.*, vol. 2, no. 8, pp. 109–119, 2014.

[16] A. Parvathy *et al.*, "RFID in cloud environment for attendance monitoring system," *Int. J. Eng. Technol.*, vol. 5, no. 3, pp. 3116–3122, 2013.

[17] M. Shiraz, A. Gani, R. H. Khokhar, and R. Buyya, "A review on distributed application processing frameworks in smart mobile devices for mobile cloud computing," *IEEE Commun. Surv. Tutorials*, vol. 15, no. 3, pp. 1294–1313, 2013

[18] G. L. and W. L. S. Geng, "Design and Implement of Attendance Management System Based on Contactless Smart IC Card," in *2012 International Conference on Computer Science and Electronics Engineering*, 2012

[19] G. D. A, "Student Fingerprint Attendance System for Faculty of Engineering By Mohammad Kamal Al-Din Abbas Indes: 044061," no.July, 2011.

[20] S. P. and B. A. S. Aamir Nizam Ansari, A. Navada, S. Agarwal, "Automation of attendance system using RFID, biometrics, GSM Modem with .Net framework," in *2011 International Conference on Multimedia Technology*, 2011

[21] V. Vijaya, R. Valupadasu, B. R. Chunduri, C. K. Rekha, and B. Sreedevi, "FPGA implementation of RS232 to Universal serial bus converter," *Isc. 2011 - 2011 IEEE Symp. Comput. Informatics*, pp. 237–242, 2011
[22] S. C. S. and M. M. M. T. S. Lim, "RFID based attendance system," in *2009 IEEE Symposium on Industrial Electronics & Applications*, 2009
[23] C. F. and E. F. and E. F. Fleisch, "RFID Applications: Interfacing with Readers." IEEE Software, pp. 67–70, 2008
[24] P. Massingham and T. Herrington, "Does Attendance Matter? An Examination of Student Attitudes, Participation, Performance and Attendance," *J. Univ. Teach. Learn. Pract.*, vol. 3, no. 2, p. 22, 2006
[25] A. Puder, K. Römer, and F. Pilhofer, "Distributed Systems Architecture," *Distributed Systems Architecture*. 2006
[26] A. Kirby and B. McElroy, "The effect of attendance on grade for first year economics students in University College Cork," *Econ. Soc. Rev. (Irel).*, vol. 34, no. 3, pp. 311–326, 2003