Journal of Computers for Society

Journal homepage: https://ejournal.upi.edu/index.php/JCS

Intelligent and Modular Based Attendance System

Haseeb Tanveer[1,*], *Fazal ur Rehman*[2]

[1] University of Science & Technology, Bannu, Pakistan
[2] National University of Sciences and Technology, Islmabad, Pakistan
*Correspondence: E-mail: fazal0492@gmail.com

ABSTRACT

This research paper presents a novel approach for solving Schools/Colleges/Universities/Offices attendance related issues using modular based approach. Radio Frequency Identification System (RFID) is used for person identification. An android application is built which communicates with RFID readers. A completely separate database is developed which is continuously automatically updated from android application. Android applications are developed based on modular approach so that customized system can be provided according to the institution requirements. System features were tap and go based attendance system, automated attendance reports to superiors, integrated door lock with attendance system, turnstile control, real time picture using front camera of smart mobile, institution entry/exit-based attendance solution, individual attendance system for each department/classrooms/supervisors and message/email to parents/superiors, parent-teacher communications. Results suggest that the institution felt more comfortable with modular based approach. Parents were satisfied due to timely attendance messages of their children.

ARTICLE INFO

Article History:
Submitted/Received 04 Mar 2023
First Revised 28 Apr 2023
Accepted 12 Jun 2023
First Available Online 13 Jun 2023
Publication Date 15 Jun 2023

Keyword:
educational institute,
modular based approach,
RFID based attendance,
smart attendance system.

1. INTRODUCTION

Although RFID based attendance system was introduce a decade ago in which researchers proposed that Students or workers tap their ID card on the reader and their attendance is marked immediately. The system is connected to the computer through RS232 or Universal Serial Bus (USB) port and update attendance in database (Lim *et al.,* 2009). Rjeib *et al.* (2018) proposed a system which uses RFID based attendance system integrated with information service system. They developed Arduino based system to read and update attendance of students on server. Each student database was developed, whenever students taps card his class timings and other information related to class is shown on LCD screen. For double authentication system, Thein and Tun (2015) introduce a system which uses RFID as well as fingerprint for successful update of attendance. Computer interface is developed for both admin and teachers to access attendance. Another system which is widely presented is Arduino based attendance system interfaced with GSM modules (Shukla, 2017).

Microcontroller based system designed are slow and for education institutes or organization having large number of students/workers system response is slow and people wait in que for updating their attendance. Biometric based attendance system is available according to (Roy, 2014). Those systems are suitable for high level security and a smaller number of subjects. Moreover, some RFID and GSM based system are also introduced in Chaniago and Junaidi (2016); Kumar *et al.* (2020). Those systems were designed on small scale and their applicability is very limited. Some people have used Arduino based attendance system in which instead of using display screen they use audio system for confirmation of attendance mark (Mishra *et al.,* 2016). RFID and pose invariant face verification based automated classroom attendance system (Pss & Bhaskar, 2016). This system uses both RFID and face recognition system for attendance marking but it was only tested in lab and no real implementation was shown. They used Arduino UNO for RFID attendance marking and MATLAB for face recognition. They have used two different systems that were working separately which can be hectic and difficult to manage both at same time. A RFID based automatic attendance system in educational institutions of Nigeria (Olanipekun & Boyinbode, 2015). They developed system using RFID controlled with PC. All the systems developed previously have mostly limited features. Targeting only limited number of audiences and not being tested in the real environment.

In this research paper we propose a complete automated modular approach. The system is designed and implemented using dynamic databases which is smart and automatically updates the whole system whenever change is observed in the inputs (Komar *et al.,* 2020). We have used a custom designed radio frequency identification (RFID) reader that directly connects with smart mobile phone on micro-usb data port. Reader gets power from smart mobile phone and whenever RFID card is tapped, read data is transmitted to application which is then used for attendance and other modules updating (Peter *et al.,* 2022). We have also integrated door lock and turnstile with attendance system. Which operates automatically and open/closes on RFID authentication. One of the most prominent and distinguishing features of our research is modular based approach as recent researchers/solution providers have not considered the necessity of modular based solution (Chaniago & Junaidi, 2016; Konatham *et al.,* 2016). where system can be customized dynamically according to requirements. We provided a system so that every institute or organization get from us on whatever they feel comfortable using. Previously researchers developed product and was then pitched into market [] while in our case we first had meetings with multiple schools, colleges and organizations administrations for information, requirements and outputs

DOI: http://dx.doi.org/10.17509/xxxx.xxx
p- ISSN xxxx-xxxx e- ISSN 2723-4088

needed from attendance system. We designed a system so that the needs of most of the institutes can be fulfilled.

In our solution multiple stakeholders are involved, depending on types of modules and institute/organization such as (1) Administrative staff (Super-Admin); (2) Managerial staff (Admin); (3) Supporting staff; (4) Parents; (5) Teachers; (6) Organization workers.Every stakeholder has different role to operate system. Some of them have complete accessibility to updating, addition and removal of records while other can only mark their attendance. Each stakeholder has its own customized application page according to its role assigned. There are two main types of attendance system which we proposed which is Tap and Go, and Door lock/turnstile Tap and Pass system.

Each type has different features which can be added or removed from application Tap and Go. The features for Tap and Go are attendance device at Entry and Exit, Multiple attendance devices (e-g classrooms, institute departments, official departments), Attendance reports (daily, weekly, monthly, yearly), Progress reports (weekly, monthly, yearly), Application based communication (e-g Parents-teachers, student-teacher, office colleagues), Cross authentication (picture capture when attendance marked), Door lock/turnstile Tap and Pass System, Manually controlled entrance and exit on authentication.

2. METHODS

Radio frequency identification (RFID) technology is widely used now a days from warehouse management to attendance [] marking (Ahmad *et al.,* 2021). It is being used more frequently since last decade. Our system also comprises of RFID technology in which there are two key components. RFID tags can be active or passive (Zhang *et al.,* 2020). For active tags they continuously transmit their unique identification address using their own power source while for passive tags they use the energy transmitted by RFID readers to send their unique ID. RFID readers read the ID of tags and transmit it for authentication purpose, in our case it is smart mobile phone (Ahmad & Nababa, 2021). RFID tags and readers should be of same frequency for communication to take place. We have used 125khz frequency reader and tag.

For any action to be performed our system is divided into three steps first is communication which is between RFID reader-tag, RFID reader to mobile application, second authentication which consists of validation and verification and third updating.

2.1. RFID reader to Mobile Communication

One of the most important and basic steps in all our modules is communication between RFID reader and smart mobile. Decision chart is shown in fig.1 where whenever subject one (a person who wants to mark attendance) taps card first step take place in RFID reader which decodes and send ten digits to receiving device. Mobile receive data on edit-text. If full set of ten characters are received, then data is forward for authentication process else an error message is showed in mobile application which is no record found or tap card again can be seen in **Figure 1** below.

.

DOI: http://dx.doi.org/10.17509/xxxx.xxx
p- ISSN xxxx-xxxx e- ISSN 2774-7891

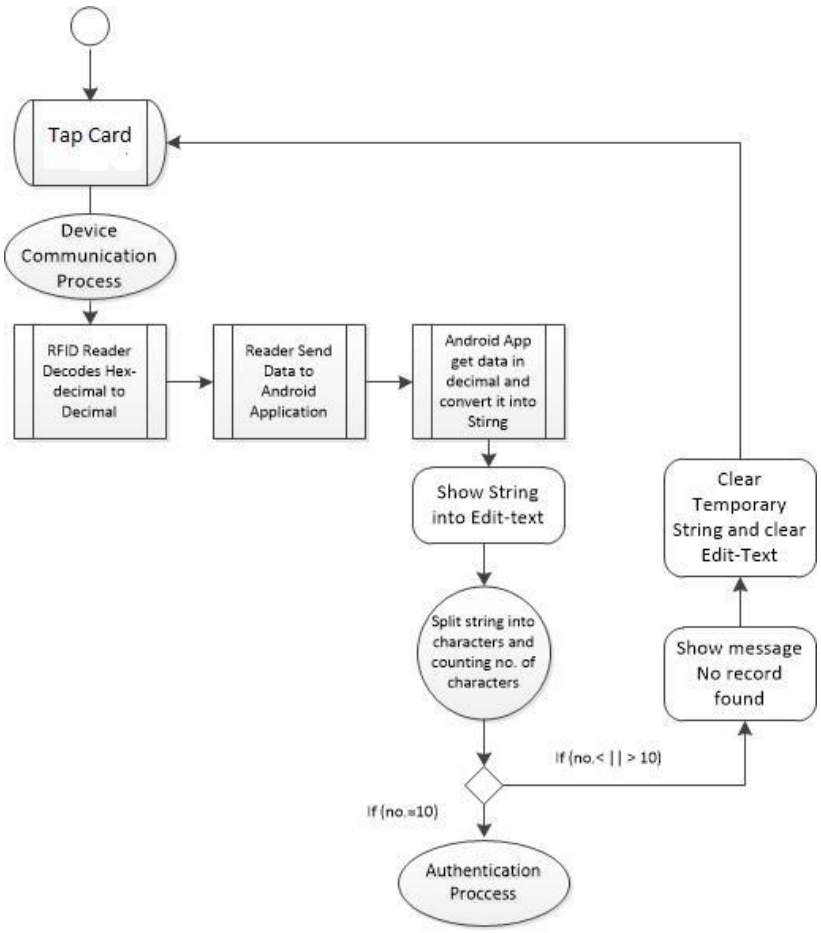

Figure 1. RFID Reader to Mobile Communication flow chart.

2.2. User Authentication Process

After proper communication and receiving data next process that takes place in android application is authentication process shown in figure no 2. In which first step is user validation. For user validation received string is compared with data in the server and if record is found then for user verification all its information is extracted and next window which is shown is according to user privileges and the modules used. If the user RFID card data is not validated a customized text message is shown on the application screen can be seen in **Figure 2**.

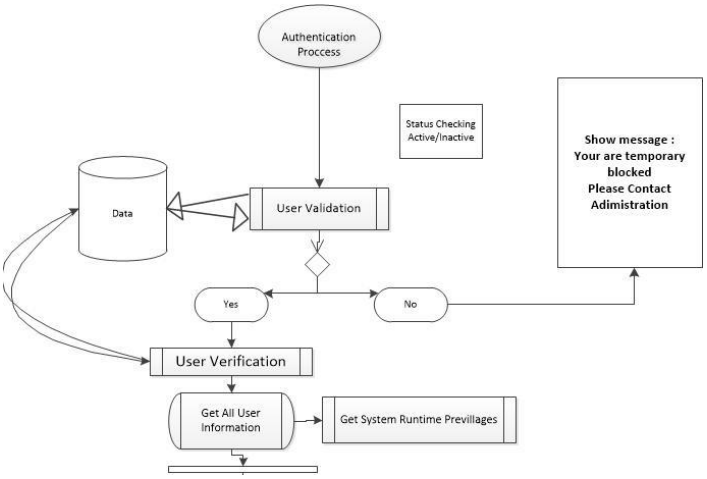

Figure 2. User Authentication Process.

DOI: http://dx.doi.org/10.17509/xxxx.xxx
p- ISSN xxxx-xxxx e- ISSN 2723-4088

2.3 User Types and Control Features

After user verification next step is the application control features for different types of stakeholders. Different stakeholders and their control features are shown in figure no. 3. Each stakeholder will be shown different page of android application after tapping his/her RFID card on RFID reader. For each stakeholder we have provided further customization of feature selection. If there is admin who tapped card, then he will be shown control panel of application he can perform different actions. If there is student, then he will be shown attendance marked on display while other than attendance page there are multiple more options whose control is also under end user. They can add, remove or request different required features that can be seen in **Figure 3**.

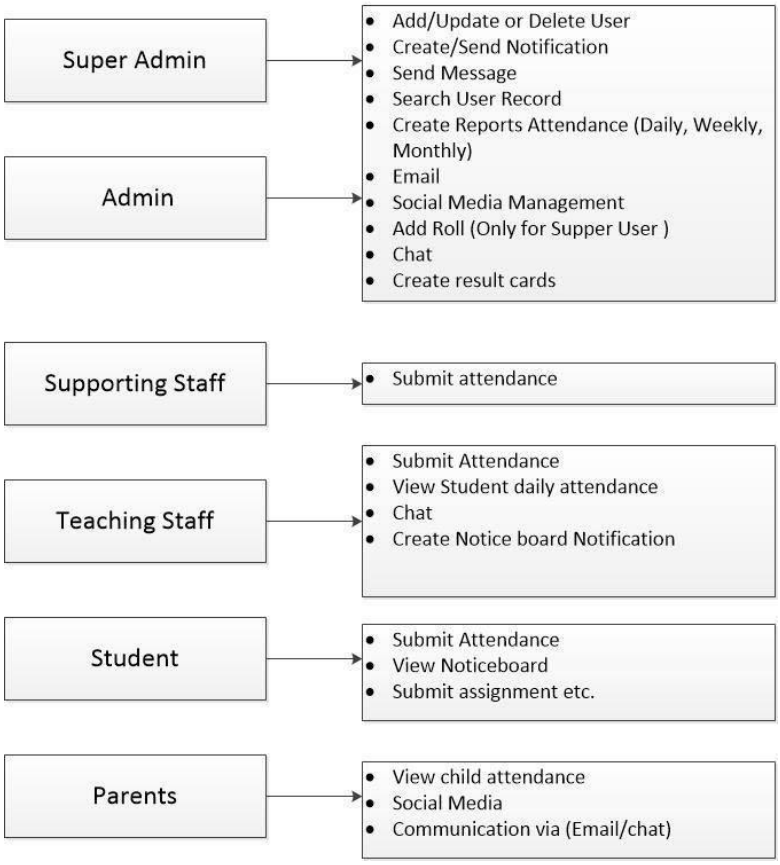

Figure 3. Stakeholders control features.

2.4. Features Provided

Our modular based approach has helped us to provide solution according to end-user requirements. Features selection possible options for different categories shown below in table no.1. We have divided our consumers in four categories which are school/colleges, universities, enterprises and organizations. And each category has some features available and few unavailable depending on their needs. Such as online assignment submission is not needed in enterprises/organization can be seen in **Table 1**.

DOI: http://dx.doi.org/10.17509/xxxx.xxx
p- ISSN xxxx-xxxx e- ISSN 2774-7891

Table 1. Features selectivity option.

	Feature Name	School	University	Enterprises	Organization
1	Automatic Attendance	yes	yes	yes	yes
2	Attendance reports	yes	yes	yes	yes
3	Events Notifications	yes	yes	yes	yes
4	Notice board	Yes	yes	yes	yes
5	Online Assignments	no	yes	No	No
6	Fee Submission	yes	yes	No	No
7	Social media	Yes	yes	No	No
8	chat	Yes	Yes	yes	yes
9	SMS	yes	Yes	No	No
10	Door Lock	no	Yes	Yes	Yes
11	Turnstile	yes	Yes	Yes	Yes
12	Capture Image	yes	yes	yes	yes

3. RESULTS AND DISCUSSION

We have developed a complete solution using modular based approach. Our system comprises of mobile application, attendance hardware, external door controllers/turnstile and server-controlled database. Customers response is shown in table 2. We developed a questionnaire for four of our customers of which customer 1 and customer 2 were enterprises or small businesses and customer 3 and customer 4 are educational institutes. Two of the customers' requirements didn't included external hardware integration which are turnstile or door lock. Our controllability option was scored 9.5 out of 10 by four customers. While results suggest that we need improvements in system response to reduce its response time, which is occurring in authentication process due to delayed communication between application and server on **Table 2**.

Table 2. Customer Response.

	Selection Option	Features Provided	System Response	Hardware Integration	System Presentability	Controllability
Customer 1	8	9	7.5	9	7	10
Customer 2	9	10	7	8	8	9.5
Customer 3	9	9	8	nil	7	9.5
Customer 4	8	9	7	nil	7	9
Mean	8.5	9.25	7.375	8.5	7.25	9.5

4. CONCLUSION

A complete intelligent, smart and robust product is developed and is deployed in educational institutes, enterprises. This modular based approach has enabled different institutions/organizations to select their required features. RFID based solutions can be very effective and extended to vast applicability. Due to modular based approach end user feel more controllability of the solution provided. Mean satisfaction of customers is above 83%.

DOI: http://dx.doi.org/10.17509/xxxx.xxx
p- ISSN xxxx-xxxx e- ISSN 2723-4088

In future we will make our system to be more presentable and develop interface which will be more user-friendly. We will integrate our system for long range RFID reader-based attendance system as well to avoid que. Dual authentication can also be added in the modules such as face recognition. Library management system and cafeteria ecommerce system can also be integrated with integrated with this system.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

6. REFERENCES

Ahmad, M. B., and Nababa, F. A. (2021). The need of using a Radio Frequency Identification (RFID) System. *International Journal of New Computer Architectures and their Applications (IJNCAA)*, *11*(2), 22-29.

Ahmad, U. S., Bisu, A. A., Umar, F. A., and Balarabe, U. (2021). Radio frequency identification (RFID) and database-based attendance management system. *Bayero Journal of Pure and Applied Sciences*, *14*(1), 120-129.

Chaniago, M. B., and Junaidi, A. (2016). Student presence using rfid and telegram messenger application. 8th Widyatama International Seminar on Sustainability (WISS 2016), *1,* 1-5.

Konatham, S., Chalasani, B. S., Kulkarni, N., & El Taeib, T. (2016). Attendance generating system using RFID and GSM. In *2016 IEEE Long Island Systems, Applications and Technology Conference (LISAT), 1*, 3-5.

Kumar, A., Krishnamurthi, R., Nayyar, A., Sharma, K., Grover, V., and Hossain, E. (2020). A novel smart healthcare design, simulation, and implementation using healthcare 4.0 processes. *IEEE access*, *8*, 118433-118471.

Lim, T. S., Sim, S. C., and Mansor, M. M. (2009). RFID based attendance system. In *2009 IEEE Symposium on Industrial Electronics & Applications*, 2, 778-782.

Mishra, Y., Marwah, G. K., and Verma, S. (2015). Arduino Based Smart RFID Security and Attendance System with Audio Acknowledgement. *International Journal of Engineering Research and Technology*, *4*(1), 363-367.

Olanipekun, A. A., and Boyinbode, O. K. (2015). A RFID based automatic attendance system in educational institutions of Nigeria. *International Journal of Smart Home*, *9*(12), 65-74.

Peter, O. C., Uwakwe, O. L., and Okoli Chinweike, C. (2022). Implementation of an RFID Technology Based Digital Class Attendance System for University Students. *Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS)*, *13*(5), 199-207.

Pss, S., and Bhaskar, M. (2016). RFID and pose invariant face verification based automated classroom attendance system. In *2016 International Conference on Microelectronics, Computing and Communications (MicroCom)*, *1*, 1-6.

Rjeib, H. D., Ali, N. S., Al Farawn, A., Al-Sadawi, B., and Alsharqi, H. (2018). Attendance and information system using RFID and web-based application for academic sector. *International Journal of Advanced Computer Science and Applications*, *9*(1), 778-782.

DOI: http://dx.doi.org/10.17509/xxxx.xxx
p- ISSN xxxx-xxxx e- ISSN 2774-7891

Roy, R. (2014). A web enabled secured system designed for attendance monitoring applying biometric and Radio Frequency Identification (RFID) technology. In *2014 International Conference on Signal Propagation and Computer Technology (ICSPCT 2014)*. 653-657.

Shukla, A. K. (2017). Microcontroller Based Attendance System Using RFID and GSM. *International Journal of Emerging Technologies in Engineering Research (IJETER)*, *5*(8), 127-131.

Thein, M.M. and Tun, C.M. (2015). Students Attendance Management System Based On RFID And Fingerprint Reader. *International Journal of Scientific & Technology Research*, *4*, 30-38.

Zhang, J., Periaswamy, S. C., Mao, S., and Patton, J. (2020). Standards for passive UHF RFID. *GetMobile: Mobile Computing and Communications*, *23*(3), 10-15.

DOI: http://dx.doi.org/10.17509/xxxx.xxx
p- ISSN xxxx-xxxx e- ISSN 2723-4088