



Radio Frequency Identification Based Student Attendance System

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ABSTRACT

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Attendance is a record tracking system used in organization. It is used in the educational sector to track students who attend classes as well as staffs attendance. This system is a form of inventory keeping system in school but instead of tracking goods, people are tracked. In Babcock the attendance system being used presently is conventional and very susceptible to attacks. Due to these, a system is created to curb these challenges. In this work an attendance system was created which receives data input from student and staff at any given instance through the help of the RFID tag embedded in the identity card and stores it in a database which the institution can use for tracking attendance. The attendance system created is a mobile application called BrasApp developed using the Java programming language. This application also has a module that tracks attendance of students at hall worship, chapel seminar and church service which forms their citizenship grade. A virtual ticket generation module is included in the BrasApp which helps the cafeteria staff reduce waste of resources and queue during meal time. In conclusion this system has helped to improve students and staff attendance to all school activities.

1. INTRODUCTION

The traditional way of tracking student's attendance has made it so easy for them to absent themselves from classes and still have their name in the class attendance list. This is possible because students will help their fellow classmates to write their name on the attendance sheet. This lapse is as a result of the unavailability of the requisite technology in the past to automate this attendance tracking process. However, with the recent proliferation of smart devices, there is a paradigm shift from the traditional method of taking attendance to a more automated and secured process that will make it possible to track only students who actually attend the lecture physically. Harnessing these recent technologies, it is imperative to take a step back and analyze the present state of things, postulate a reasonable and logical solution to the problem discovered when developing a solution and initiating the development process. To achieve this, one must critically carryout a background study of the traditional approach of accomplishing the set task with respect to an established system. In doing so, a short overview of the entire system would be highlighted [1].

The system of tracking attendance, ticketing and other student and staff activity within Babcock University, a 21st century institution is archaic and bound to bring about incorrect data and create lack of data integrity. A good example is the technique used in marking the attendance of

students within respective classes, hall gatherings and other school organized activities. The attendance process is mostly manual, timing is not accurate and students tend to by-pass and engaging in other activities while still maintaining attendance. In the case of the cafeteria ticketing system; tickets could be replicated and doctored by students, leading to a shortage of prepared meals for a predicted crowd. All of the aforementioned loopholes are what this paper tends to address by creating an incorruptible system that would connect various aspects of student and staff attendance and ticketing into one single interface. The work also tackles the issues observed within 'Food Services' as a department in retrospect to ticketing; Problem being an inaccurate meal plan. An instance would be when meals are prepared and are not consumed by the respective students it was prepared for, leading to a waste. Another instance would be the flip situation; when students proceed to the cafeteria and the available meal packs cannot satisfy the crowd present.

The previously highlighted are issues this work addressed and solve which are associated with the current traditional methods of doing things within the institution. To this end, an RFID based attendance monitoring application was developed which create an automatic method of monitoring attendance in class and other event such as chapel seminar, hall and church worship. The system also helps to manage and control traffic in the university cafeteria during food collection.

2. LITERATURE REVIEW

This section briefly gives an insight to the radio frequency identification mode of operation and how effective it is. Section 2.2 gives a detail summary of closely related works and the research gaps that exist in each.

2.1 The RFID technology

RFID is an acronym for Radio Frequency Identification; a type of communication that is wireless and integrates the use of electromagnetic waves, specifically radio wave frequency to uniquely identify objects, animals and individuals. RFID technology can be used in the following areas: inventory management, shipping, retail sales, healthcare and home use [2].

RFID technology is indistinguishable from barcode technology but differs from each other in the following ways:

- i. RFID tags do not require close contact before it authenticates items but barcode requires close contacts before things are authenticated
- ii. Real-time update of data stored on the RFID tags. In juxtaposition, barcode cannot be altered. Data can only be read-only.
- iii. Power source is required for the RFID tags. In juxtaposition, the bar code device is the only one required to have a power source.

2.1.1 RFID mode of operation

A RFID system is composed mainly of three main elements they are:

- i. A scanning antenna
- ii. Transceiver
- iii. Transponder

The RFID reader is a device formed by amalgamating together the transceiver and the scanning antenna. The RFID reader is mainly a device that is network connected and is portable or attached permanently. Signals are transmitted using the radio frequency waves which activate the tag. After it is activated, waves are sent back from the tag to the antenna where it is translated into data (raw fact). The transponder, another main component of the RFID, is located in the RFID tag. The record range for RFID tags varies based on factors including tag type, reader type, RFID frequency and surrounding interference [3]. Figure 1 shows a diagram of the RFID mode of operation.

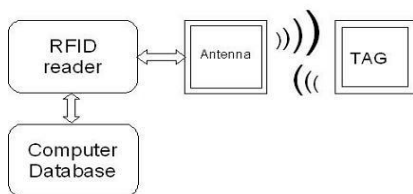


Figure 1. How an RFID works

2.2 Related works

Thein and Cmnhm [4] developed a Students' Attendance Management System Based on RFID and fingerprint reader. The purpose of the system was to transform the manual method of managing attendance with the automatic system. The system was developed using Microsoft Visual studio2012, Microsoft SQL Server 2012, RFID and fingerprint technology.

The programming language used to implement the system is C#. This system was mainly used by the admin/teacher and student.

Arulogun et al. [5] developed an RFID-based student's attendance management system. In this work, the researchers also attempted to solve the problem of manual attendance taking which is very common with most developing countries. The system is capable of detecting the presence and absence of the student in a class on the database and then the record is transmitted using wireless technology by mobile device, called a tag, which is read by the RFID reader and processed accordingly as programmed on the personal computer and update the student's attendance record with the arrival time and departure time at the end of the class respectively. The drawback in this system is the inclusion of a notification system using email or SMS, these two methods may not be effective due to network related challenges.

Patel and Priya [6] worked on development of a student attendance management system using RFID and face recognition. This was a review paper that discovered that the Old conventional methods for student attendance are still used by most of the universities. As this method is used, many students are helping their friends by signing in their attendance in case of their absent in the institute. So, while this method is used, attendance records are analyzed and maintained manually by the faculty to know the present and absent student list. The faculty has to take attendance again if the attendance sheet is being lost and in this case absent students get chance to make their present in new sheet.

Hameed et al. [7] researched on RFID based attendance and assessment system using wireless database to keep attendance record. In this worked, the authors applied this system to the agricultural, transportation, healthcare sectors amongst other sectors. The developed application facilitates the use of automatic wireless identification through electronic passive and active tags with suitable readers to keep track of attendance. The system incorporated the application of RFID and wireless data base record entries solely for attendance purpose. One advantage of this systems is that it did not only eliminates the time consumed in manual attendance, rather it maintains the record of entries which can be useful for statistical purposes such as allocation of appropriate attendance score and further administrative tasks. One major loophole this system did not consider is that time delay may occur in trying to connect to the wireless database to verify the attendance record, this delay can be caused by changes in climate such as thunder storm and rainfall.

Qureshi [8] implemented an RFID based attendance system. This system was developed for King Abdul-Aziz University (KAU) Saudi Arabia, although the current system they have was partly solving issue regarding attendance but this one work better by using modern technologies. Some of the benefits of the RFID based system includes the use of both mobile and web-based interfaces, daily absent report, and sending automatic SMS alert to the parent and guardian, which will in turn reduce administrative work, improve the ratio of attendance. The system is also economical and highly efficient. The system was developed to be web-based and mobile application that was tested on android operating system. The gap in this system is that it did not consider the issues surrounding sending SMS to parent as some messages may not deliver due to network related issues.

Dedy Irawan et al. [9] developed an attendance monitoring system using RFID and IOT technology to monitor students'

attendance to class. The system utilized the RFID technology with the inclusion of Internet of Things (IoT) and Cloud technology, which helps to provide a real time monitoring of students attendance. The system allows various parties, such as lecturer, campus administration and parents to have access to this attendance record. Hence, with this monitoring system students who are not present in class can be immediately discovered and the necessary action can be taken and this will enable the learning process run smoothly. One major drawback with this system is that the researchers did not specify the particular RFID tag that was used to capture the attendance, also connection delay may occur during the process of saving the attendance record to the cloud infrastructure, and this can be due to internet or network failures from the service providers.

Chiagozie and Nwaji [10] developed an RFID based attendance system with automatic door unit. The system was to produce a time-attendance management system that keep track of student's attendance in class. This system is made up of the hardware and the software part. The hardware comprises of the motor unit and the RFID reader. The RFID reader is connected to the host computer through the serial to USB converter cable. Visual basic.Net was used to develop the user interface of the attendance system. The System operate by registering ID, deleting ID, displaying live ID tags transactions, recording attendance and other minor functions. This user interface was installed in the host computer to enable it capture the attendance as students enter each class. The system did not take in the consideration time lag between the hardware and the installed software on the host computer.

Wright [11] carried out a survey on Radio Frequency Identification Classroom Management System. The work focused on discovering how effective an RFID attendance management system will be when implemented as a classroom management instrument. The study used a multi criteria analysis approach to examine two different infrastructures and compared them to determine the best alternative: a broad passive ultra-high frequency (UHF) system, and a localized passive high frequency (HF) system were therefore examined in this work. The outcome of this research shows that a passive HF system will lead to a reduction in time spent taking attendance, an increase in student performance, increase in the fairness and accuracy of recording classroom participation, and also enhance teacher-student relationship more than the UHF.

Mahyidin and Abdullah [12] researched on Student Attendance Using RFID System. This work presents an automatic attendance using RFID and student card which helps reduce the problems associated with manual attendance taking. The system operates by getting the code on the student's card and compares with the record in the Microsoft Access database. Visual Basic 6.0 was used to develop the Graphical User Interface (GUI) through which access is granted to the database for easy storing of the attendance record. Each lecturer will be registered on the system, then choose port and connection speed to make connection with the RFID reader. After setting up the reader the attendance taking process will begin. This process is done by allowing Students swap their card on the reader and the code from the card will be use to compare with the stored record in Access databases. When the code is match with database, the student information like name and ID number will show on interface and that information will trigger into a list. The list serves as the attendance for the student. The list comprises of information

such as student name and ID number which is attached to the lecturer name and subject. If the code does not match with database, it shows that student entered the wrong class or is yet to registers in that class. At this point, the lecturer registers the student by using the registering form and the information for the student will be updated into database. The flaw in this work comes when students fail to register before entering any class, this will cause time delay for the lecturer, therefore doesn't eliminate totally the problem with the manual system.

Quite a significant amount of works already exist on techniques used to excellently monitor student's attendance. [13], designed and proposed a Fingerprint Based Student Attendance System Using GSM. Their work was able to identify the flaws of traditional methods. The proposed methods were topnotch with a lot of advantages, such as uniqueness, permanency, and ease of use. However, authors didn't consider a case of damage in the recording system, cases of power failure in third world countries, failure in Telecoms installation which may affect functionality of the design, issues of requirement for implementation were not considered for the design, cost. These areas need to be re-considered vis-à-vis design.

Shoewu and Idowu [14] worked on development of attendance management system using biometrics. This work proposed the development of an attendance management system using biometrics. Instead of physically signing the attendance sheet, user will pass their thumb over the fingerprint scanner, print is then matched against the list of existing recorded users, and once there is a match from the list, the user/ individual recorded as an attendee of the lecture. Although author recorded high success rate with the population considered, but this work didn't consider cases of technological failure. What if the scanner couldn't read the finger print due to damage to organ or prints? Time factor is another important issue. Author didn't specify for how long (in seconds or minutes) user will have to wait during finger scanning.

Hassan and Asghar [15] one of the close works on web based attendance management system. Amongst others, the author tries to remove duplicate data entry, including time errors and attendance entries. And as well carry out automatic attendance calculation and security. Author didn't do much on system reliability and nothing is shown to demonstrate its effectiveness. These needs to be explored.

Badmus et al. [16] this work is one of the most recent and has the closest affinity to our work. Author was able to establish the different ways of taking attendance electronically. The work further stated that the majority of these applications were put together on a single factor model. Their research work emphases on designing a smart protocol for RFID authentication plus fingerprint biometric information. It is a very good concept. However, issues bothering on cost effectiveness (in terms of the technicalities, estimation and subsequent maintenance) is the major concern of this design.

3. THE DESIGN AND WORKING OF THE SYSTEM: BRASAPP

The software development model that was used is the waterfall model which is also known as a linear-sequential model. This model was used because the requirements of the proposed system are known and the proposed system is a small system.

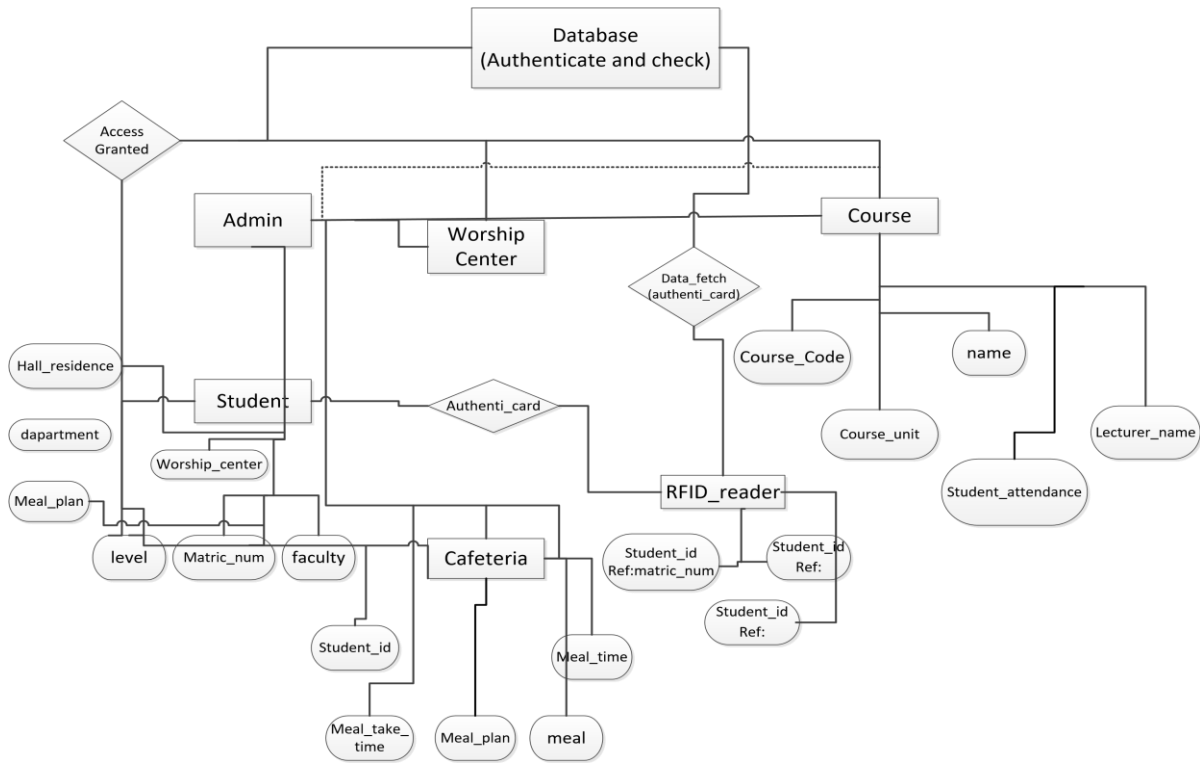


Figure 2. Entity relationship diagram

Android studio was used for the development of the attendance system since the application would run on an android device that supports RFID or acts like an RFID or NFC reader. Aside it running on android, a programming language called Java was used for development alongside other tools like NodeJS, MySQL, figma and the NFCtools which was used to write to the RFID tag.

The Figure 2 above depicts a workflow of the radio frequency identification-based student attendance system; which also depicts the system's backend also known as the database, which serves as a data storage for the BrasApp. The database of this system was created using MySQL as the database management system (DBMS).

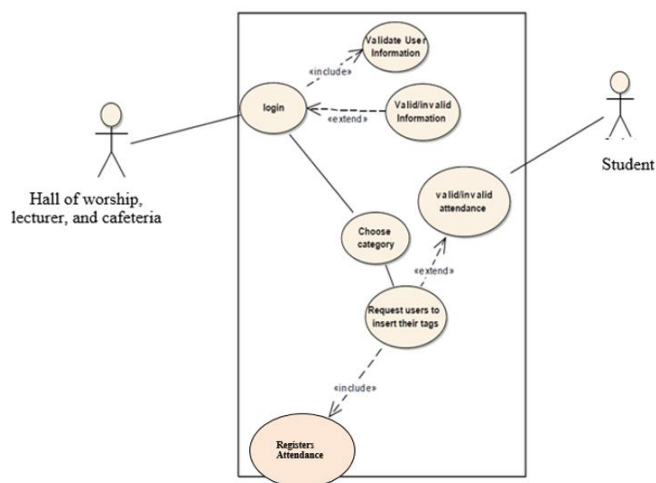


Figure 3. Use case

Use Case: The actors in this use case in Figure 3 are the Admin, students and the lecturers and they individually are able to perform actions:

Admin:

- i. Register and Create profiles for all Staff and Students: This allows the admin to add staff and student profiles to the universities matriculation and information system that carries all the data about the active employed or enrolled entities.
- ii. Manage established information system: This enables the admin to be able to query and make reports regarding its staff and students.
- iii. Record attendances and ticketing of both staff and students: This being an attendance system, the admin can know and record how many people attended a particular event or class held by a staff or the institution itself.
- iv. Checking and Authenticating Entity access: The Admin being the one that holds the database (UMIS) can check and validate students and staff access into the cafeteria for example, hence making ticketing streamlined and recording accurate.

Staff:

- i. Initiate a class and start taking attendances via the application: Lecturers for the sake of class recording, validation and attendance taking, use the application to organize classes.
- ii. Verify and Validate entry into cafeteria.
- iii. Capture attendance at various student gatherings and events organized by department(s) or institution as a whole, events such as Chapel Seminar, Weekly worship etc.

Students: Students are also actors in this system as they approach the Staff and interface with the Admin through the staff and perform actions.

Students

- i. Approach Staff at the beginning of a class or event and present their RFID enabled ID cards for attendance recording.
- ii. Students approach the cafeteria and present their RFID enabled ID cards for ticketing at the cafeteria.

3.1 How the BrasApp works

The system, RFID based attendance system is a system that would mainly automate the whole manual attendance system through an application that would keep track of student participation in activities such as; class attendance, hall worship, chapel seminar and the ticketing system in institutions.

A mobile application is built using an android studio that specifically uses java as its programming language, node as the server-side of the application, MySQL as the database management system (DBMS). An RFID/NFC tag that uniquely identifies every student through their matric number is attached to each students card to allow for each student to be recorded to each event i.e. class attendance, hall worship, chapel seminar and the ticketing system in the institutions respectively through the RFID/NFC reader which in this case would serve as any android device that supports NFC/RFID. The matriculation number is written to student's identification card using an application called NFC tools. This tool is downloaded via google play store and written instantly to the card in .json format.

In order to use the BrasApp, it has to be installed in an android device, after which the lecturer or admin logs into the application then student is called fourth to place their identification card on the android device so that students are verified and marked present for that particular class. The same protocol is observed for other events. Below are screenshots of the implemented BrassApp application and RFID card or tag looks like as shown in Figure 4 to Figure 11.

Figure 4 present the welcome page of the BrassApp, this is the window you will see once the application is lunched.

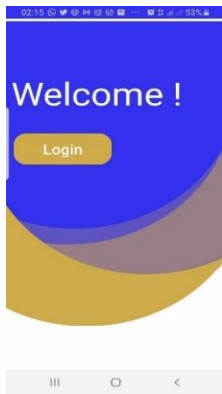


Figure 4. Welcome page

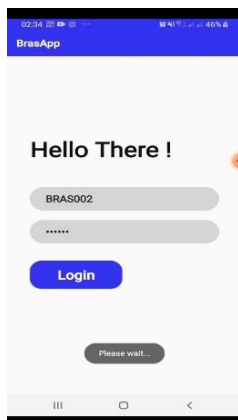


Figure 5. Login page

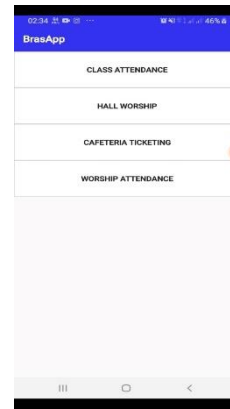


Figure 6. BrassApp home page

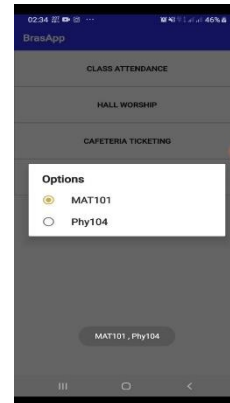


Figure 7. Class attendance options

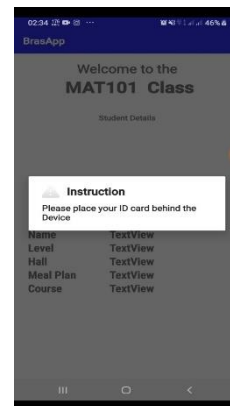


Figure 8. Card request

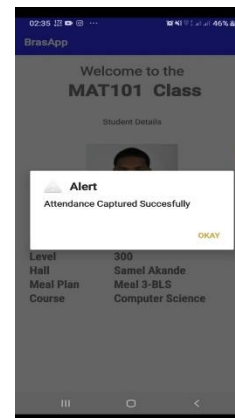


Figure 9. Attendance captured

Figure 5 present the login page of the BrassApp, the lecturer will supply his username and password then click on the login icon to access the home page.

Figure 6 shows the home page of the BrassApp application, here you can select either to capture the class attendance, Hall worship attendance, worship attendance and lastly attendance at the cafeteria.

Figure 7 is an example of the class attendance option. Here the lecturer will select the particular course he is teaching to take the attendance for a particular student.

Figure 8 shows the RFID card request window, here the students is asked to place his card behind the device and the attendance is captured.

Figure 9 shows that the attendance for a particular student has been successfully captured.

Figure 10 shows the details such as Name, level, hall of residence, meal option and course of study of the student that the attendance was successfully captured.

Figure 11 shows the RFID/NFC tag as used in the BrassApp application.



Figure 10. Class attendance summary



Figure 11. RFID/NFC tag

4. CONCLUSION

In conclusion, the study proposed an application brought from organizations into the academic institution to make attendance of every form accurate and effective. RFID (Radio Frequency Identification) Based Attendance System, a mobile application system used to automate the attendance system has been developed, therefore, fulfilling its aims and objective. The system adopts the process where results recorded cannot be altered hence making the system secured and fraud-free. Therefore, alterations on the part of the students and lecturer

cannot be made. Also, the study creates an avenue to where results gathered from various modules of the application can be used to predict the average number of students in a particular lecture, cafeteria amongst other activities in the school.

The RFID technology has been fully in cooperated in tertiary institutions for attendance monitoring in the developed countries, but it is still seldomly used in most African countries especially in Nigeria where Babcock University is situated, therefore this can be seen as a flaw in this work. However, this study intends to in cooperate other recent technologies such as the use of contactless cards into the attendance system as form of future updates of the system.

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