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A Multi-Purpose Student Identity Card Using A Two Dimensional Quick Response Code (2D QR Code)

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ABSTRACT

Identity card (ID) given to student in most tertiary institution was without either means of authentication or verification and these cards are susceptible to cloning by persons who may be desperate to be a student or who have lost his ID or has ulterior plans. Most ID cards are mainly used for identification purpose which is below the potential it contains. Although most institutions also used the ID card in library for borrowing, renewing and returning books but it uses most be increase as much as possible. Attendance is taken manually by lecturers in institutions during lecture/examination but there is need for automated attendance system which records attendance and stores it in database for future reference. Quick Response (QR) code is said to be the next generation of barcode and using QR code with ID card brought positive outcomes. In this work, a multi-purpose student identity card using 2 dimensional quick response code (2D QR code) is designed. The multipurpose ID card system (MID card) is made up of four modules namely; the administrator module, student module, school officer module and the database. Each of the modules performs specific functions and also interacts with each other to achieve a common goal. The software requirement are PHP, Java programming language with NetBeans, PHP, Android API, MySql and additional QR code scanner application. This proposed design will speed up the process of authenticating student status properly and also takes care of preventing unauthorized attendance registration. It also aimed at reducing the manual work, eliminating the use of multiple ID cards and solving insecurity associated with carrying of cash. This proposed design can be use in attendance management, canteen/campus shuttle payments, library, etc.

Keywords: Attendance tracking, Identity, Library management, E-payment, Quick Response.

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1. INTRODUCTION

An identity document *(*also called a piece of identification or *ID*, or colloquially as papers) is any document which may be used to prove a person's identity. If issued in a small, standard credit card size form, it is usually called an *identity card* or passport card. Educational institutions in developing countries are vast sector and they are expanding rapidly. With the rapid growth of technologies, educational institutions are still lacking behind. For identification of students they still lie on manual handwritten ID card and files [5]. Student ID card is the card of identification which is used for holding specific characteristic of students.

Identity cards given to student in most tertiary institution is without either means of authentication or verification and these cards are susceptible to cloning by persons who may be desperate to be a student, or student who has lost his or has ulterior plans. The present ID card system lacks innovation because it is only use for identification purpose which is less compared to the potential it contains. Although institution ID card is used in library for borrowing, renewing and returning books but it functionality still need to be increase as much as possible. It was also observed that many students faces the problems of obtaining change in stores/shops/canteen within the campuses and this idea can solves this problem efficiently. It can also solve insecurities associated with carrying of cash which may not be found once lost. Attendance reports are done manually by lecturer, students can make mistakes or purposely sign on another student's name; and also the paper can be lost which will result to inability to calculate the attendance of students. Installing this type of system can leads to complications but this idea can be easily implemented with existing institution ID with minimal efforts.

If proper ID card system is introduced, then it would be much easier to identify a student and track his/her progress. While using software tools, identity cards works fine and suitable for an educational institution as it is free. Quick Response (QR) Code is said to be the next generation of bar code and using QR code with ID card brought positive outcomes. The QR code was mainly created to overcome the limitation of a traditional barcode. The 2-dimensional barcodes are much faster as compared to the barcode. QR code-based technology is superior in other ways, such as higher data storage capacity, lower implementation cost, technical simplicity, widespread use and widely available, free programs for reading and decoding. These features make this technology popular for identification and authentication systems, especially in sectors with limited resources. QR Codes are two dimensional images that, when scanned by a smart phone's camera; it will prompt the smart phone to open a webpage or display an image, video, or text [7]. The embedded information in the card is readable by mobile phone [14]. [9] stated that with QR code, it is much easier to access the information with the help of the inbuilt QR scanners of the smart phones.

Therefore, in this work a multi-purpose student identity card using 2 dimensional quick response code (2D QR code) is proposed. The automated student ID had image capturing facility and requirements of an ID. QR code is attached into ID card and student personal details can be read by scanning the QR code with smart phones (downloaded and installed QR reader software) since statistics shows that averagely, 42% of Smartphone users are 26 years old [6]. Thus, there is widespread of smart phones among University students which can be used to scan the student ID card [15]. This proposed design will speed up the process of authenticating studentship status properly and also takes care of preventing unauthorized attendance registration. It was also aimed at reducing the manual work and eliminating the use of multiple ID cards in tertiary institutions.

2. LITERATURE

[1], proposed a QR code based identity card which is used to identify a student and track his progress. The information of the students is stored in the database and the student ID card is generated and given by the administrator. [16], developed a campus Smart Card system for Colleges and Universities. It was based on systems of shared library, unified identification platform to construct the "Campus Smart Card" system centralized platform, which includes general management platform, identification platform, student's fingerprint registration and other sub-systems. [4] designed students' records management system using smart card and biometrics technology for educational institutions. The system stores student records in the database and identifies students with a valid contactless RFID tag. Student data stored includes their student ID number, academic details, hall of affiliation, and institutional details. The system comprises of a reader connected to a PC through a RS232 to a USB Converter which was a simple connection that allows easy access to the computer.

[13] developed a system which identifies students by scanning the QR code placed on the back of the student's identification card. Each black and white box on the code, when scan is translated to digital information; which allows the computer to access the database and provide the student academic record. [12] proposed system of attendance management which was implemented using barcode technology. Student's record is entered into the system and tied to the barcode. The code was uniquely associated with each student's details for easy identification. [2] designed student authentication and verification system using barcode scanner. The application uses the barcode scanner to store the transaction information of the library and central computer center. Each student ID card has a barcode which will be scan before entering into the library and computer center. [3], proposed a QR code based smart attendance system. This system consists of two applications, one for generating the QR code by entering the student details and second application for taking the attendance and generating the attendance in CSV or XLS format. The QR code of student particulars needs to be scan in order to confirm their attendance.

[8] reviewed student profile management system using QR Code. The system requires a simple login process by the class instructor through its Server Module to generate an encrypted QR code with specific information. This can be done at any time before the class. During the class, or at the beginning, the instructor displays an encrypted QR code to the students. The students can then scan the displayed QR code using the system mobile module, provided to them through the Smartphone market by the University. Along with the student's facial image captured by the mobile application at the time of the scan, the mobile module will then send the information collected to the server module to confirm monitoring. The whole process will take less than a minute for any student as well as for the whole class to complete their monitoring confirmation. Smartphone's may communicate with the server via either the local Wi-Fi coverage offered by the institution or through the internet. The system is limited to student profile management and it requires a login process by the lecturer which might take time.

[11], used a barcode reader to take student details. In this system, each student is issued with barcode tag. The entire details of the student are stored in the database. The system is expensive to implement as initial investment needs to be done on hardware procurement. [10], developed a smart ID card system using RFID Technology. The RFID card is scanned with the help of RFID scanner. The tag provided to the student/staff contains unique identification that will be used to identify the student/staff identity. When a student place the tag on the RFID reader, the reader reads the unique ID and check if the ID is present in the system and if the unique ID is not present, the system will notify the administrator that the RFID tag is not registered into the system database

3. DESIGN METHODOLOGY

3.1 Design Consideration

(i) Quick Response (QR) Code: the software decodes built-in into the applications is used to convert scanned code images into the coded information and save it into the database.

(ii) Authentication: Security is achieved through the use of access control mechanism. Hence, the access control mechanism is used to determine authorized users that have the right access to the institution facilities using the ID card. However, access control tailors the access rights granted to different student and provides a means of specifying required credentials or bind attributes.

(iii) **E-wallet:** allows student to pay any college dues using 2D QR. The amount in the card can always be refilled with the help of the admin. When the ID is scanned the balance is deducted from the student's account that is associated with the 2D QR code

(iv) **Attendance**: This could give the statistics of student attendance and absence information.

3.2 Architecture of a Multi-Purpose Student Identity Card using Two Dimensional Quick Response Code (2D QR)

The architecture of a multi-purpose student identity card using two dimensional quick response codes is presented in figure 1. The Multipurpose ID Card System is made of four modules namely; the administrator module, student module, school officer module and the database. Each of the modules performs specific functions and also interacts with each other to achieve a common goal.

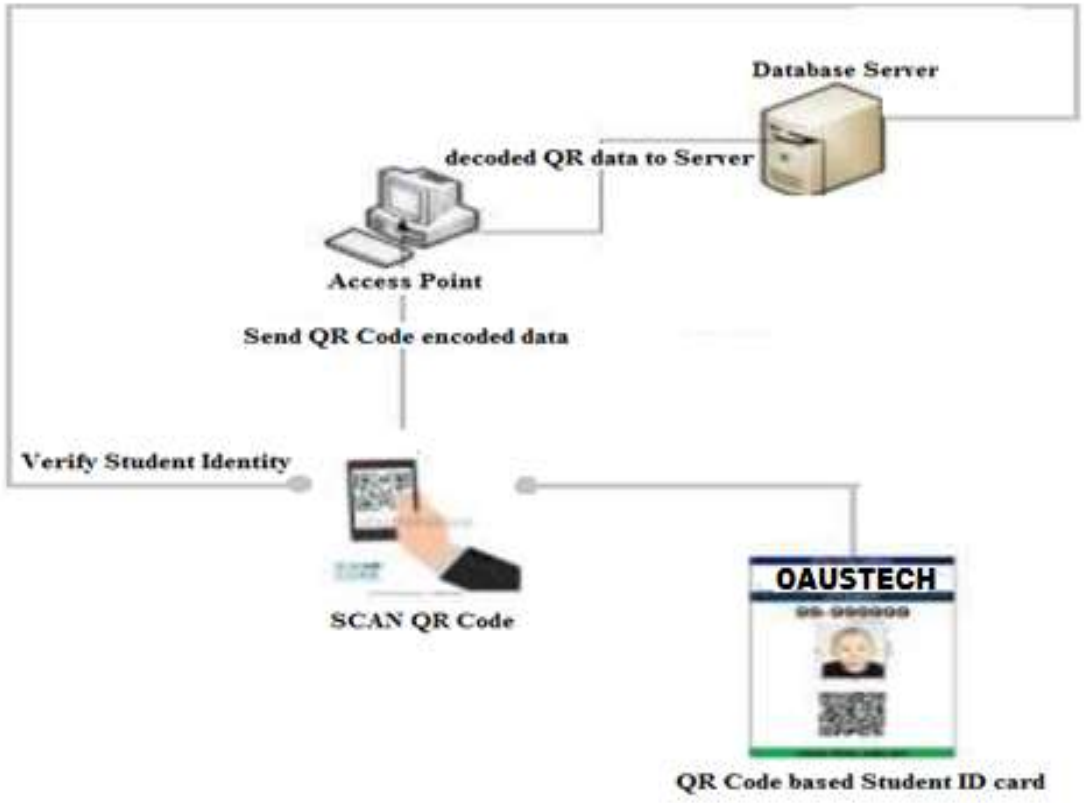

Figure 1: Architecture of a Multi-Purpose Student Identity Card using Two Dimensional Quick Response Code (2D QR)

a) Administrator Module

The administrator performs the following functions; store students' detail in database, generate ID card for students and manage the records and database. This module is used by the administrator to manage student profile, accounts, attendance and generate report on different transactions and attendance. The module consists of three models namely; Registration Model, E-Wallet Account Model, Report Model and Attendance Model.

i. **Registration Model:** In this model, the administrator is allowed to register a new student into the database, create the student account information, login credentials and the notified the student about this information through email/SMS. When creating the student profile the following information; matriculation number, first name, middle name, last name, date of birth, programme, department, level, email and phone number are added. After these, the system will automatically create the student E-Wallet account and login credentials referencing his matriculation number as the main focus and then sent an email notification to the student containing his E-wallet

account information along with login credentials for his mobile app for him to view and edit his profile, set new password, view account transactions and contact the administrator for any information.

ii. **E-Wallet Account Model:** In this model, the administrator is allowed to credit the student account and also allow the student to spend the money credited/added into his account in different locations in the institution such as the bookshop, library, store, canteen, shuttle bus, etc. The student approaches the administrator for him to credit his account using the multipurpose ID card given to him. The student can do some transaction with the multipurpose ID card by using it in the provided locations within the campus/institution and then scan his ID card which allows his account to be debited with the specific amount. Notification will be send to him with all his transaction details via email as soon as the transaction is completed and also the transaction can be track using the android app developed.

iii. **Attendance Model:** In this model the administrator is allowed to manage attendance procedures according to institution rules and regulations. This model records student attendance with the help of 2D QR code printed on the student ID card when presented at the lecture venue and the information is stored into the database for future reference such as making reports. Operation can be carried out further on the data capture. The information on attendance can also be viewed on the android app developed.

iv. **Report Model:** This model allows the administrator to generate automatic real time reports on the student profile, E-wallet account transactions and attendance. This report can be printed or sent to the student whenever it is required or needed.

(b) Student Module

The students are the holders of the ID card and this module is used by the student to view his profile, transactions and change his account information such as email, picture, etc. The student will be prompted to login before he can access the application on his phone. The student login credentials are provided automatically if the student had been registered in the database through the administrator system. The student app can allow him to change his profile information and also track account transactions along with attendance. The Student app consists of 3 models:

i. **Profile Information Model:** This model allows the student to view his profile such as name, matriculation number, programme, department, email id, contact number and picture and also to edit his profile information which will be automatically updated in the database.

ii. **Transaction Model:** This model allows the user to view his transaction history of how and when money was added or credited into their account and the timestamp; spent or debited from his account with appropriate timestamp and purpose it was spent on, for easy tracking; and also views the remaining balance in the account.

iii. **Attendance Model:** This model allows student to view his attendance history.

(c)School Officer: The school officer scan the QR code with smart phones (downloaded & installed QR reader software) to verified the student identity

(d)Database Server: is used to store all the student records. All files are organized sequentially and their details stored in the database. The database is responsible for storing all data used throughout the system. Therefore, it is important that it runs at all times as data can be needed at anytime and anywhere, also the information is stored securely and backed up regularly.

4. IMPLEMENTATION

The multipurpose ID card was implemented using java programming language with NetBeans, PHP, android API, MySql and and with additional QR code scanner application.

(i) NetBeans: This software was used to develop the desktop Java application for the administrator to load money, update information, stores documents.
(ii) Android Studio: This tool was used to develop an android app for the user which was used in retrieving balance, account transactions and document.
(iii) MySQL Sever: This was used for creating the database to store students' related information
(iv) PHP: This tool was used to ease the communication between android app and the server containing the database.

4.1 Microsoft MySQL

This is the relational database management server that was used to stores data in form of tables. It was made up of the following tables:

(i) Student table: This table holds the student information such as matriculation number, first name, middle name, last name, date of birth, programme, department, semester, QR id, email, phone number, etc.
(ii) Account table: It holds all students account number.
(iii) Login table: It holds all students login credentials.
(iv) Attendance table: It holds all student attendance report.
(v) Debited table: It holds all account of money spent and the purpose. It holds information such as transaction id, account number, date, time, amount spent, purpose.
(vi) Credited table: It holds all account details of money added/credited and timestamp. It holds information such as transaction id, account number, date, time when money was added.
(vii) Log table: holds all activities done by the administrator such as registering a student, crediting accounts, debiting account and attendance

4.2 Preliminary Testing of a Multipurpose Student Identity Card using Two-Dimensional Quick Response (2D QR) Code.

This section describes how the Student identity card was created and used. It consists of different modules and interfaces for easy communication and usage.
Figure 2 shows the student's login page in the Website. Admin must have added the student before the student can log in. The Admin is also responsible for adding lecturers, sellers and librarians to the database.

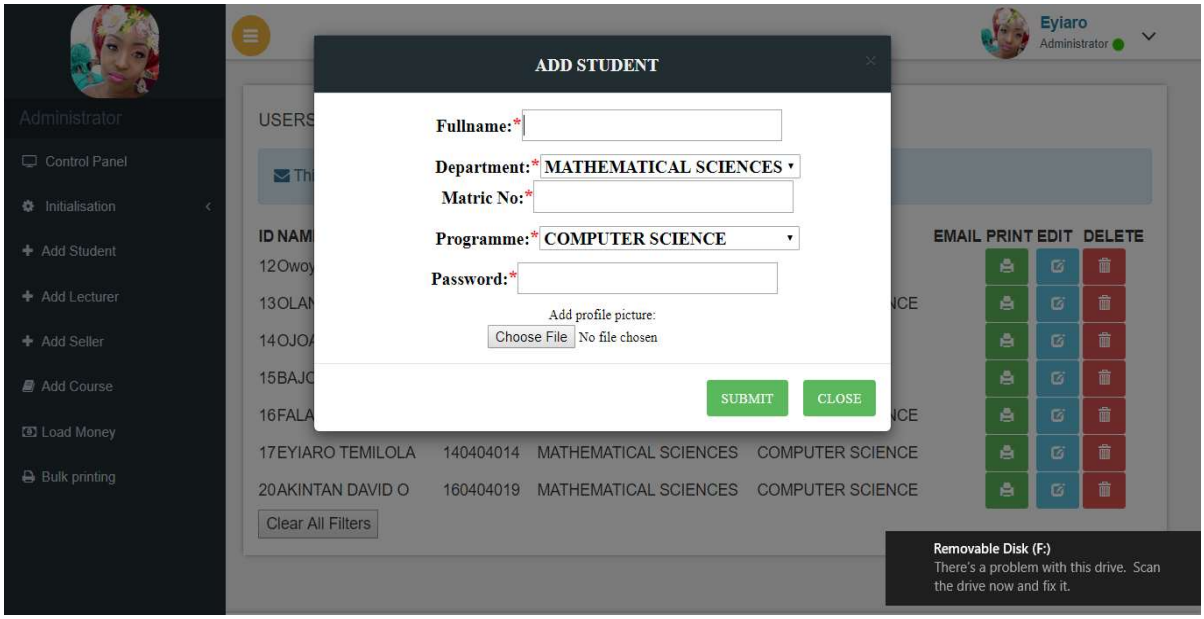

Figure 2: The students' registration page

Figures 3 and 4 shows the students' dashboard and the students' transaction log on the GUI website respectively.

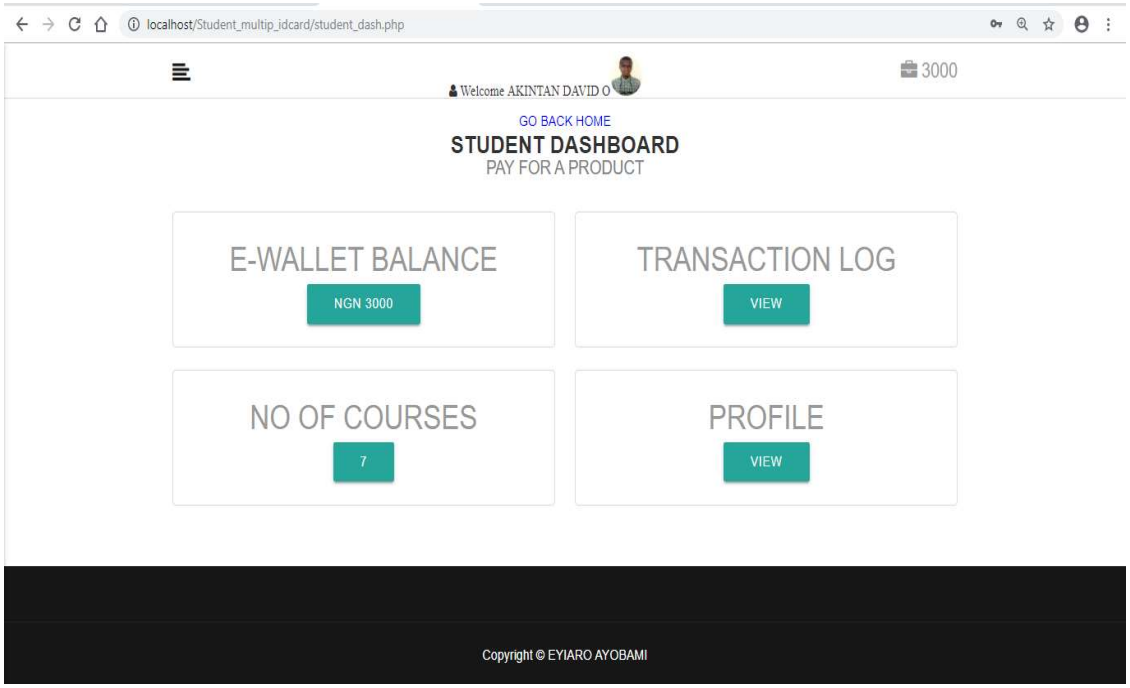

Figure 3: The students' Dashboard on the GUI website

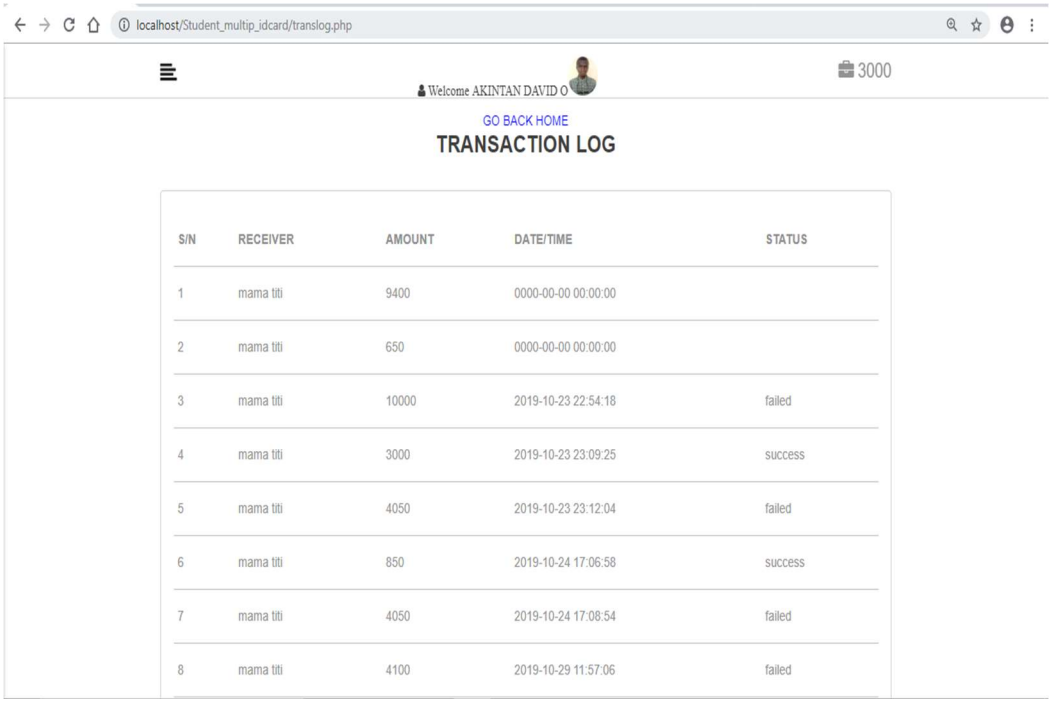

Figure 4: The Students' Transaction Log on the GUI Website

Figures 5, 6 and 7 shows the attendance scanning page, students' attendance records and staff courses list respectively. The staff courses page shows the number of courses taught by a particular lecturer, while students' attendance record shows the attendance list of students for a selected course. The attendance scanning page helps to scan the student QR code on their identity card and the image of the student appears and the lecturer can mark the attendance for the student.

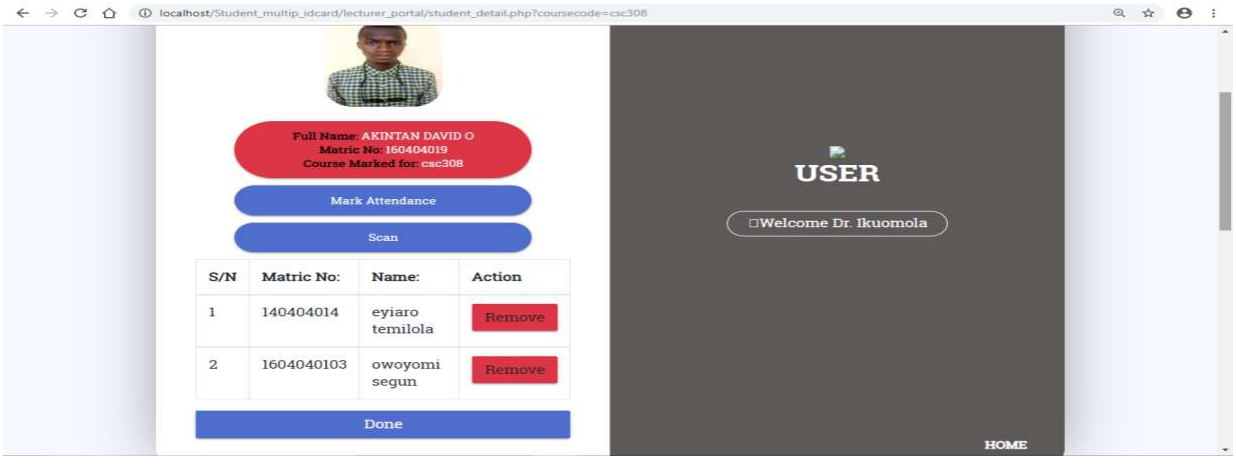

Figure 5: The attendance scanning for a particular course (CSC 308)

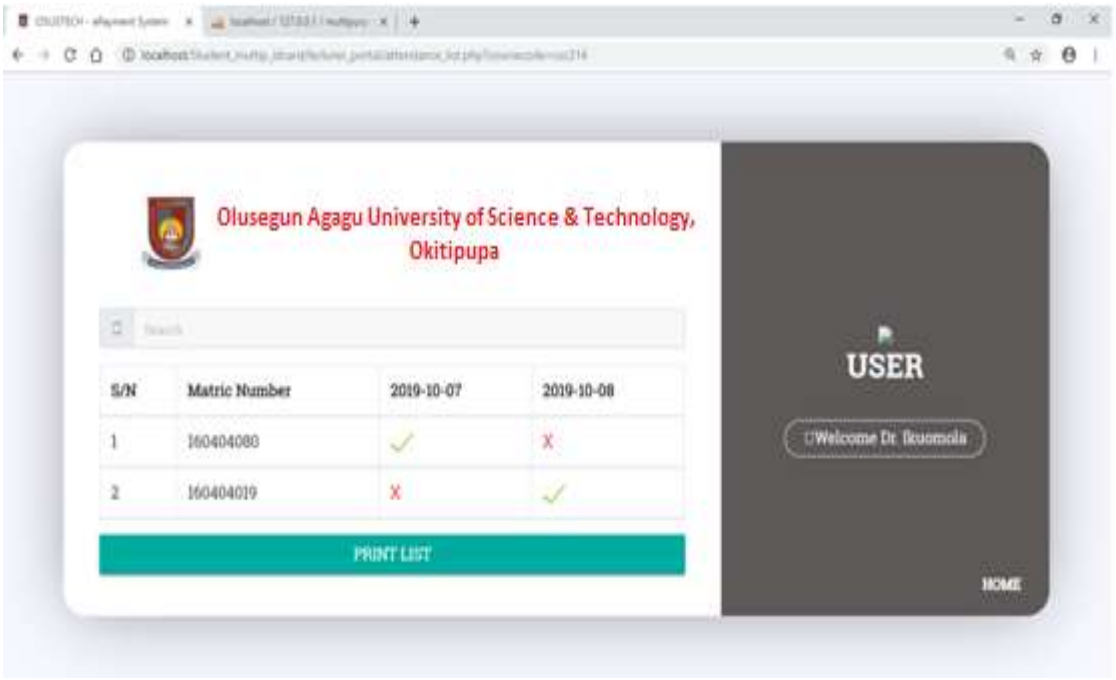

Figure 6: The students' attendance list for a particular course (CSC 314)

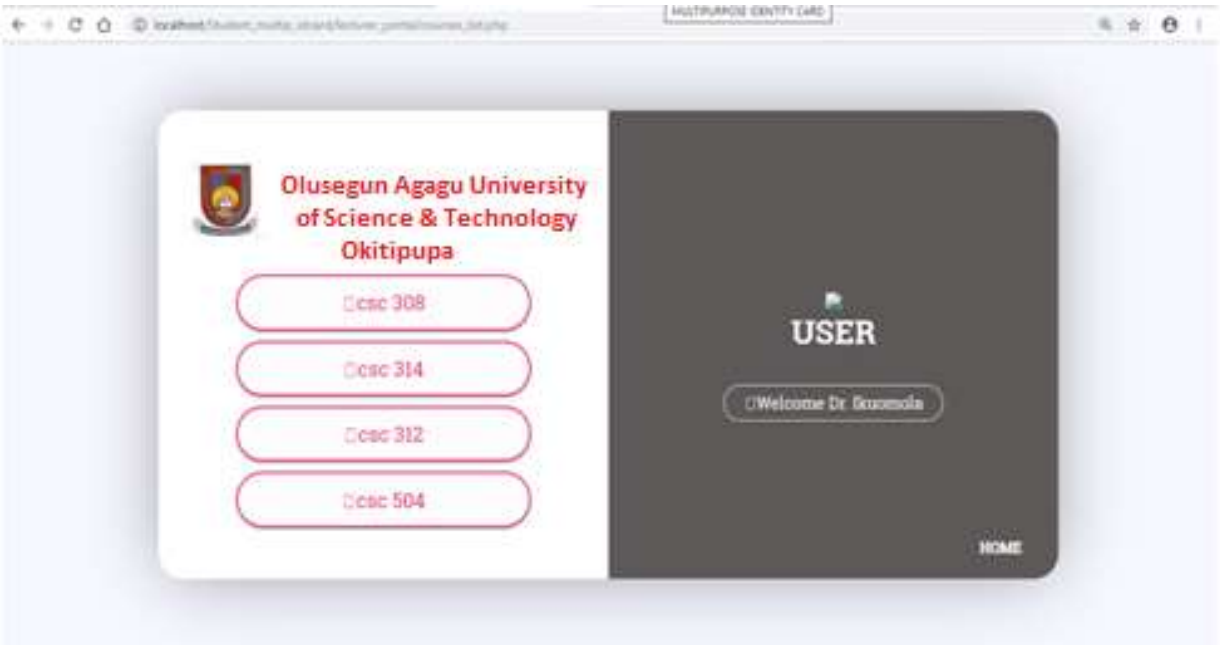

Figure 7: The Courses List on the GUI Website

The attendance scanning page helps to scan the student QR code on their identity card and their details appears and the librarian can mark the attendance for the student. Figure 8 and 9 shows the products list and the payment platform. The products list page enables the student to choose whatever meal he/she wants while the payment scanning platform helps to scan the student QR code on their identity card and their details appears and the seller can verify the payment.

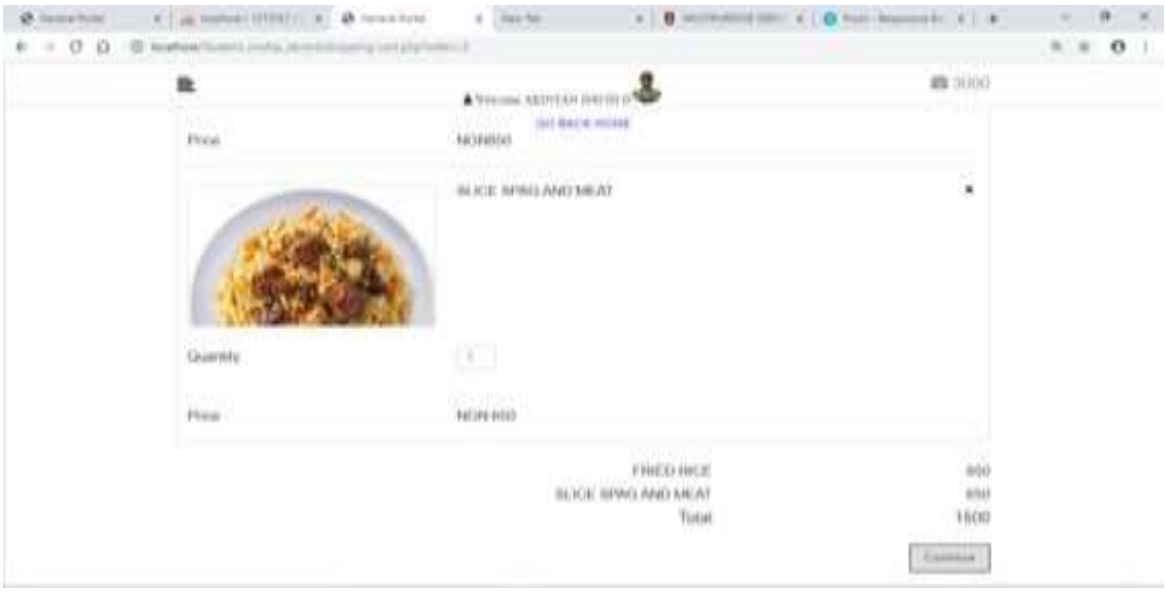

Figure 8: Products list

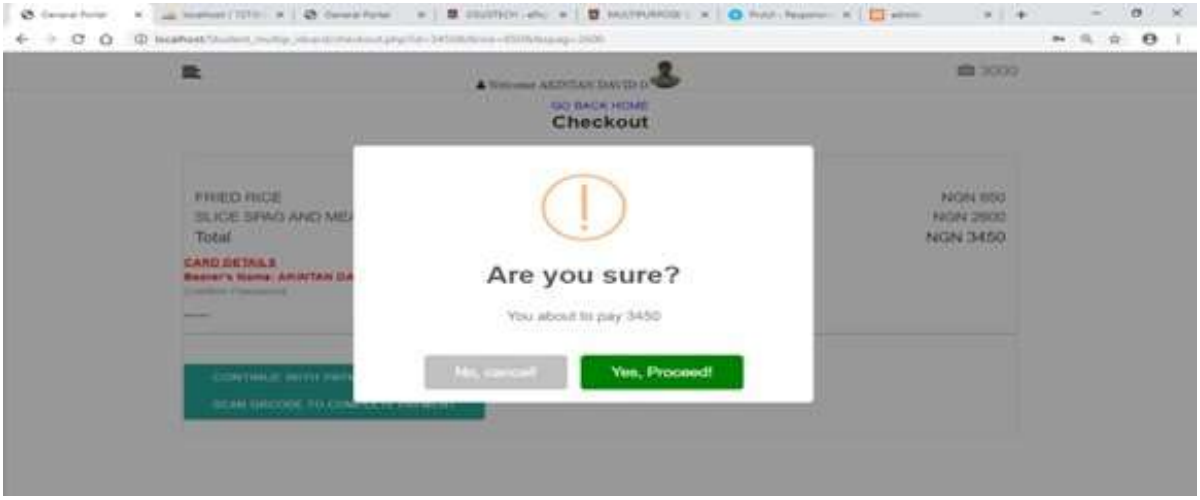

Figure 9: Payment Platform

5. CONCLUSION

Identity card system has been made easy with the use of 2 dimensional quick response code (2D QR code). In this work, a multipurpose ID card system (MID card) using 2D QR code was developed. The multipurpose ID card system is made of four modules namely; the administrator module, student module, school officer module and the database. Each of the modules performs specific functions and also interacts with each other to achieve a common goal. The development of the identity card system is a unified management system that provide comprehensive identity authentication, financial service, information service and other functions.

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Development of student attendance with fingerprint Authentication System to Eradicate Examination Impersonation in Higher Institutions

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