

EXAMINATION ELIGIBILITY VERIFICATION AND ATTENDANCE SYSTEM USING QUICK RESPONSE CODE

By

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ABSTRACT

In many institutions, during each examination, the only requirement that is needed for a student to enter examination hall is his/her identity card, which is checked for authenticity and validity of the student. This process does fail to identify if such a student is eligible to write that examination. Currently with the high ratio of students to invigilators in many examination halls, using only ID card for verification does not show whether a student has registered for a subject or not. As a result, some students make use of this loophole to request the assistance of another student from another level or other department to help them write the exam on their behalf. This act is impersonation and thus, is an act of examination malpractice. In this paper, an examination eligibility verification system using quick response code was developed. The EEV system was designed using UML diagrams and implemented using JavaScript, Cascading Style Sheet, and HTML5 in Microsoft Visual Studio Code for the front-end, and PHP and MySQL relational database management system for the back-end. The EEV system was validated using a smartphone to scan the QR code generated. It was observed that the system took four seconds to verify a student's eligibility status. This shows that 300 students can be verified in 20 minutes. Furthermore, it provides a log file that keeps track of eligible students, which serves the purpose of attendance. So, the EEV system was friendly, secures and reliable, and has fast response time.

Keywords: Examination, Eligibility, Verification, Impersonation, Attendance.

INTRODUCTION

Recently, impersonation is being experienced every now and then in examination centers; the ghost student syndrome that has become a threat across all levels of education is often referred to as examination malpractice. In education, an examination is a formal test intended to measure the knowledge, skill, aptitude, proficiency, or ability of a candidate in a subject/course. Therefore, it is a service. At this information age, whoever who wants to authenticate use a service must have a means of verifying his/her eligibility/identifications for example, identity card, ATM card, driving license, health care card, etc. Examination as a service is not an exception. Nowadays, in many institutions of higher learning, during an examination the only method invigilators and security personnel use to verify eligibility of a student is through checking his/her identity card to know

whether he/she is registered or not. Consequently, some students may not write their examination or test personally, especially for courses that they perceived as "difficult". Therefore, they may hire or request for help from a registered higher-level student or another student in a different department that is well learned in the course. This is impersonation and consequently examination malpractice. This becomes possible because only ID card is used to identify and verify registered students. However, using only ID card for verification does not show whether a student has registered for a course or not. As a result, some students make use of this loophole to request the assistance of other students from another level or other department to help them write the examination on their behalf. Furthermore, in some universities, each student is issued an examination card, which consist of the registered courses for that semester/session. In some

cases, when they are not given an examination card, the student is informed to come along with their course registration forms. This consumes a lot of time and is stressful. It also gives the students an opportunity to write words that could be helpful in examination. From the aforementioned reasons, in this paper, Quick Response Code (QR code for short) is employed to verify students who are eligible to sit and write examination or test in a particular course at a semester/session. This is because QR code has fast readability and greater storage capacity as compared to other bar codes (Adsul, Kumbhar, Chincholka, Kamble, & Bankar, 2014). A QR code consists of white background with black squares organized in a square grid on it (as shown in Figure 1), which can be read by an imaging device such as a camera, and processed using Reed-Solomon error correction till the image can be appropriately interpreted (Masalha & Hirzallah, 2014). Using QR code for eligibility verification not only reduces impersonation in the examinations and consequently maximizes the time of examination malpractice committee meetings, but also saves precious time of Invigilators and encourages the defaulters-to-be to read and prepare very well for any examination.

The contribution of this paper is twofold. Firstly, the authors propose Examination Eligibility Verification (EEV) system using QR code for identifying and preventing illegal students into the examination hall. Secondly, they implement and validate the QR code based EEV system using smartphone and web-cam.

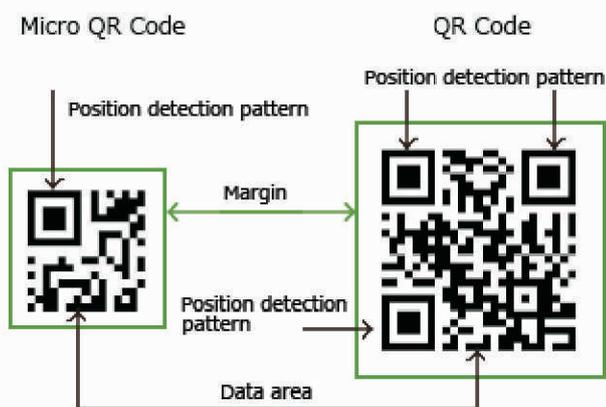


Figure 1. Micro and Regular QR Codes

1. Related Work

Subramanian, Hassan, and Widyarto (2013) proposed barcode scanner based Student Attendance System (SAS) to replace the manual attendance record system with the bar code scanner technology in order to record and regulate the student attendance records more efficiently and effectively. According to the researchers, in the bar code scanner technology, each student will be given a student card for each of them with the bar code displayed on the card for a scanning purpose every time he/she attends a class. A student attendance status will be recorded into the system once a lecturer scans a student card with bar code scanner automatically. This shows that the attendance system using bar code scanner technology is much better than the traditional attendance system in school as a lecturer just requires to scan the bar code on the student cards as a proof that the student attended the class. More so, the system allows the administrator to generate warning letters if a student does not meet the attendance requirements, however, the generated warning letters will be given to each default student for onward delivery to his/her parent without giving a Short Message Service (SMS) or email to the parent. Therefore, there is every possibility that some students may throw away the letter without handing it over to their parents. Since the letter is not a good news on their part.

Arulogun, Olatunbosun, Fakolujo, and Olaniyi (2013) proposed RFID-based Student Attendance Management System. The Radio Frequency Identification (RFID) technology system in this application area is to observe the presence and absence of the student data to be transmitted wirelessly by mobile device, called a tag, which is read by an RFID reader and processed according to the programmed instruction on the Personal Computer (PC). The RFID reader will automatically observe the student attendance and record it, while the RFID card gets closer to the RFID reader, which means it is using the non-contact type of reader and passive types of card. However, the system cannot instantly identify non-members of that class or course.

Masalha and Hirzallah (2014) proposed a student attendance system based on QR code using

smartphones to fast track the process of taking attendance by University instructor. The system requires a simple login procedure by the class instructor through its Server Module to create an encoded QR code with exact information. This can be done at any time before the class. During the class, or at its beginning, the instructor displays an encoded QR code to the students. The students can then scan the revealed QR code using the system Mobile Module, provided to them through the smartphone market by the university. Along with the student's facial image taken by the mobile application at the time of the scan, the Mobile Module will then communicate the information collected to the Server Module to confirm attendance. The proposed system allows fraud detection based on the GPS locations as well as the facial images taken for each student. However, precious time is being lost during the period, instead of the lecturer to lecture the student they tend to use the period to take their attendance.

Falguni, Utkarsha, and Madhuri (2015) proposed QR code approach for examination process. QR code reader via camera device in mobile phones is used to automate examination process. This proposed system is appropriate for objective examination and also have Multiple Choice Question (MCQ), True/False and extended matching variety. Teachers have to register on the examination server so that they can create objective type of question paper. After encoding it then server creates QR code for matching question paper. The students are expected to have Android mobile phone and must be able to send and receive data when linked to Wi-Fi range. Students are instructed to scan the QR code using their mobile phone once so that they will be able to see the examination question to be taken. This proposed system focuses on the objective part of an examination neglecting the essay part of an exam.

Liao and Lee (2010) observed that user authentication is one of the fundamental procedures to ensure secure communications and share system resources over an insecure public network channel. Thus, a simple and efficient authentication mechanism is required for securing the network system in the real environment.

Nevertheless, in general, the password-based authentication mechanism provides the basic capability to prevent unauthorized access. Especially, the purpose of the one-time password is to make it more difficult to gain unauthorized access to restricted resources. Instead of using the password file as conventional authentication systems, many researchers have devoted to implement various one-time password schemes using smart cards, time-synchronized token, or short message service in order to reduce the risk of tampering and maintenance cost. However, these schemes are impractical because of the far from ubiquitous hardware devices or the infrastructure requirements. To remedy these weaknesses, the attraction of the QR-code technique can be introduced into an one-time password authentication protocol. Not the same as before, the proposed scheme based on QR code not only eliminates the usage of the password verification table, but also is a cost effective solution since most internet users already have mobile phones. For this reason, instead of carrying around a separate hardware token for each security domain, the superiority of handiness benefit from the mobile phone makes the approach more practical and convenient.

Saheed, Hambali, Adedeji, and Adeniji (2016) proposed attendance management system using barcode on student's ID card to eliminate attendance by proxy as well as monitor student that skip classes. The barcode, which is attached to the back of student's ID card, contains unique information, such as matriculation number, department, level, etc., for each student. The system allows students to view their attendance percentage thereby motivating them to control their class attendance reputation. However, QR code has fast readability and greater storage capacity as compared to bar codes.

(Rahman, Rahman, & Rahman, 2018; Rahman, Rahman, Rahman, & Haider, 2016) proposed students' attendance system using fingerprint biometric identification system. The system compared previously stored templates of fingerprints against candidate fingerprints for authentication and identification purposes. Furthermore, the system allows taking attendance manually by clicking the checkbox from the list of students. However, the

system cannot capture the original fingerprint images from the scanner; instead, it can only receive the fingerprint templates from a server.

Ayeleso, Adekiigbe, Onyeka, and Oladele (2017) proposed an offline identity card authentication system using QR code and Smartphone. The QR code, which contains a unique encrypted matriculation number for each student, is printed on the students' ID card. However, the procedure of authentication is cumbersome, as it requires manual input of student matriculation number onto the Application before authentication. It also performs decryption of information captured from the QR code.

2. Examination Eligibility Verification System

The proposed EEV system using QR code is a webbased application, which is resourceful in giving an effective and reliable verification of student's eligibility over the existing system as second level authentication. The EEV system involves two parties: Student and Invigilator. On one hand, every registered student do have an Identity (ID) card. On the other hand, a web camera can be attached to Desktop Computer Systems while often; it is embedded in Laptop Computers. Therefore, QR code image can be embedded in an ID card, which invigilator can scan using the web camera to authenticate eligibility of the student.

In other words, before a student is allowed to enter the examination hall, the invigilator and/or security personnel attached to the hall will scan the student's ID card for eligibility verification. If the student has registered the course in that session, it will show ELIGIBLE (meaning that the student is eligible to write examination of that particular course) and that represent sign in, otherwise it shows NOT ELIGIBLE. More so, when a student is about to finish and submit his/her script, the exit scan of ID card will be performed to signify sign out. For this purpose, the EEV system is divided into two phases (see Figure 4): enrolment and verification. In the first phase, each student is enrolled by registering his/her personal details and courses to offer. While in the second phase, invigilator and/or security personnel verifies each student's eligibility. The following sub- sections describe the steps adopted to develop EEV

system.

2.1 Requirement Definition

The requirement definition for the proposed EEV system consist of two parts. These include functional and non-functional requirements.

2.1.1 Functional Requirements

- It specifies EEV system behaviour or its functions, which are as follows:
- It can validate and display student's eligibility status for an examination.
- It can scan and verify QR code embedded in the student's ID card.
- It can generate a unique QR code per student.

2.1.2 Non-Functional Requirements

- It specifies criteria that can be used to judge the operation of an EEV system, rather than its specific behaviours, which are as follows:
- The EEV system is user friendly.
- The EEV system is secured.
- The EEV system is reliable.
- The EEV system has fast response time.

2.2 Functional Model

The system functions from the external user perspective are modelled with use case diagram as illustrated in Figure 2. It consists of two actors: student and university database. More so, it consists of the following use cases: login, check profile, cancel, verify QR code, validate QR

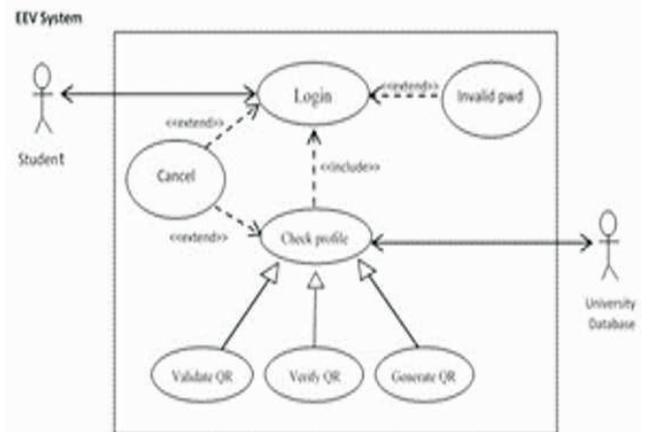


Figure 2. EV System Use Case Diagram

code, invalid password (pwd), and generate QR code. The cancel and invalid pwd use cases are optional or exceptional scenarios while login is mandatory upon which check profile depends.

2.3 The EEV System Architecture

The EEV system was designed based on MVC (Model, View, and Controller) model as shown in Figure 3. The model part of the MVC provides an interface for manipulating the database, in which each table is represented with a model for manipulating it. The Controller part of the MVC handles all the application logic, it communicates with both model and view parts. The view of MVC is the User interface with which the system users interact.

2.3.1 Enrolment Phase

This is where students' profile is being created and it is further divided into three modules (see Figure 4): Student Information Registration, QR code Encoding and

Generation, and Course Registration. Each of these modules are described as follows:

a) Student information registration module is an interface where each student registers his/her details such as Names, Gender, Student ID, Matriculation Number (Matric No, for short), Date of Birth, Level, Department, and State of Origin. Without loss of generality, once a fresh student paid his/her acceptance fee to the University, a unique student ID number and password are generated and given to him/her. This is unique to each student throughout his/her stay in the university. This ID number is NOT the Matriculation number.

b) QR Encoding and generation module is an interface where student ID number is used to encode and generate a unique QR code (as shown in Figure 5) for the student once throughout his/her studentship on campus. This QR code will be embedded on the student's ID card every session. The ID number for each student does not change throughout his/her studentship on Campus.

c) Course registration module is an interface where each student uses the received ID number and password to login into his/her profile to select courses for registration. The unique QR code generated is connected to the database for retrieval of information on course registration. Whenever course registration table in the database is updated, say in a new session, the same QR code works with current information in the table.

2.3.2 Verification Phase

Every student's identity is being verified with respect to course examination before entering examination hall at this stage. This is further divided into the following modules: QR code decoding, authentication, and database update module.

a) QR code decoding module is an interface where a

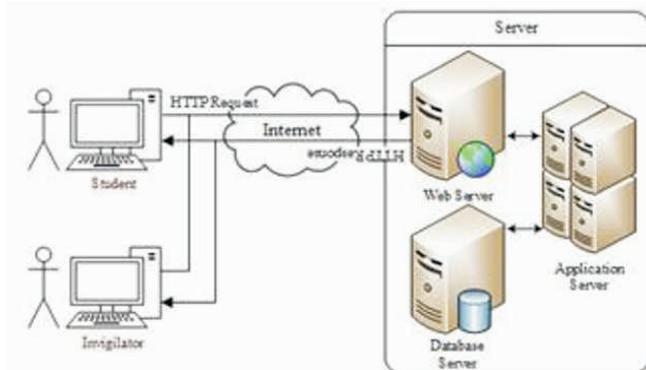


Figure 3. EEV System Architecture

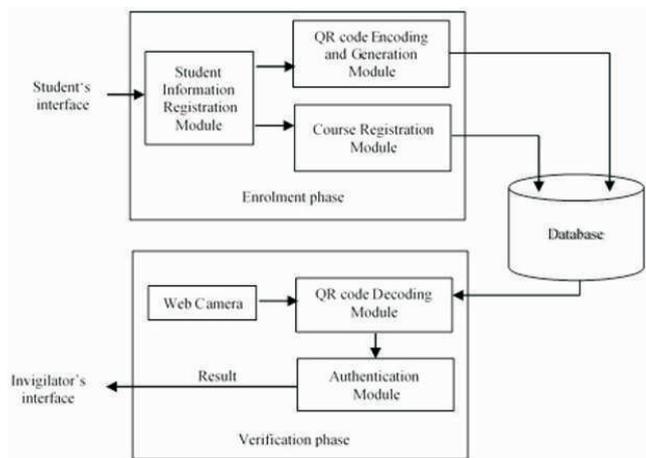


Figure 4. EEV System Detail View

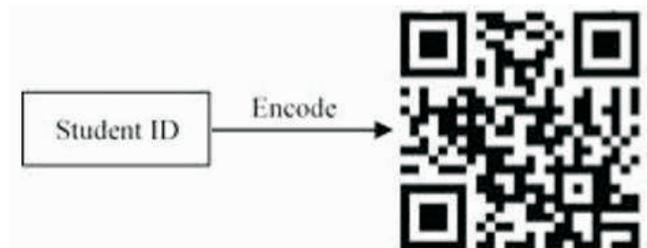


Figure 5. QR Code Encoding and Generation

course for which a student is to be examined is selected and then eligibility of the student for that examination is verified. The ID card of each student is scanned using web camera and EEV system displays the eligibility status: eligible or not eligible (see Figure 6). The entry scanning represents sign in and the exit scanning when submitting signifies sign out.

b) Authentication module is an interface where all courses are selected from a course registration table in database where the student id matches the scanned QR Code and compares each with the entered examination course. If the result is true the student is eligible, otherwise, is not eligible (see Figure 6).

c) Database update module is a storage where all the information of all the students is stored. Furthermore, a log file is being created here that keeps track of eligible student details, such as examination course, full name, matric number, sign in, and sign out. This can be printed out as attendance list for record purpose in examination office and for the course Lecturer.

2.4 Behavioural Model

Without loss of generality, a fresh student can pay his/her acceptance fee and submit the payment information online. Using a name combination of the candidate, an email is automatically created for him/her that contains his/her login details, i.e., a unique student ID and password. The candidate's JAMB number is being used as a default password to access the email. Thereafter, he/she then uses those login details to access the portal to register courses to be offered for current session (see Figure 7), which are saved in the database.

As earlier explained, each student is authenticated and his/her eligibility is verified using his/her student ID card before entry into the examination hall. The processes

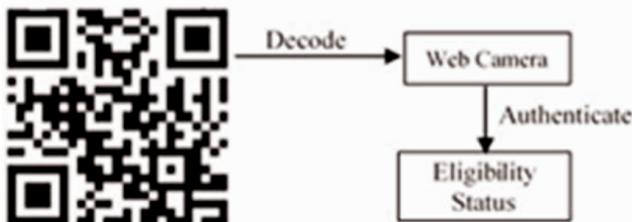


Figure 6. QR Code Decoding and Authentication

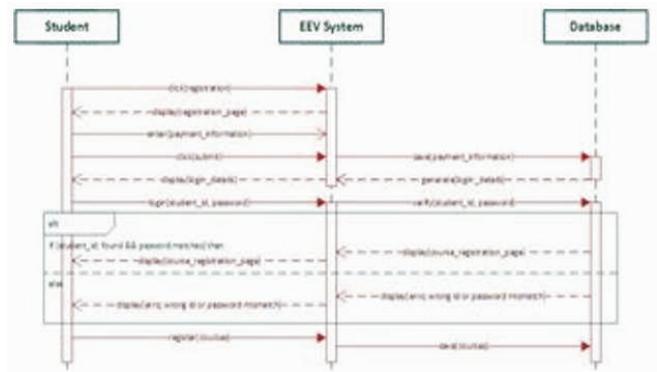


Figure 7. Enrolment Phase

being followed to determine eligibility status of each student is illustrated in Figure 8.

2.5 Database Schema

The class diagram is used to display the organization and structure of EEV system in terms of its components that make up EEV software system and their relationships. The components are student, student biodata, and course registration classes as shown in Figure 9. The primary key for both student and student biodata tables is student id while that of course registration table is the serial number

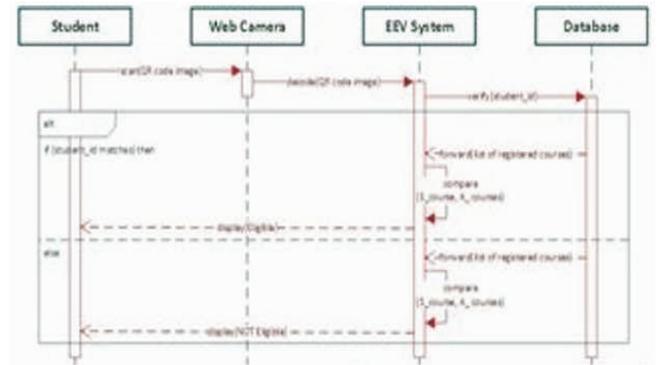


Figure 8. Verification Phase



Figure 9. Database Schema and Relationship

of the student in the database.

3. System Implementation

The front-end of EEV system was implemented using JavaScript, Cascading Style Sheet, and HTML5 in Microsoft Visual Studio Code and the back-end was implemented using PHP and MySQL relational database management system. Chrome was used as a browser not only because is an open source program for accessing the World Wide Web and running Web-based application, but also available for Windows, Mac OS X, Linux, Android, and iOS operating systems. Furthermore, it is remarkably fast and manages a level of simplicity, which other internet browsers lack. Therefore, some menu's description, results and discussions are as follows.

3.1 Menu Description

- Student Registration Page allows a student to enter his/her information using student ID and password to create profile on the application (see Figure 10).
- Student Profile Page displays information of a

Figure 10. Student Registration Page

successfully registered student including the generated QR code image. So, the student can now continue with course registration (see Figure 11).

- Course Registration Page allows a student to select his/her course offerings for registration in the session (both first and second semesters) (see Figure 12).
- QR Code Scanned Page displays the captured QR code image for eligibility verification (see Figure 13). For practical experiment, smartphone was used to scan the QR code image generated.
- Not Eligible Status Page displays the matric no. and full name with red background that the student is not eligible to write examination of the selected course (see Figure 14).
- Eligible Status Page displays the matric number and full name with green background that the student is

Name:	Nura Fatima Musa
Matriculation Number:	2012/1/41784ct
Student ID:	M1000523
Level:	500
School:	SICT
Department:	Computer Science
Date of Birth:	1993-09-05
State of Origin:	Kano

Figure 11. Student Profile Page



Figure 12. Course Registration Page

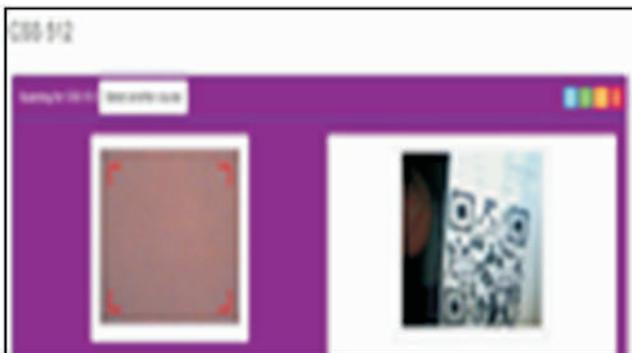


Figure 13. QR Code Scanned Page

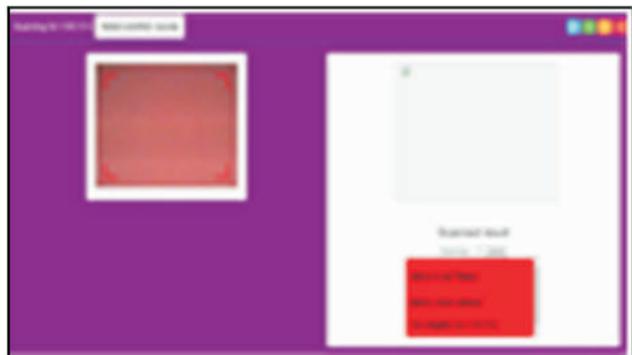


Figure 14. Not Eligible Status Page

eligible to write examination of the selected course (see Figure 15).

- Attendance List Page displays full name, matric number, sign in time, sign out time, information on examination course, and date as attendance list (see Figure 16).

Conclusion

In this paper, examination eligibility verification and attendance system were proposed to identify illegal students and eliminate impersonation. This was achieved using quick response code due to its attractive features, such as large capacity, small printout size, high-speed scan, and damage resistance. The EEV system leverages on the existing University database to access students' information online. It is an added functionality, which connects to the database for retrieval of information on course registration. Hence, the same QR code works for all sessions. Therefore, if a student does not register a particular course in a session and appear at the venue of examination for authentication and eligibility verification, the EEV system will identify him/her as not eligible to write that examination. Furthermore, the EEV system creates a log file that keeps track of eligible students as they sign in

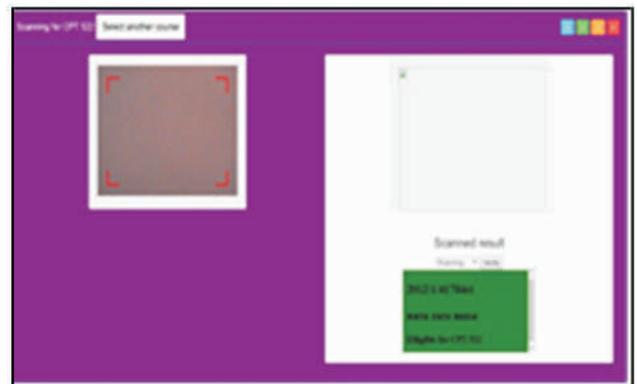


Figure 15. Eligible Status Page

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA				
INTRODUCTION TO DATA MINING 1 (CPT 522) EXAMINATION ATTENDANCE LIST				
2017/2018 ACADEMIC SESSION				
2018-05-13				
SN	STUDENT NAME	MATRIC NUMBER	SIGN IN	SIGN OUT
1	NEERA FATMA MUSA	201218219SCT	11:48:05	11:48:28
2	ABDULLAH MUSA BABALOGUN	201118213DCS	11:43:15	11:43:32
3	IRAH JOHANNI MOSES	201218209ACE	11:42:11	11:48:33
4	JOHN ISRAEL NATHAN	201118217SCT	11:42:05	11:45:48
5	MUHAMMAD YUSUF ALFI	201218214KCS	11:39:04	11:50:03
6	ESTHER MOSES BAWO	201218215SCT	11:28:19	11:50:39
7	MUHAMMAD TAUJUM BALOGUN	201218210KCS	11:30:35	11:49:10
8	SADEU HARUNA OME	201218219ACE	11:19:58	11:50:16
9	JOHNSON MICHAEL MUSA	201218218SCT	11:37:53	11:58:17

Figure 16. Attendance List Page

and out. To demonstrate the implementation of EEV system, smartphone was used to scan the generated QR code image, which took four seconds to authenticate and verify eligibility status of a student. This shows that 300 students can be verified in 20 minutes. Finally, smartphone can be used to check for eligibility conveniently as students queue up for entry to the venue of examination, thus leveraging ubiquitous devices that support mobility.

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