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Student Identity Card Based On Advanced Quick Response Code Technology

[1]Saheed Y.K. & [2]Salau-Ibrahim T.T.
[1,2]Department of Physical Sciences
Al-Hikmah University
Ilorin, Kwara State, Nigeria
[1]yksaheed@alhikmah.edu.ng [2]taofeekatsalau@gmail.com

Kadri A. F.
[3]Department of Computer Science
[3]Kwara State University
Malete, Ilorin, Kwara State, Nigeria
akeem.kadri@yahoo.com

[1]Corresponding author: 08142683364

ABSTRACT

All academic institutions have certain means for student's identity. Student identity card is an indispensable means of identification for every student's in Africa Universities and beyond. In this paper, we advance the current means of identification in Al-Hikmah University which is the student identification card by designing and developing a Quick Response code student identity card to replace the current student Identity card. We adopted the use of Quick Response (QR) code to generate student based identification card which can be achieved through the use of a virtual Server that keeps student record, generate a QR code using QR generator which will hold the link to each student details on the server. The developed system identifies students by scanning the QR code placed on the back of the student's identification card. Each black and whites 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. This new system which enhances data integrity and confidentiality ensures that there is a unique way of identifying an individual as an Al-Hikmah University student.

Keywords: Quick response code, Student identification card, University, Education

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1. INTRODUCTION AND BACKGROUND

Quick Response Codes (QR codes) offer a way of coding information into a matrix barcode, appropriate for 'reading' and decryption by a good vary of devices, as well as cell phones and computing tablets. After being developed for use in the Japanese automotive industry, QR codes became one among the foremost standard sorts of two dimensional barcodes.
According to (So, 2011) QR codes can literally hold any kind of information up to several thousand bytes. Coupled with a moderate equipped mobile device, it opens up a new horizon for many applications in the commercial world as well as in education. From hospital applications to labels of wine bottles, we can find QR codes everywhere commercially. In education, we believe that the movement of using QR codes is slow and still in its infancy. Many researchers are very excited about the technology and found the use of QR codes in education fun. They felt that the technology is easy to use, easy to implement, and, to a certain extent, low cost.

Now-a-days with rise of population, people need to be known and it's currently a requirement for each organization from a corporation to an oversized country to possess the identity card (ID) for the each individuals. Therefore, now for every instructional institute associate ID card for a student is compulsory. ID card is claimed to be the outline of any student so. It's extremely essential for an academic institute to produce ID card to every student of it. ID card is mostly thought of to be the outline of a student's information. This paper proposed the use of Quick Response (QR) code to generate student Based Identification Card which can be achieve through the use of a virtual Server that keeps student record, generate a QR code using QR generator which will hold the link to each student details on the server and lastly fetch and output students picture, registration details and courses registered; this proposed QR based Student ID card can also be used for examination card and also in lieu of course registration form.

1.1 Identity Card

We can define an identity document as the document that help to make the proper verification of the personal identity of a person (Sanaul and Richard, 2014). The ID is also known as the portion of identification or the paper of any person. It is a small standard size card and usually called the identity card that can be easily kept in a pocket or inside wallet. A card can show data of the identification about any person including names (first name, surname, last name), age, address, a passport photograph to have color of body, hair and eyes. These types identification are used commonly in place of school for the student, companies for the employees. Therefore it can be said that student ID card is the card of identification which is used for holding specific characteristic of students. We can compare the traditional ID of higher institutions in developing country, it will only contain all the details with hand written and anyone can make the fake ID card easily. When administrator make ID card with his or her hand writing then it can be filled of error and mistake. Sometimes they made the mistake of writing wrong name with spelling and so on.

1.2 Problem Statement

Educational institution in Nigeria is a vast sector and it is expanding rapidly. With the rapid growth of technologies and in security in the country, educational institutions are lagging behind. For identification of students some still relied on manual handwritten ID card and files and anyone can make the fake ID card easily. If proper ID card system is introduced then it would be much easier to identify a student, track his/her progress, improve efficiency in the identification, high speed operation, saves time, efficient and reliable, therefore comes the need to implement the advanced use of QR code for student Based Identification, as it is free. Thus, ID card will be a perfect use of modern technology in Africa and beyond.

Identification practices carried out using the identification card process which is the conventional way of identification in our society today faces serious challenges which to some extent render the whole system virtually useless for failing to meet up to the current security challenges in our society.

These problems are outlined below:

i. The inability of the identification process to check the genuineness of an identification card.
ii. The ease of counterfeiting of identification cards.
iii. The absence of security motive.
iv. Difficulty in accessing the database of identification systems.

The aforementioned shortcomings among others serve as the justification for the proposed student identity card based on Quick response code technology.

1.3 Understanding QR Codes

QR Code is a form of 2D bar codes. A sample is shown in Figure 1. It was developed by Denso-Wave, a Japanese automatic data capture equipment company (Denso, 2009), in 1994. “QR” stands for “Quick Response.” It is readable by moderately equipped mobile phones with cameras and QR scanners. Information such as URL, SMS, contact information and plain text can be embedded into the two dimensional matrix. With smart phones, we can visit the Website linked by the URL quickly, we can send the SMS message directly or we can save the contact information onto the address book easily. This format of 2D bar codes is so popular in Japan and emerges gradually around the world because the patent right owned by Denso Wave is not exercised (Denso, 2010a).

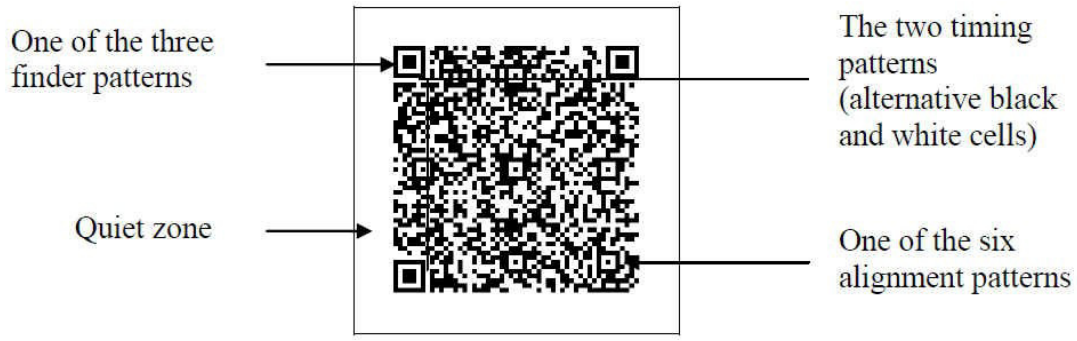

Figure 1: A QR code sample

A QR code is capable of holding 7,089 numeric characters, 4,296 alphanumeric characters, 2,953 binary bytes, 1,817 Kanji characters or a mixture of them. The data capacity is much higher than other 2D codes such as PDF417, Data Matrix and Maxi Code (Denso, 2010b). It stores information in both vertical and horizontal directions. A QR code can be read from any direction in 360° through position detection patterns located at the three corners as shown in Figure 1. A QR code can be read even it is somewhat distorted by either being tilted or on a curved surface by alignment patterns and timing patterns. The error correction capability against dirt and damage can be up to 30%. A linking functionality is possible for a QR code to be represented by up to 16 QR codes at maximum so that a small printing space is possible. The size of a QR code can vary from 21x21 cells to 177x177 cells by 4 cell-increments in both horizontal and vertical direction. Data can be easily encrypted in a QR code to provide a confidentiality of information embedded in the code.

2. USING QR CODES IN EDUCATION

The study of QR codes in education can be placed in the context of mobile learning. Mobile learning is a major field of research in education (Kukulska-Hulme, 2005; Naismith et al., 2005; Pachler, 2010; Sharples, 2007). Before we go on to provide the literature review of QR codes in education, we would like to highlight the salient characteristics of mobile learning and guide the readers to understand our motive behind this research. The trinity of "location independence," "time independence" and "meaningful content" is the most important aspect in the study of mobile learning (So, 2008). These three dimensions are the salient characteristics of mobile learning and distinguish from the related fields of e-learning or web-based learning. "Location independence" refers to learning not restricted to a fixed location. Locations include indoor and outdoor settings. "Time independence" means that learning may extend beyond the discrete classroom learning time, but into other informal learning environment at suitable time. We refrain from using the phrase, "anyplace and anytime," a slogan commonly used in mobile learning. This is because the phrase is over simplification and somewhat propagandistic. "Meaningful content" refers to the content not only at the semantic level. We need to consider whether the content is suitable to be delivered with the media, devices and communication settings as well.

2.1 Examples of applying QR codes in Education

The movement of using QR codes in education is still in its infancy. We have only a few examples which can be drawn from the literature as discussed. The University of Bath is the forerunner of applying QR codes in education. Some educational applications using QR codes are reported in the following:

1. For each catalogue search at the library of the University, a QR code will also be displayed automatically to summarize the key information, the title, the author, and the shelf location as shown in Figure 2.
2. Student assignment submission to the Faculty of Engineering & Design needs to accompany with a coversheet bearing the relevant QR code as shown in Figure 3.

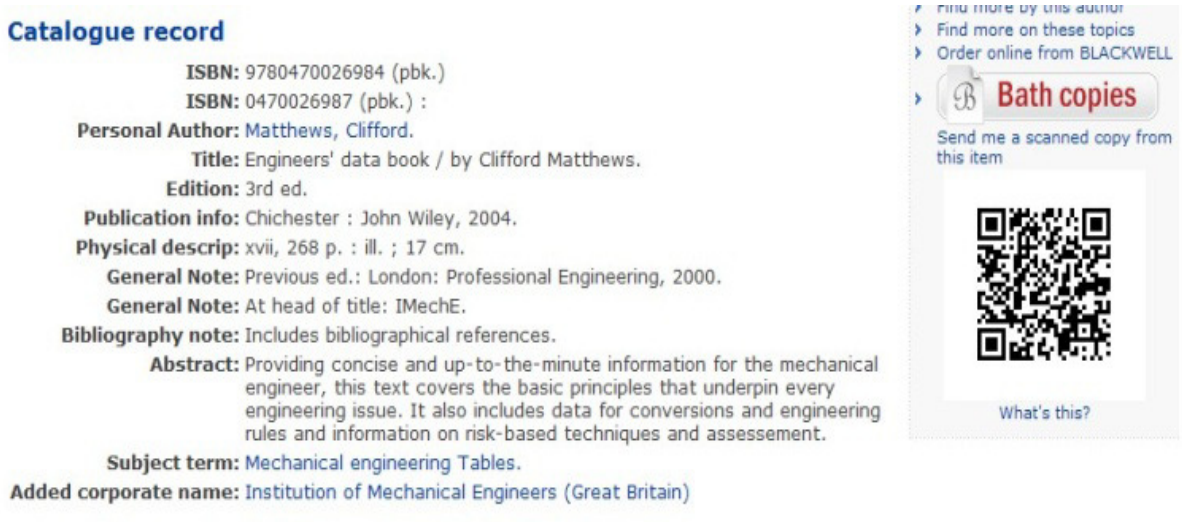

Figure 2: A catalogue sample from the library of the University of Bath (Law & So, 2010).

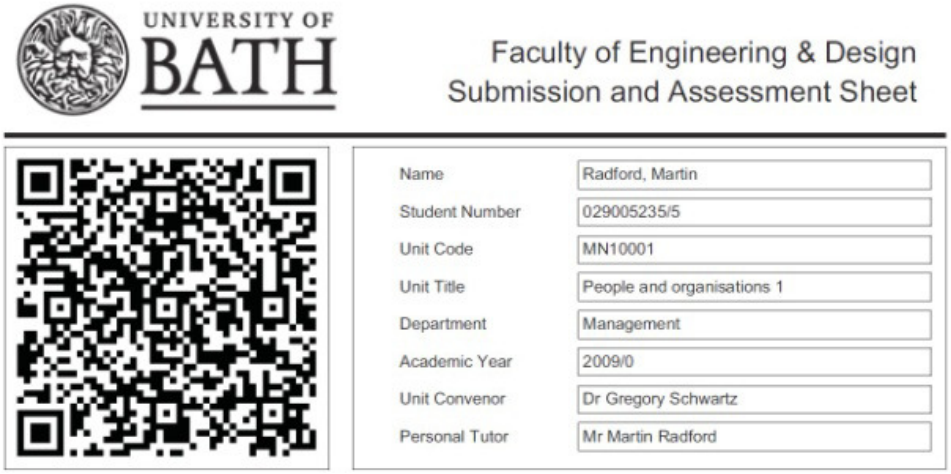

Figure 3: A student assignment submission sheet from the University of Bath (Law & So, 2010).

1) QR codes are automatically added to the bottom of Moodle print-outs. The QR code contains the URL of the page on that particular Moodle course.
2) QR codes can also be found on posters around campus, on Websites and service blogs for bookmarking, in handbooks linking to activities, and in marketing materials from departments.

Huang et al., (2008) integrated Pocket PCs and QR codes to provide a ubiquitous learning environment for primary students to explore life science subjects such as trees. The authors conducted a pre-test and post-test study with two groups of students (i.e., control and experiment groups) to find out the effectiveness for the described ubiquitous learning environment.
A student designed a QR-code periodic table of chemical elements in Italy as shown in figure 4 (Rizzo, 2009)

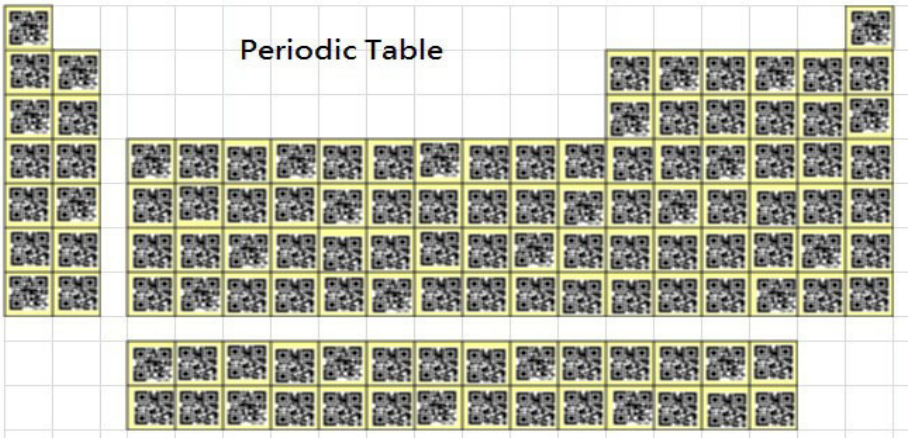

Figure 4: The layout of a periodic table with QR codes
(The original illustration could be found in http://www.qrcode.es/?p=350&language=en)

2.3 Function and Algorithm of QR Code

According to (Sanaul and Richard, 2014), normally the QR code provides the functions which have six major parts:

i. Three Position Detection Pattern: At the three corner out of the four corners the three codes are located which are called position detection pattern are three position detection pattern.

ii. Timing Pattern Code: In order to identify the location of each and every cell inside the QR code, the timing pattern code is greatly used. All the things are done by the decoder application.

iii. Reed- Solomon Error Detection: If $(x_1, x_2, ..., x_n)$ is the input sequence of the values of n in a field F then the codebook will be the input sequence of n distinct values over the finite field F; then the codebook C will be $\{(f(x_1), f(x_2),\ldots,f(x))/f\sum f/x/, \deg(f) <k\}$ (1)
Here, f[x] = polynomial ring.
The input sequence $(x_1, x_2,.., x_3)$ of value n = N is made as $(0, K, K,\ldots K^{N-2})$, K=Primitive root.

iv. Data Area: Into data area the error correction codes are inserted where the each and every cell is saved in the form of binary number.

v. Buffer Zone or Quite Zone: This zone is used for isolation of code from the information of different packaging.

vi. Alignment Pattern: When code is being curved then the QR code makes the correction for the distortion. The alignment corner is in the corner of lower right (Sprague, 2012).

3. DESCRIPTION OF THE PROPOSED SYSTEM

The proposed system will identify the student by scanning the QR code placed on the back of the student's identification card. Each black and whites box on the code, when scan is translated to digital information; which will allow the computer to access the database and provide the student academic record. This new system would ensure that there is a unique way of identifying an individual as an Al-Hikmah university student and the system would have high integrity, confidentiality, be accessible and non-repudiating. It would be such that when a student ID card is scanned and his/her identity is obtained, it should be possible to ascertain that they are who they say they are and this can be repeated everywhere around the country with the same result. The system would be the pure automated solution and it will help to generate student Identification card easily. It is a special type of software, which will be used to make an advance ID card using QR code instead of the barcode. The QR code would be attached at the back of each student's ID card and the information that would be embedded in the QR code will contain unique data of the student such as matriculation number, department, faculty, Level, course registered and all other important information about the student. Students are able to make use of the card only by swiping their identity card through the QR code scanner.

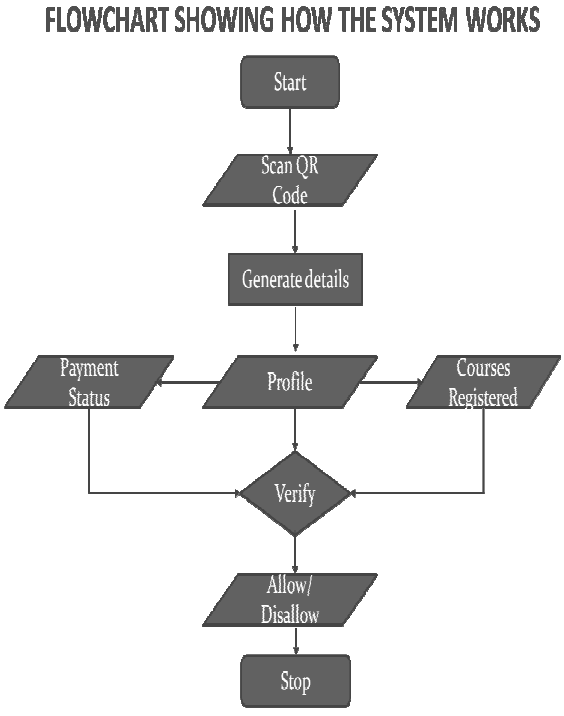

Figure 5: Flowchart of the proposed system

3.1 Advantages Of The Proposed System

The designed system is a fully automated system, reliable, fast, accurate and eliminates paper work. It saves time, cost-effective, difficult to replicate or simulate and difficult to alter. This proposed system will eliminate any possibilities of identity theft and ID card forgery.

4. RESULTS AND DISCUSSION

4.1 Module Description

The system should be designed in such a way that only authorized people should be allowed to access some particular modules. The records should be modified by only administrators and no one else. The user should always be in control of the application and not the vice versa. The user interface should be consistent so that the user can handle the application with ease and speed. The application should be visually, conceptually clear.

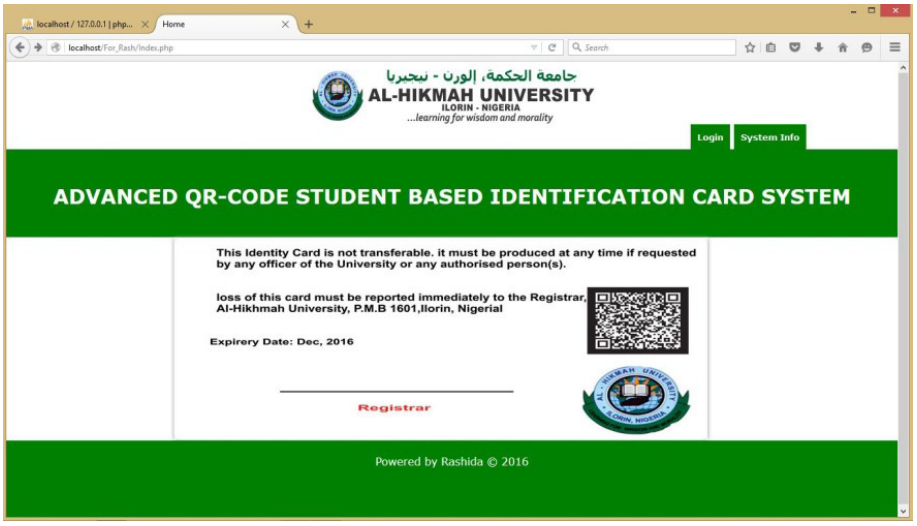

Figure 5: QR-Code Student Based ID card interface

4.2 Control Center module

This module allows the registration of new user of the system, register student, search, register user and provide update of existing user.

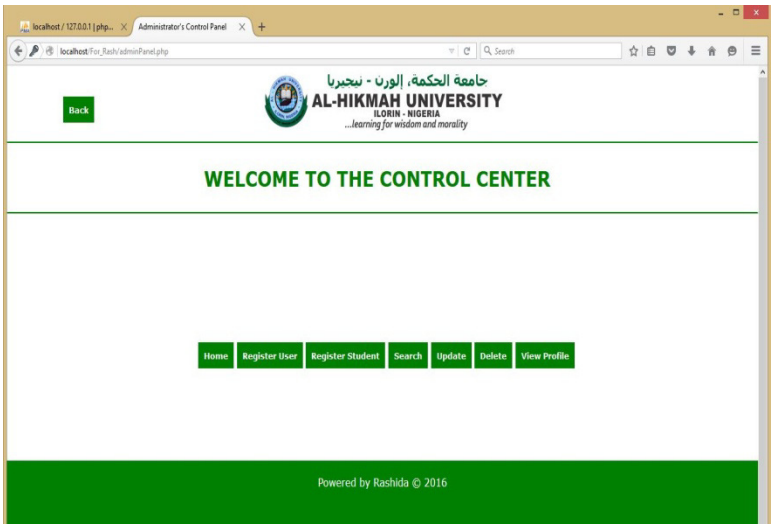

Figure 6: Control Centre of the proposed ID card scheme

4.3 Student Profile Interface

This interface serves the purpose of providing all the necessary information about a student.

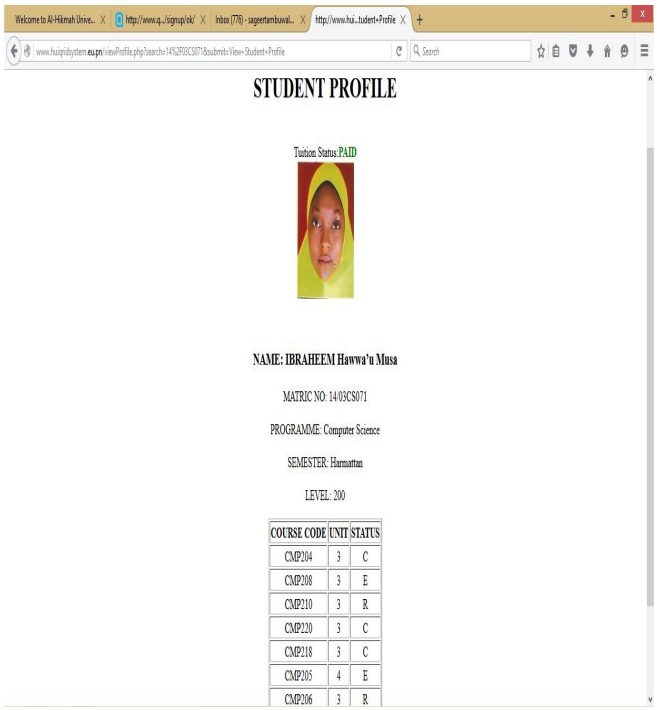

Figure 7: Student profile with tuition status completed

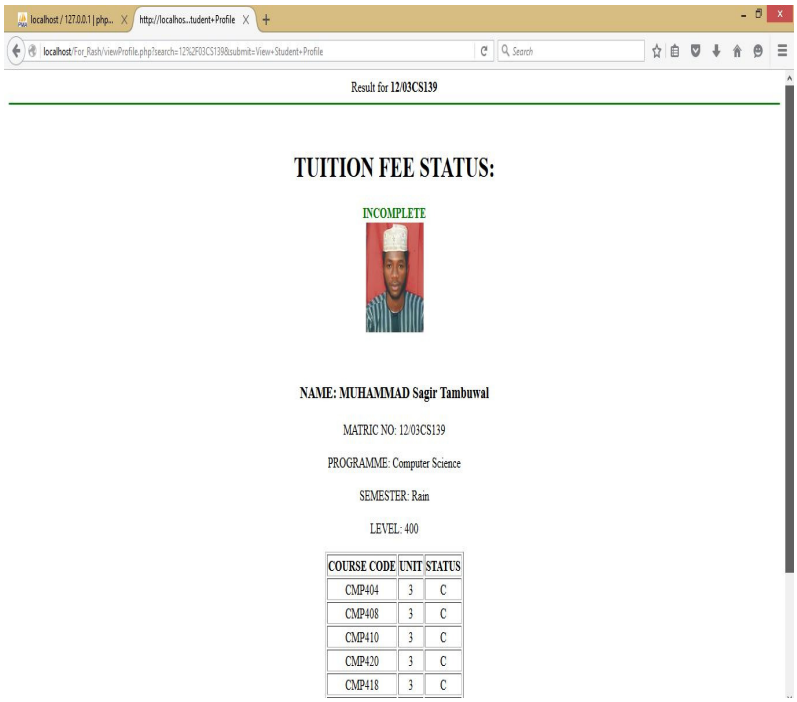

Figure 8: Student profile without tuition status in-completed

4.4 QR code based student ID card

This card is more reliable, efficient and not easy to forge.

Figure 9: Front view of the proposesd ID card

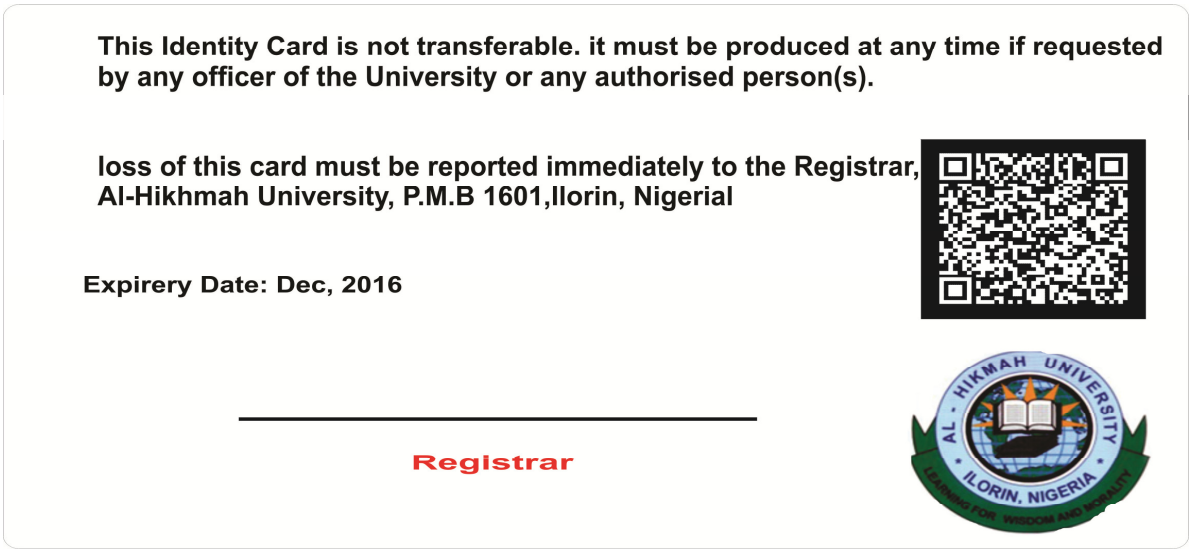

Figure 10: Back view of the proposed ID card

5. EVALUATION

Data was collected and analyzed to get the best result from the requirements of the users of the system. Then we compare our ID card with other ID card available in the market and comparing all the facilities as well, see Table 1. Therefore it can be said that QR code is much better than any other ID card to make the ID card perfect.

Table1. COMPARING QR Based ID CARD & OTHER ID

Metrics/Features	Traditional ID card	Normal ID card	QR ID card
Type of ID card	Handwritten	Bar code ID card	QR code ID card
Cost	Not free	Not free	Free
Scan speed of barcode from smart phone	Do not have any facility	2.5 seconds	3 seconds
Swapping speed to open security gate	Not valid	3 seconds	1.5 seconds
Information in each Code	Do not have Any	Hundreds of characters only	5000 characters
Passport photograph option	No	Yes	Yes

6. CONCLUSION

In this paper, we proposed an advanced QR code based student identification card which can replace the students identity card that are been used presently in majority of Africa Universities and beyond. This new system provides a unique way of identifying an individual as a student. The proposed identity card can be used for other purposes as against the present ID card that can be used for identification alone. This card can serves as examination ID card because all the courses registered can be revealed by just a scan of the proposed ID card on the QR scanner. It will eliminate the issuance of examination card and the issue of impersonation. Computerization of the student identity card will reduce the human stress of traditional student identity card.
This proposed work is therefore recommended for Nigeria Universities and other institutions who may appreciate the beauty of this work. In future, we intend to provide a means of results generation of each student by just a scan of QR code card on the scanner and also a provision for a feature that will allow students to receive confirmation e-mail whenever they are registered in the system.

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