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Android Based Examination Monitoring System Using Identity Cards Embedded With Qr Codes

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Abstract –
The android based examination monitoring system was borne out of the daunting challenges faced by examiners in differentiating between authentic candidates and impersonators.it is the use of ID cards embedded with QR codes to admit students into examination halls. The system scans the QR code on the ID card and extracts the biometrics of the holder. Physical comparison is made to ascertain if the holder is the authentic owner of the card. In the exam hall, the video of a student caught cheating at real time is taken without the student knowing. This video record can be viewed from the android or by the Admin. The methodology employed here is the Object Oriented Programming (OOP) Methodology. This methodology is a strategy for designing and developing programs using object technology. UML Prototyping was also adopted. This involves the use of Unified Modeling Language (UML). Such UML used include Use Case and Activity Diagram. These methodologies facilitated the use of competent high level programming tools during the development of the software. The system is capable of ending impersonation and reducing other forms of examination malpractices to the barest minimum.

Keywords: *Examination, Monitoring, QR Code, Scanner, Biometrics*

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I. BACKGROUND

The unethical conduct associated with the examination is a serious issue that needs to be attended to. As the level of security breaches and transaction fraud increases, the need for highly secured personal verification technology and real time examination monitoring is fast becoming apparent [1]..

In most tertiary institutions in Nigeria, examination cards given to student are without either means of authentication or verification, apart from the student's photo embedded on it, the name of the student, his registration number and department. With the advent and access to innovative technology, such examination cards are susceptible to cloning by persons who may be desperate to be students of particular department, or have ulterior plans. This simple method of examination monitoring leads to different methods of malpractices [2] [3]. Therefore, there is a need for a mobile and accessible exams card authentication system as solution to both physical security and certain administrative duties that demand examination monitoring. This work proposes an embedded QR-code on examination card to be given to students and introduction of Smartphone App which will be used to authenticate and verify the QR-codes on these cards.

Since there is proliferation of mobile phone users in recent times, coupled with the fact that smart phone prices are now affordable, it is assumed that the potential users of the proposed system presented in this research would have been used to the operation of smart phones. Thus, the proposed system will be accessible to these intending users at no additional cost and less training. This research presents an examination monitoring system utilizing smart phone for reading and recognizing of QR-code embedded within an examination card using the in-built camera function of smart phones in an offline and real-time basis. Being an offline system, the proposed system is not hooked to the supply of network connection for its deployment unlike other existing systems. Therefore, making it deployable anywhere, anytime, even in remote areas where there are no networks.

The proposed Examination Monitoring System as an Android Mobile Application uses Students ID Cards embedded with Quick Response (QR) Codes. In authentication, the system reads the QR Code on the Student's ID Card, retrieves his registration number, and matches same with what the student submitted during registration and now included in the school database. With the student's registration number as the primary key, the system displays his/her biometrics from his/her record in the database and compares with the student's physical features. The system also has the capacity to register the student's attendance and malpractices at real time.

The system can be linked with the School's Central Database so that the student's bio-data can be accessed directly from the database.

II. PREVIOUS RELATED WORKS

In a paper presented by [4] personalized data, signature and picture of card holders were captured, while the system dynamically generated 2D Barcode that represents captured data and affixed this barcode image on card . The card was thereafter used to validate and authenticate the holder within the central database online. The basic idea behind the authentication was to match the encrypted unique ID of the person within the barcodes with the one within the central database. The work presented by these researchers depends on the availability of network for its operation.

Similarly, [5], in their work, applied the utilization of QR Code and Smart phone to Degree Certificate verification and authentication. The verification process scans the QR-code embedded on the certificate (M1) and decrypts the signature from the university's public key in order to generate the hash value (M2). If the hashed value generated from M1, matched that of M2, then the certificate under authentication test is passed or otherwise. This work does not look in the direction of an offline system that will save the technicality demands and cost requirements of an online system. Review of the earlier stated systems show that they are all online systems. That is, their operation is solely dependent to the availability of a network connection. For the certificate to pass the authentication process, the hashed value generated from the certificate must match that of the university's public key otherwise, the certificate will not pass the authentication process.

[6], [7], [8] proposed an online attendance system for both the staff and student using QR code and Smartphone. In this work, the Staff is required to generate a QR code that would be scanned by the students and sent through the wireless network for necessary automatic attendance checking. In other to avoid proxy of attendance, [8] Introduced fingerprint and voice verification to authenticate the attendance system.

[9] Proposed an embedded QR code on identity card to be given to students and introducing Smartphone App to authenticate the embedded QR code. Their proposed system is an offline system which does not require a network connection for authentication. The major shortcoming of their work is that student matriculation number has to be manually inputted before authentication.

Another set of authors in [10] designed and developed an effective and secure fingerprint-based biometric attendance device (ESFB2A). The device developed helped in reducing the workload and stress of inspecting each students attendance and calculation errors when obtaining the total attendance. The data from previous manual attendance data from another type of biometric device, the current manual based method and the fingerprint device developed were compared. The previous biometric device recorded a time of 13.81 seconds while the newly developed ESFB2A recorded a time of 13.08 seconds. The average execution time for the other type of biometric device yielded 16 seconds while that of the newly developed ESFB2A yielded 11 seconds.

A device providing an improvised electronic card and card reader serially interfaced to a digital computer known as an embedded computer based attendance management system was proposed by [11]

The authors in [12] developed an automated attendance monitoring system using an Android platform. In their work, the results showed satisfactory improvements in accuracy as compared to using user-based paper-based approach. Their proposed technique provided an easy way of generating adequate reports. According to [13] in a bid to tackle the issues of examination malpractices, the management of West African Examinations Council (WAEC) introduced an ICT device. The device, Candidate Identity Verification, Attendance, Malpractice and Post Examination Management System (CIVAMPEMS), works using the mobile, handheld terminal, REFID Smartcards and UV torch light. The device can produce students' subject information, while the invigilator/supervisor can use it to register candidate's attendance at examination and record malpractice committed by a student during the exam, as well as confirm exam code and handle candidates without cards.

[14] and [15] proposed a system to electronically monitor the university examination arena, capture, record and store whatever transpires from the start of the examination to the end. Using the CCTV camera. Videoing starts immediately the exam starts and stops when the exam ends. The video feed is uploaded directly to a webserver using the File Transfer Protocol (FTP).

It is based on the above research works and the inherent flaws that gave rise to this project that uses ID cards embedded with QR codes to admit authentic students into examination halls. According to [16] and [17] Quick Response codes or in brief QR-codes, are two dimensional (2D) matrix barcodes that are scanned using web capable smart mobile phones having camera, with QR Reader put in as default application, allows one to access some pre-written content such as a web site address, email address, details of things within the catalogue, phone numbers etc

[18], [19], and [20] stated that QR-code is a reasonably 2-D zymology developed by Toyota subsidiary Denso Wave in 1994 with the first aim of being a symbol that is easily decoded by scanner instrumentation at high speed with additional knowledge content than conventional barcodes. Conventional Universal Product Code contains decoded data in one direction i.e. vertically into bars and house in between; whereas QR-code contains decoded data in each of the directions i.e. vertical and horizontal direction. QR-code is capable of holding additional volume of data than barcode, which is even an entire bunch of times as abundant data.. According to [21], QR codes can be used on various mobile device operating systems. Both Android and iOS devices can

natively scan QR codes without downloading an external app. The camera app is able to scan and display the kind of QR code along with the link . These devices support URL redirection, which allows QR codes to send metadata to existing applications on the device. Many free apps ar e available with the ability to scan the codes and hard-link to an external URL.

According to [22], the following are steps for creating a QR code:
1. Choose a QR code Generator
2. Determine the type of content
3. Enter the content in the QR code generator using the input field or option provided
4. Customize the QR code according to your preferences
5. Generate the QR code
6. Download or save the QR code generated.
7. Test the QR code using a QR code scanner before usage

III. SYSTEMS ANALYSIS

Most of the current systems do not make use of the QR-code concepts. In the current examination card system, students will register their courses which they will sit for during the examination and after the registration, an e-photo card is brought to the exam hall, but this is still not a strong measure of security because the card will be observed/inspected to check the passport photograph and compare to the holder. Any student who is not capable of writing the exam due to laziness or corruption/malpractice in studies might pay someone else to write the exam for him/her. The person involved is the impersonator. In the university system, not all students are known by the lecturers. A student simply arrives at the exam hall for the exam and enters with his exams card without being checked properly if he/she is a student of the department/faculty. As a result, students from other department/faculty can come and impersonate for other students. This is now common among youths and graduating students since there is no] proper security check for the students to ascertain if truly, they are made to write the course and if the student is from that department/faculty. Those systems that use the QR code are usually configured to perform a single task and are mostly dependent on network connection. For some other systems, like WAEC, the system is configured in such a way as to be used in a special device and not on android phones. The existing systems have the following flaws:

i. Ineffective in its application and comprehension of the act of exam impersonation.
ii. It deals with the process of authorization. This is a concept of what you have which can be manipulated at any time.
iii. Matching to establish security measures occur through the physical eye and this is a very big problem and requires great power of recognition, hence an impersonator can be present without being recognized.

The new system aims at developing and implementing an easy and affordable QR Code System on the Students' ID cards containing his biodata and academic records. A database shall be created to store information of students and their academic records. A mobile application to be embedded on android phones capable of scanning the QR Code System and accessing the Student's records in the database shall also be developed for the new system. This system shall be capable of verifying the authenticity of students' ID cards, marking their attendance at real time and reporting examination malpractices at real time, including taking the photograph of the student caught.

The system will identify the student by scanning the QR-code placed on the student's examination card. Each black and white box on the code, when scanned is translated to digital information, which will allow the computer to access the database and provide the student's record. This new system would ensure that there is a unique way of identifying an individual as EBSU student and the system would have high integrity, confidentiality, be accessible and non-repudiating. It would be such that when a student's exam 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/exams card easily. It is a special type of software, which will be used to make an advanced examination card using QR-code instead of the barcode. The QR-code would be attached to each student's examination card and the information that would be embedded in the QR-code will contain unique data of the student such as registration number, department, faculty, Level, course registered and all other important information about the student.

The Object Oriented Programming Methodology was the methodology adopted for this research. This is because, the methodology is a strategy for designing and developing programs using object technology (classes, encapsulation, inheritance, and polymorphism). Prototyping was adopted. This involves the use of Unified Modeling Language (UML). Such Unified Modeling Language used include Use Case, Data Flow Diagram and Class Diagram. These methodologies facilitated the use of competent high level programming tools during the development of the software.

Below are the reasons for the choice of Object Oriented Methodology for this research work:

i. it allows changes more easily
ii. It represents the problem domain, because it is easier to produce and understand designs
iii. It makes easy to reuse the code in a new system
iv. It increases quality due to program re-use
v. It makes code easier to maintain separately, and locating and fixing problems easier
vi. It reduces the software object's model complexity and makes the program structure very clear
vii. It provides nice structure for thinking, abstraction and leads to modular design

Flowchart for the new system is depicted in figure 1.

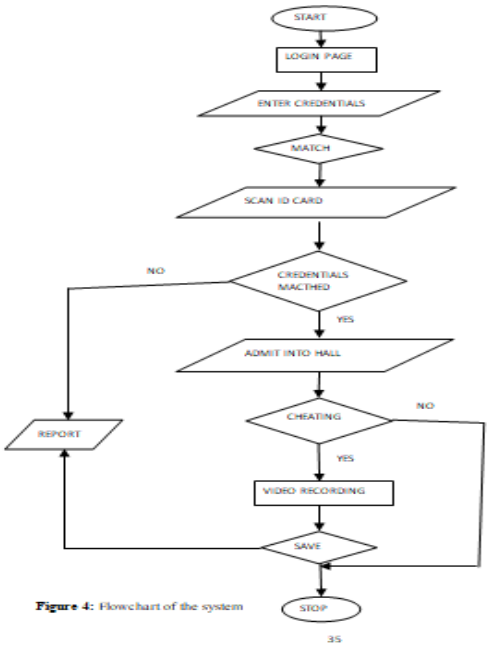

FIGURE 1: Flowchart of the New System

Use Case diagram in figure 2 describe what a system does from the standpoint of an external observer. The emphasis of use case diagrams is on what a system does rather than how. They are used to show the interactions between users of the system and the system. A use case represents the several users called actors and the different ways in which they interact with the system. The actors are the Admin, lecturers and the students

Below is the diagram of the use case for the system.

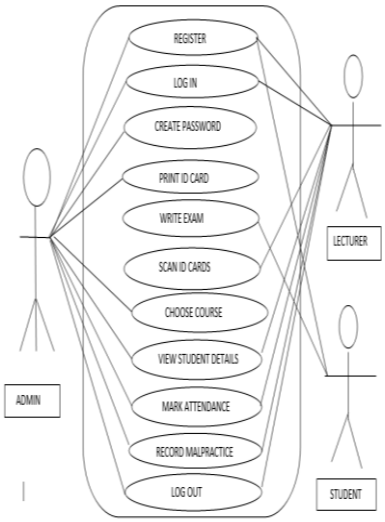

FIGURE 2: Use Case Diagram of the New System

In the activity diagram in figure 3, the functions to be performed by the Admin are listed. From the figure, the admin can create password for the lecturers, add the users (lecturers' data), add courses offered by the students, view the courses, register the students with their biometrics, add departments of the students, view the video records of a cheating student, and delete unwanted/unnecessary records.

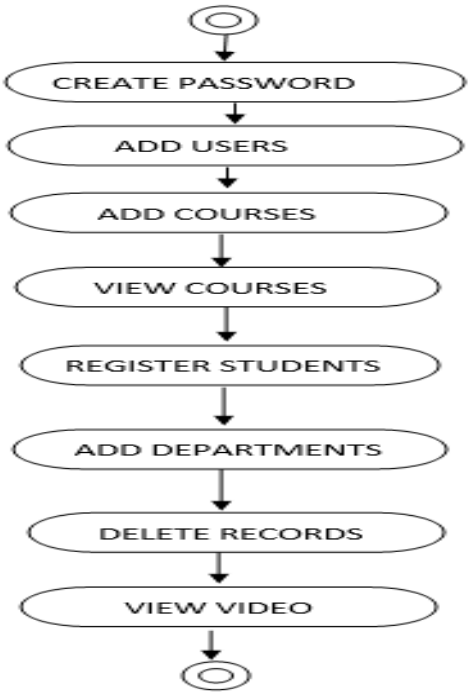

Figure 3: Activity diagram of the Admin

In the activity diagram in figure 4, the functions to be performed by the Lecturer are listed. From the figure, the lecturer can log in with his credentials, scan student ID Cards, view student biometrics, record video, save video and logout.

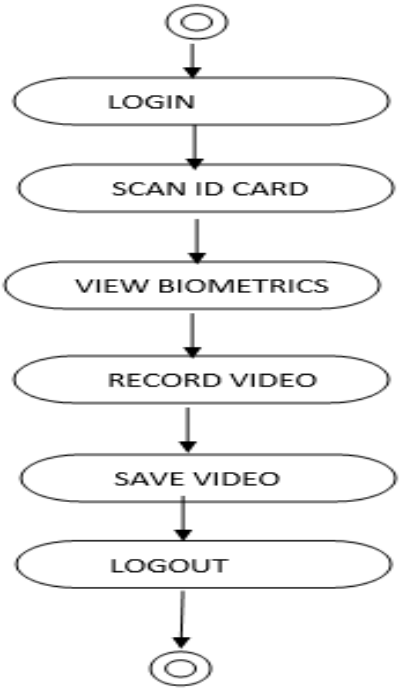

Figure 4: Activity diagram of the Lecturer

In the activity diagram in figure 5, the functions to be performed by the Student are listed. From the figure, the student can provide biometrics, register courses, provide ID card for entry into the hall and write exam.

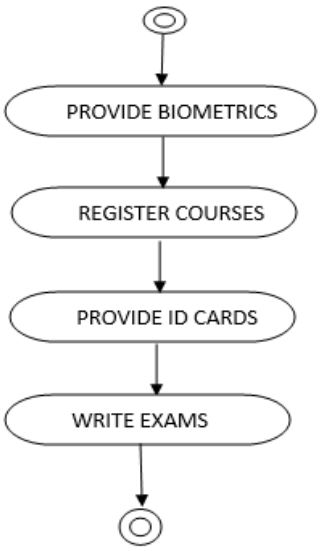

Figure 5: activity diagram of the Students

IV. SYSTEM DESIGN, RESULT AND DISCUSSION

The main menu provides links and buttons for accessing modules within the system. Design of the main menu emphasized the action buttons to be used to access the system. The arrangement, operation and performance of all input in the system were so specified so as to capture data at any point in time. There are three main inputs to the system, registration/sign up input, Login input and the video input. The system user is expected to register as a new user wherein he/ she will enter some of their personal details to gain access to the system. In the registration input, the Admin registers the Lecturers as the users and captures the students' biometrics. In the Login Input, the user will provide his/her username and password. Output specification entails the result from a given input to the system, or information obtained from processing data that was fed into the computer system. From the developed system the output shows the biometrics of the student once the ID card is scanned. The database of the system describes an organized collection of data and its specification refers to the explicit requirements to be satisfied by the system database. The system can run as an android based APP. The application requires an android phone with a version of 5.0 and above and a computer system. It has a characteristic of mobility, autonomy, collaborative behavior and adaptability that makes it easy to use and occupies less space in its environment. The internal memory size of 2GB is enough to execute the mobile App version. The Random access memory (RAM) should be at least 1GB with Hard Disk Drive of at least 50GB. The user interface of any application is one of the most important aspects of the application because it is the part of the application that the users interact with. Figure 4 is the main menu design with its various input and buttons. Figures 6 and 7 are the login page for the Admin and the database.

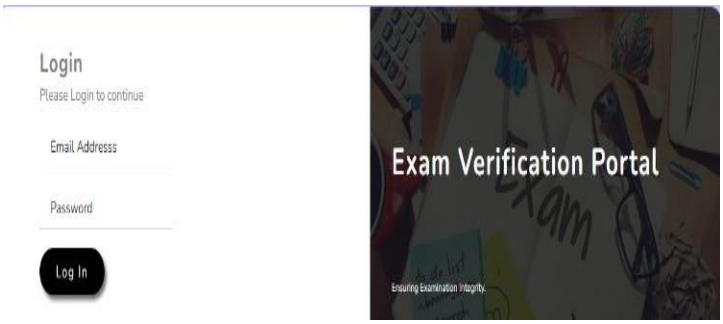

Figure 6: Admin Login Page

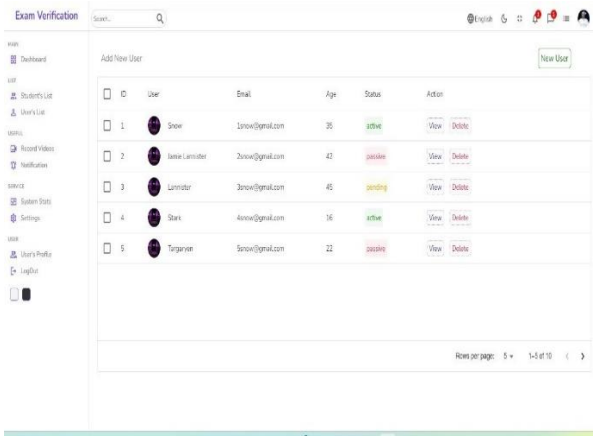

Figure 7: System Database

Figures 8 to 17 show the system application interface and the various output pages for effective examination monitoring.

Figure 8: Application Interface

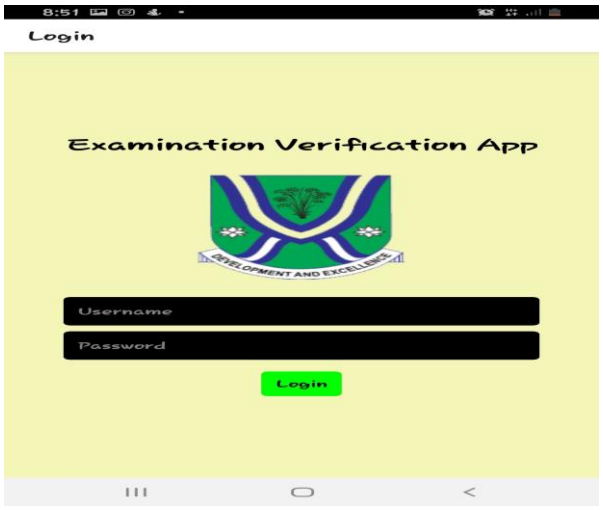

Figure 9: User Login

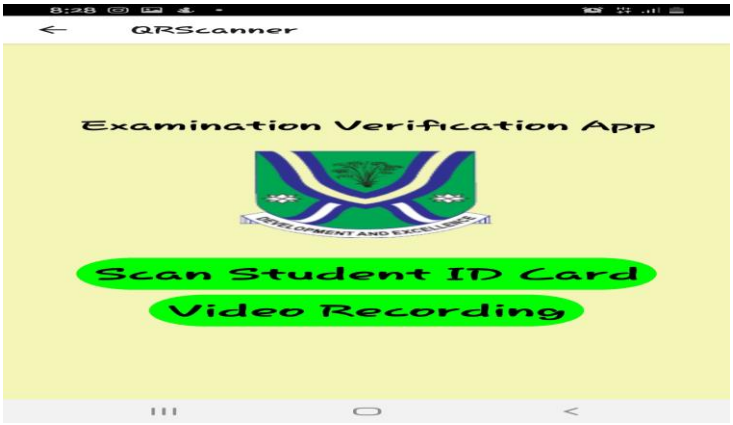

Figure 10: Scan ID Card/ Record Video page

Figure 11: QR Scanner

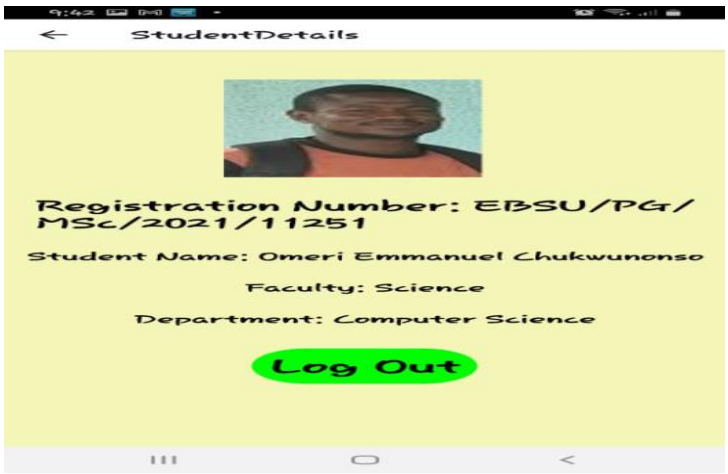

Figure 12: Student Biometrics Page

Figure 13: Video Recording Page

Figure 14: Stop recording Page

Figure 15: Save Video Record Page

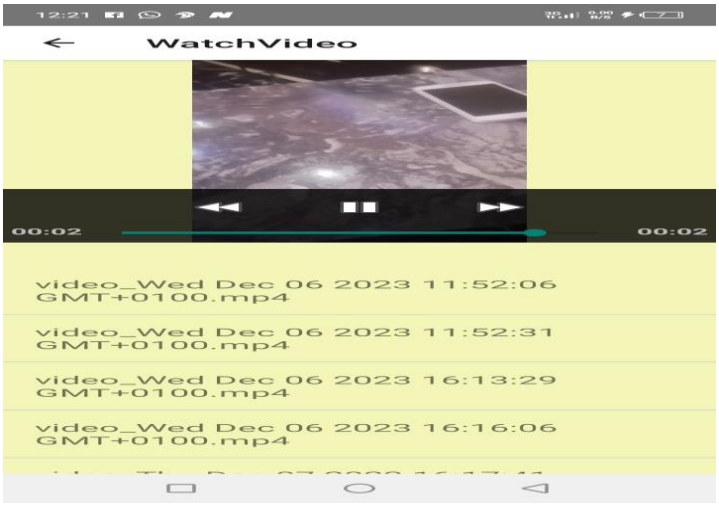

Figure 16: Watch Recorded Video

Figure 17: Logout Page

Android Based Examination Monitoring System, as shown above, makes it easier to an examiner to monitor the examination hall with ease from the beginning to the end. It allows the user to authenticate the students ID cards, take attendance, stop impersonation and capture the video of students seen cheating in the hall. It will replace the old system were ID cards are faked and impersonators admitted into the hall. The system identifies a student by scanning the QR-code placed on the student's examination card. Each black and white box on the code, when scanned is translated to digital information, which will allow the computer to access the database and provide the student's record. This new system ensures that there is a unique way of identifying an individual as a student and the system has a high integrity, confidentiality, accessible and non-repudiating. It is such that when a student's exam card is scanned and his/her identity is obtained, it is 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 is pure automated solution and helps to generate student Identification/exams card easily. It is a special type of software, used to make an advanced examination card using QR-code instead of the barcode. The QR-code is attached to each student's examination card and the information embedded in the QR-code contains unique data of the student such as registration number, department, faculty, course registered and all other important information about the student. Once the ID card is scanned, the system sends the record to the database, which registers the student attendance and displays the biometrics. A student caught cheating in the hall can also be recorded at real time and the video sent to the database when saved. Such video can be watch by the admin in the database or the user using his android phone.

V. CONCLUSION

This project was successfully carried out with some achievements such as eliminating the weaknesses of the manual identification and admission of students into the hall, writing of their attendance using paper and pen which may be lost in transmission, and assaults, threats and denials associated with reporting some students caught cheating in the hall. It also reduces cost in implementation and time spend to view records as compared to

the CCTV camera. In this new system, all the students' biometrics are in the central database to be retrieved once their ID cards are scanned and authenticated.

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