

# An Implementation of Secure Exam Management System

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*Abstract*— Today there are two forms of training and education: Distance education and Conventional education. Mobile learning, or "M-Learning", offers modern ways to support learning process through mobile devices, such as handheld and tablet computers, smartphones and mobile phones. For increasing the learning awareness and understanding of teachers and students Mobile learning is necessary. Online examination is necessary part of the M-learning and secure authentication is the most important parameter for success of M-learning. Hence, conducting the exam in open environment and providing security to them where each student is using her or his mobile phones, laptops or tablets which are connected to the internet through Wi-Fi network. This paper discusses the implementation of secure exam management system. The paper discusses about system which consist of online examination, secure authentication and secure environment for examination.

**Key words:** LMS; Moodle; M-learning; SEMS

## I. INTRODUCTION

Over worldwide every institution conducts the exam to judge knowledge of students. Till 20<sup>th</sup> century offline exams were conducted. Now a day's many colleges and universities such as University of Pune [11], Jawaharlal Nehru University, Hyderabad [12], National Institute of Electronics and Information Technology [13] offer online examination. After huge evolution in VLSI industry, the chips with good quality are manufactured and which results in increase in manufacturing of smartphones. As smartphones are available with almost every student it is essential that students should able to give exam online through their own devices.

Mobile devices are more comfortable than desktop computers and have a less costly technique. According to the Horizon report 2015, it is expected that Bring Your Own Device (BYOD) learning technology is accepted by Institutions in one year time or less to make use of mobile and the online learning [7]. It is expected that the number of smart phones users for 2019 will be 5.61 billion globally which is 3 times that for 2013[8]. The mobile learning or M-Learning means use of mobile and hand-held devices like mobile phones, laptops, PDAs and computer technologies in educational use.

Learning management systems (LMSs) is very important part of M-learning so that it has been used by many organizations. Nowadays, LMSs has achieved great success worldwide. 74% of US corporations and educational institutions currently using LMS [2]. Over 90% universities and the colleges in Spain use an LMS [3]. 29% of the organizations like banking sector, retailing sector, etc. in Turkey uses E-learning applications [4]. The annual growth rate of market for LMS is estimated of about 25% through the year 2018[6].

### A. Challenges of M-Learning [19]

- No two way street communication, training sessions, practical expertise or technical troubleshooting with mobile devices [14], [15].
- No additional institutional support is provided [14], [15].
- Problems with the parts and equipments of another system in LMSs [16].
- Safeguard, Privacy [17], [18].

### B. Benefit of M-Learning [19]

- Support distance learning.
- Can improve student/learner targeted learning [20].
- Great for anywhere, anytime learning environment.
- Supports of student learning desires and avoids restrictions.
- Can increase interest and performance of students in education [21].

Through security point of view the current various existing systems are not appropriate and also not service oriented. The existing online exam system has some drawbacks which are as follows:

- Verification of personal identity
- Opening another browser or tab in order to find answers:
- Creation of secure e-learning environment

So that considering students future of various institutes, security is the important parameter for online examination using mobile devices. This paper consists of four sections. First section consists of Introduction; section 2 illustrates Existing work, Section 3 explains Technogym to be used, Section 4 explains proposed system with detailed Model-wise explanation, Section 5 explains implementation of system, Section 6 explains Uniqueness of the system, followed by Future Research Directions in Section 7.

## II. EXISTING WORK

In Designing a Secure Exam Management System (SEMS) for M-Learning Environments [1], the paper explains Moodle that it is one of the widely accepted LMS. It is used as open-source LMS. It is a web based application. Till now 70696570 users uses Moodle. Total 7.5+ million courses are available on Moodle. Over 1.2+ million teachers are connected to Moodle [9]. But the quiz Engine fixed in Moodle is not built based on Service Oriented Architecture. It is constructed as a huge of PHP code which has to be access by standard web browsers that are slow on mobile devices and cannot catch the exam security issues that present in m-learning environment. Moodle services extension to Moodle does not touch the Moodle's Quiz Engine. Thus, we need to develop a new Quiz Engine that can be deployed as a service learning application, so that its services can be consumed by a mobile application designed to cater to m-learning specific security requirements. As well, it should be integratable with Moodle/Moodbile in order to have a complete LMS which



### 3) Write Better Code

The Java programming language encourages good coding practices, and its garbage collection helps you avoid memory leaks. Its object orientation, its JavaBeans component architecture, and its wide-ranging, easily extendible API let you reuse other people's tested code and introduce fewer bugs.

### 4) Develop Programs More Quickly

Your development time may be as much as twice as fast versus writing the same program in C++. You write fewer lines of code and it is a simpler programming language than C++.

### 5) Avoid Platform Dependencies With 100% Pure Java

You can keep your program portable by avoiding the use of libraries written in other languages. The 100% Pure Java™ Product Certification Program has a repository of historical process manuals, white papers, brochures, and similar materials online.

### 6) Write Once, Run Anywhere

Because 100% Pure Java programs are compiled into machine-independent byte codes, they run consistently on any Java platform.

### 7) Distribute Software More Easily

You can upgrade applets easily from a central server. Applets take advantage of the feature of allowing new classes to be loaded "on the fly," without recompiling the entire program.

## B. The Java Programming Language

The Java programming language is a high-level language that can be characterized by all of the following buzzwords:

- Simple
- Architecture neutral
- Object oriented
- Portable
- Distributed
- High performance
- Interpreted
- Multithreaded
- Robust
- Dynamic
- Secure

## C. The Java Platform

A platform is the hardware or software environment in which a program runs. We've already mentioned some of the most popular platforms like Windows 2000, Linux, Solaris, and Mac OS. Most platforms can be described as a combination of the operating system and hardware. The Java platform differs from most other platforms in that it's a software-only platform that runs on top of other hardware-based platforms. The Java platform has two components:

- The Java Virtual Machine (Java VM)
- The Java Application Programming Interface (Java API)

## D. JDBC

In an effort to set an independent database standard API for Java; Sun Microsystems developed Java Database Connectivity, or JDBC. JDBC offers a generic SQL database access mechanism that provides a consistent interface to a variety of RDBMSs. This consistent interface is achieved

through the use of "plug-in" database connectivity modules, or drivers. If a database vendor wishes to have JDBC support, he or she must provide the driver for each platform that the database and Java run on.

## E. Java Web application

A Java web application generates interactive web pages containing various types of markup language (HTML, XML, and so on) and dynamic content. It is typically comprised of web components such as JavaServer Pages (JSP), servlets and JavaBeans to modify and temporarily store data, interact with databases and web services, and render content in response to client requests.

## F. JavaScript & Ajax Development

JavaScript is an object-oriented scripting language primarily used in client-side interfaces for web applications. Ajax (Asynchronous JavaScript and XML) is a Web 2.0 technique that allows changes to occur in a web page without the need to perform a page refresh. JavaScript toolkits can be leveraged to implement Ajax-enabled components and functionality in web pages.

## G. Web Server & Client

Web Server is a software that can process the client request and send the response back to the client. For example, Apache is one of the most widely used web server. Web Server runs on some physical machine and listens to client request on specific port. Java Servlet and JSPs are server side technologies to extend the capability of web servers by providing support for dynamic response and data persistence.

## H. Web Container

Tomcat is a web container, when a request is made from Client to web server, it passes the request to web container and it's web container job to find the correct resource to handle the request (servlet or JSP) and then use the response from the resource to generate the response and provide it to web server. Then web server sends the response back to the client.

## I. Java EE (J2EE)

Java EE (Enterprise Edition) is a widely used platform containing a set of coordinated technologies that significantly reduce the cost and complexity of developing, deploying, and managing multi-tier, server-centric applications. Java EE builds upon the Java SE platform and provides a set of APIs (application programming interfaces) for developing and running portable, robust, scalable, reliable and secure server-side applications

## J. Android

The official language for Android development is Java. Large parts of Android are written in Java and its APIs are designed to be called primarily from Java. Android software development is the process by which new applications are created for devices running the Android operating system. Applications are usually developed in Java (and/or Kotlin; or other such option) programming language using the Android software development kit (SDK). All Java 7 language features are supported, and some Java 8 language

features (and additionally some Java 9 code has been backported to work).

### K. Encryption Technology

#### 1) AES algorithm

The Advanced Encryption Standard or AES is a symmetric block cipher used to protect classified information and is implemented in software and hardware throughout the world to encrypt sensitive data. The features of AES are as follows

- Symmetric key symmetric block cipher
- 128-bit data, 128/192/256-bit keys
- Stronger and faster than Triple-DES
- Provide full specification and design details
- Software implementable in C and Java.

### L. Database

#### 1) MySQL

MySQL, the most popular Open Source SQL database management system, is developed, distributed, and supported by Oracle Corporation. The MySQL Web site (<http://www.mysql.com/>) provides the latest information about MySQL software.

- MySQL is a database management system.
- MySQL databases are relational.
- MySQL software is Open Source.
- The MySQL Database Server is very fast, reliable, scalable, and easy to use.
- MySQL Server works in client/server or embedded systems.
- A large amount of contributed MySQL software is available.

## IV. PROPOSED SYSTEM

Proposed system aims to find out various vulnerabilities that may violate examination safety in M-learning and provides solutions<sup>6</sup> that can be put in to make sure exam safety. Proposed Secure Exam Management System (SEMS) meets the different security requirements of m-learning environments. The system highlights the benefits and future challenges of mobile learning in our educational environments in both online and offline mode. It can also be work for m-learning when it integrates with Moodle because m-learning system of Moodle is appreciated for last 15 years. The proposed system will generate question paper automatically. This system will overcome the traditional manual work of faculty to produce a new question paper in few amount of time.

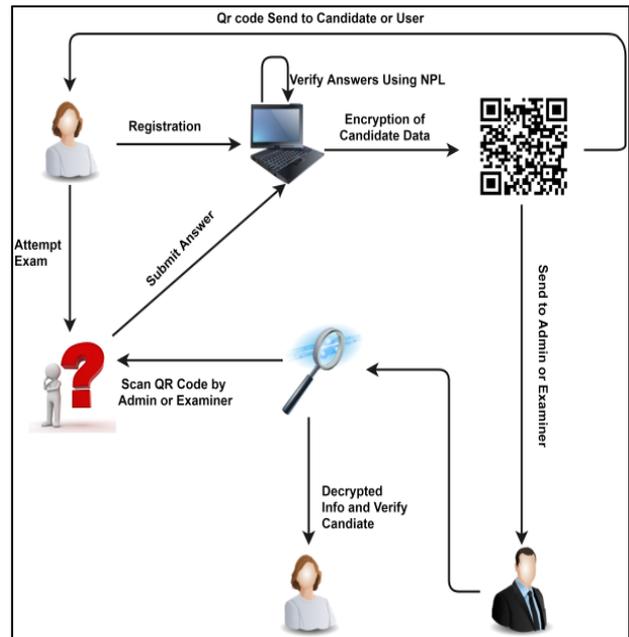


Fig. 2: System Architecture

### A. Modules

Following are the three modules of our proposed system:

#### 1) Student/Candidate

- Registration: Registration of all required data of student.
- Receiving QR code: Student gets basic information submitted while registration through email in QR code format. Basically, this QR code acts as a hall ticket.
- Check exam schedule: Student can check schedule of exam and exam center. Apply for selected exam.
- Attempt the exam: Student must have to go exam centre and after examiner or admin verification he/she can appear for exam.

#### 2) Admin/Examiner

- Receiving Secrete Key: Examiner will receive appropriate secrete key for decryption of QR code.
- Scan QR code: Using secrete key examiner decrypt the QR code and get student's hided data.
- Verification: Examiner checks whether authorized candidate has come for exam or not.
- Allow for exam: After verification, the examiner will allow system to send the question paper to user account.

#### 3) System

- QR code generation: System will generate QR code and send it to user.
- Secret key: Sending secret key to examiner.
- Generating exam paper: After examiner's verification student will receive exam paper on account.
- Answer verification: After submission of exam paper, system will verify MCQ's using answer key and for descriptive questions system will use NLP method.

## V. IMPLEMENTATION & DISCUSSION

### A. Registration

- Registration of all required data of student will be done in this module (including any unique ID for verification).

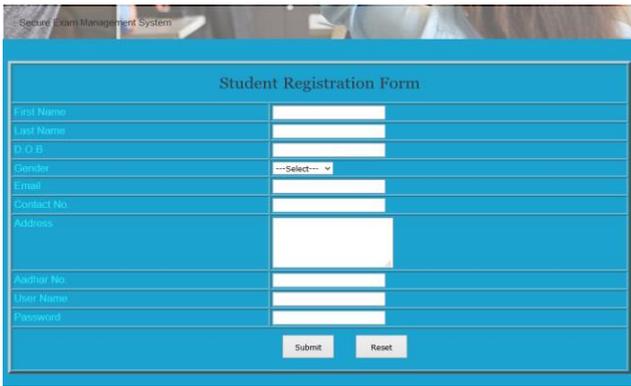


Fig. 2:

- Student's data will be encrypted. The data will be hidden behind QR code. Then QR code is sent to student's mail ID along with secret key.



Fig. 3:

B. Scanner

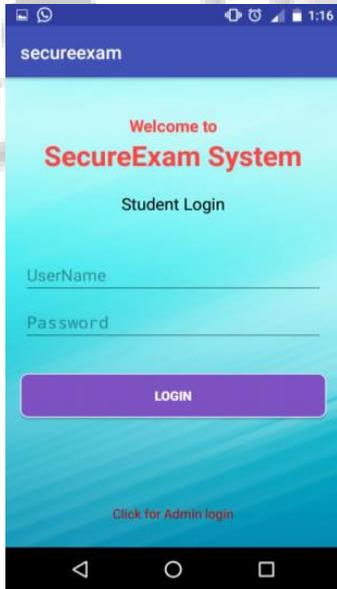


Fig. 4:

- Student will go to exam center with his/her QR code. The examiner will scan the QR code using scanner of secure exam application.

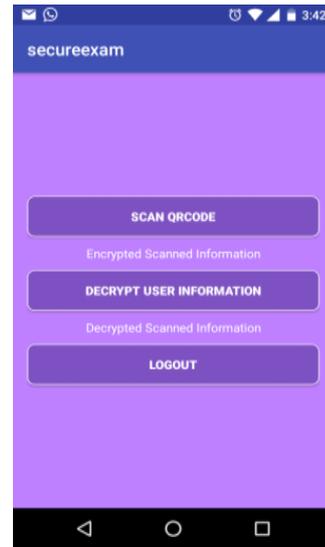


Fig. 5:

- Then using secret key examiner will decrypt the data and verify student's information.
- If the student is fake he will not be allowed to sit for the exam else he can attempt the exam.

C. Log In

- Authenticated student can login to the secure exam system, and can attempt the exam.



Fig. 6:

D. Attempt the Exam

- Student will give online exam on PC or mobile. Exam includes multiple choice questions as well as descriptive questions.
- After submitting the exam the result will be immediately sent to the student's e-mail.

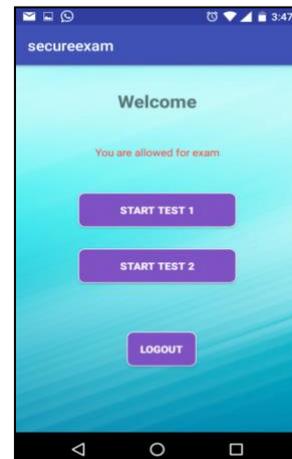


Fig. 7:

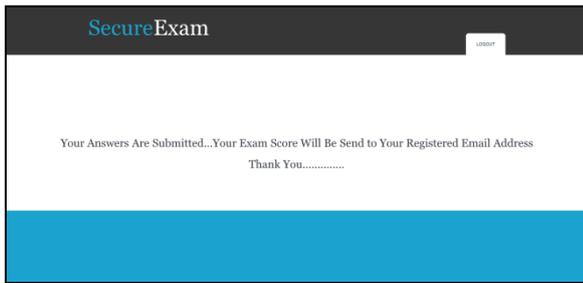


Fig. 8:

- If he/she tries to cheat in the exam by opening another tab or by opening any other application, then the screenshot will be immediately captured and will be saved in the database for proof.

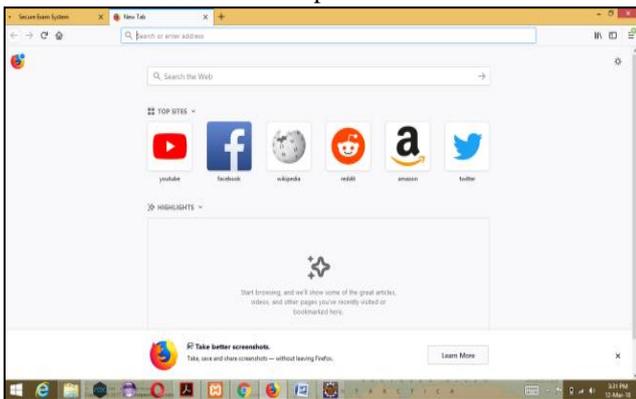


Fig. 9:

- At the same time exam will be submitted and the message will be sent to his email account about cheating.

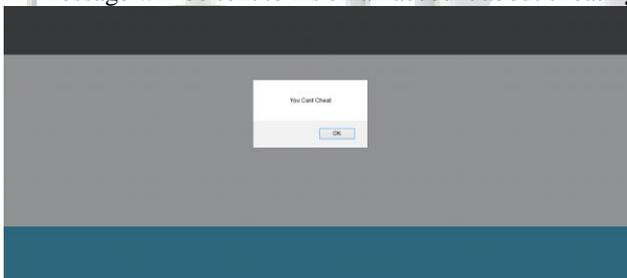


Fig. 10:



Fig. 11:

## VI. UNIQUENESS OF THE SYSTEM

When we compare our proposed system with existing systems like moodle we came to know about some unique features of our proposed system, they are as follows:

- For providing strong security to information filled by student during registration we encrypt data and that encrypted data hide behind the QR code. Then QR code along with secret key for decryption of encrypted data will be send via mail to student.
- At the time of examination, if student try to cheat or we can say if student try to find out the answer of question by accessing any other tab then immediately exam get automatically submitted and screenshot as a proof of cheating will be send to the system. So in our proposed system we can able to detect student who are cheating during examination.
- In our proposed system, we are using Advanced Encryption Standard (AES) algorithm for Encryption/Decryption which is symmetric cryptography algorithm with 256 bit size which is better than any other algorithms like RSA, DES, etc.
- To avoid frauds like fake student can attempt exam instead of valid student, we are using adhaar card number for proper authentication.
- Our proposed system is Service oriented unlike moodle, means student can attempt exam from his/her own devices like laptops, mobile phones.
- We are using Java as a programming language instead of php because php contain bulk of code which is time consuming on various browsers as well as on mobile phones.

## VII. FUTURE RESEARCH DIRECTIONS

The main aim of this paper is to provide the guidelines for further research related to online exam security. The outlines are given below:

- Design a system which will work with both offline and online more efficiently.
- Achieve 100% accuracy in identifying the authenticate students by providing other unique identifiers such iris detection.
- Include new features like face detection of student. This technique will provide an extra security while student is attempting the exam.
- Also Turbo Mode Assessment feature can be added which will set or add the questions as per the knowledge or the capacity of student.

## VIII. CONCLUSION

The proposed system is more secure and transparent than the normal existing system. Proposed system takes normal details of student while registration along with unique identification AADHAR card. So that examination frauds can be avoided. Proposed system uses QR code data hiding technique along with advanced encryption standard which provides robustness to the system. Also system is provided with screenshot capturing facility which is one of the best facility. The system is provided with descriptive language evaluation which is the key feature of proposed system. So finally it is

expected that the proposed system will be more transparent, reliable than the existing online exam system.

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