Design and Implementation of a Monitoring System to Prevent Cheating in Online Test

GRADUATE PROJECT REPORT

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ABSTRACT

Now-a-days, most of the activities of an organization, an industry and an individual person are performed online i.e., over the internet, as it saves time, money and provides convenience. Moreover, many advancements and the wide spread use of internet has contributed to the evolution of a wide range of applications. Online education, one of the major applications over the internet is being adopted by many educational centers. Online tests, exams and contests, a part in online education are not widely implemented due to lack of resources and security related issues. In the current project, an online test is being designed and implemented over the secure internet. Here, the online test is conducted irrespective of place and time. No examiner or proctor is present while the test is taken. The current project proposes an easy solution to the issue of security and cheating in online exams.

In the current project, the online test is conducted safely over the internet by providing two functionalities, namely cryptography and cheat prevention. Cryptography is implemented to provide security to user details and online test data. Two cryptographic algorithms, namely RSA and DES are used. Cheating by the user is effectively prevented in the online test by using desktop, video and audio recording methods. USB ports disable functionality is provided to prevent a user from connecting external devices to a computer.
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1. INTRODUCTION

1.1 Online Education

Online education is increasing steadily every day and is being implemented by most of the reputed universities and educational institutions. Mostly the online education is used for the purpose of teaching courses. But other aspects of online education like online test, online discussion through chat rooms, online assignments are not much concentrated. Tests conducted are mostly paper-based or on a computer in a fixed location where an examiner or a proctor is present to monitor the students. [Jung 2009]

So, the real advantage of online education is not being fulfilled. There are many problems for not implementing online tests in online education. Cheating and weak security systems are some of the major issues obstructing for conducting online tests. A user can have many advantages by taking online test. The test location is not fixed which provides easy accessibility and save money that incur in travelling to the test center. [Jung 2009]

The effective implementation of the online test can be achieved by providing strong security to the data and user credentials as well as providing ways to reduce cheating. The current project provides a solution to the issue of cheating and security. Online monitoring is done to detect any abnormal behavior of the user. Cryptographic algorithms are implemented to provide security to user personal details and online test data. Online monitoring uses video and audio recording to find the user activity. Desktop recording is used to store the session of the desktop during the online test. Cryptography is implemented using RSA and DES algorithms. [Jung 2009]

The current project focuses on conducting online tests in any area of study restricting the location. The online tests in the project are comprehensive designed with
fixed number of questions. The order of the questions displayed in a specific test is same for all the users. The functionalities of the proposed system are described in later sections which help in successful implementation of the online tests.

1.1.1 Online Test

Any test conducted over the internet using a computer is called as an online test. Online test has many advantages. The online tests help in evaluating a student’s intelligence, logical skills within a specified time. Though online tests help in judging students’ performance, there exist many pros and cons. [Jung 2009]

1.1.2 Advantages of Online Test

Online tests have many advantages based on the different factors.

- **Easy Grading**: Online tests help an instructor to grade the exam in a short span of time. As soon as a user takes an exam, the score is recorded in the database. Theoretical questions are arranged in an order which helps instructor to understand easily. Results are provided very quickly.

- **Fewer Resources**: Conducting online tests helps in saving travelling costs of the user, electricity and test papers provided by the test center. An examiner or a proctor is not necessary. All the above resources save the revenue to a great extent.

- **Access 24/7**: The online exams can be conducted at flexible times. In some cases, 24 hour access is provided for taking online tests.

- **Overcome Disabilities**: A physically handicapped user can conveniently take online test by sitting at his residence. Now-a-days, special equipment is available for blind and deaf students for taking online test.
• **Special materials**: Video, audio and pictures can be provided in the online tests for efficient understanding of the questions. Different patterns of exam can be conducted using special materials.

• **Different formats**: The online tests can be created in various forms like true/false, multiple choice, fill in the blanks, essay type, speaking etc.

• **Less prone to errors**: Analysis says that users commit fewer errors compared to a paper based test. Online tests also save time by using less mechanical work.

1.1.3 Disadvantages of Online Test

Online tests have many disadvantages mostly occurring on the side where test is conducted at remote location.

• **Cheating**: Users can implement a lot of cheating methods while taking test. Using of mobile phones, local disks, browsing internet, instant messaging, and email are some forms of cheating.

• **Security**: Security is a major issue in conducting online exams. Hackers and intruders try to gain access to the use credentials and test material breaching the security.

• **Connectivity**: Internet connections with less bandwidth can delay the response time and the data transfers between the client and the server. Connectivity problems sometimes lead to longer delays due to overload.

• **System Failure**: Power failure and system crash can cancel the exam. The user time will be wasted and needs to take the test again if the system failure occurs.
1.2 Types of Online Test

The online tests are classified based on the major factors like location and time.

1.2.1 Online Test with a Proctor

Online test with an examiner or a proctor is conducted at a fixed location, where the users taking the exam are monitored by the proctor. An internet connection and a computer are the basic requirements for taking the test. The time is fixed for the online test and the user must attend the prescribed test center to take the exam. The users are authenticated by checking the credentials like ID card, test registration form before taking the test. The users are also prevented from using the multimedia and electronic times. Some of the tests have multiple sessions. Each session will be provided with short breaks so that the user gets relaxed. GRE, TOEFL, GMAT, MFT are few examples for online tests conducted with a proctor. [Jung 2009, Castella 2006]

1.2.2 Online Test at a Remote Location

Online test of this category is conducted restricting the location. The user can take the test at his home, in a library where an internet connection is available. The test may or may not be scheduled at a fixed time. The test can also have a fixed interval of time between the start and end time. The test can be resumed and may also have session breaks depending upon the method of design. The user needs to register before taking the test. The authentication of the user is done by providing the login details to the corresponding website. In recent years, live monitoring of the user is done through webcam. The user is also identified by capturing the images of the person and storing in the database server. The authentication process of the user is very weak and the chances
to intrude into users’ computer are very high. Blackboard, WebCT are few examples for online tests conducted at a remote location without a proctor. [Jung 2009, Castella 2006]

1.3 History

The online tests are widely implemented in many educational institutions. The online exams are considered far superior due to the numerous advantages over the offline exams. The online tests are first implemented on the computer using the internet service at a fixed location. The users were instructed to register for the desired exam to book the slot. Every online test is scheduled on a specific date and time. The test center has a proctor to authorize and monitor the users taking exam. The users are authorized before entering the test center. The users taking the exam are monitored by the webcam. The proctor present in the test center looks at the videos recording live from the webcam plugged to the user computer. Closed circuit televisions are also used in a test center with large capacity. After few years, different applications were created for online tests where a user was allowed to take the test irrespective of place and time. Later, the online test created has no proctor to monitor the users taking the exam as the place was remote. The scheduled time to take the exam is left to users’ choice. In some cases, the functionality to pause the online test is provided. The user needs to login to the test site to continue taking the test from the stopped time. The security for exams is very weak and the chances for intrusion are high. Many cheating methods are implemented by the user to get through the test. Browsing internet, instant messaging and usage of electronic devices are some of the common cheating methods. At present, the online tests are introduced with security and user monitoring techniques. Cryptographic algorithms are used to
encrypt the data and store in an unknown format in the database server. [Jung 2009, Rowe 2004]

1.4 Drawbacks in Existing Systems

Besides having advantages, the existing online test systems also have many drawbacks. The disadvantages in the online test vary based on the method of implementation.

1.4.1 Drawbacks in Online Test with a Proctor

The online test with a proctor is conducted at a fixed location. Some of the disadvantages of the system are 1) Fixed location, 2) Fixed time 3) Cheating, 4) Proctor for monitoring, 5) Resource wastage

1) Fixed Location

The exam is conducted at a fixed location. The user must select the test location while registering for the test. Fixed location will be problematic to physically handicapped users. The users need to make some expenditure for travelling to the test center.

2) Fixed Time

The time for the exam is fixed. The user needs to take the exam on the scheduled date and time. Some breaks might be provided in between the exam. Users are forced to take exam on a fixed date which is really a disadvantage.

3) Cheating

The user implements various cheating methods. So, the level of cheating by the user depends upon the proctor monitoring the test center. Using mobile phones, pagers,
calculators, hand held devices and discussing about answers among the users are some of the cheating methods implemented in the online test with a proctor. So, no effective techniques are brought up to resolve the issue of cheating.

4) **Proctor for Monitoring**

A proctor is necessary to conduct the test and monitor the users taking the exam. So, the staff invigilating the exam must be paid which incurs an additional expenditure on the organization.

5) **Resource Wastage**

Resources like electricity, computers, room for conducting exam and other electronic devices must be provided to conduct an online test. Maintenance of all the resources is a big problem. Moreover, a huge amount must be spent to purchase the resources required for the exam.

1.4.2 **Drawbacks in Online Test at a Remote Location**

The online test conducted at a remote location has many advantages over the test conducted at a fixed location using a proctor. But, there are equal amount of disadvantages in conducting the test at remote location. Security, cheating practices are the main issues.

1) **Security**

The user needs to provide login details to start the exam. So, during the time of validation, hackers can retrieve the credentials of user. Moreover, the exam questions can also be hacked over the network while user takes the exam. So, security is a major concern in the existing systems.
2) Cheating Practices

A number of cheating techniques are implemented by the user, as the proctor is not present during the exam. Browsing internet, accessing local hard drives, using electronic devices, instant messaging, taking exam in groups are some of the cheating techniques used during the exam.

1.5 Rationale

In terms of security, Cryptographic has always been the first line of defense. Cryptographic mechanisms have been evolving since many years. Since the basic online test model with a proctor came into existence, researchers have been trying to propose various techniques which provide complete security. Researchers have tried to propose an online test which can be taken at a remote location but with poor security. But nevertheless, there has not been a single mechanism till date which has provided complete security. The attackers have also been evolving at the same time and have been creating new mechanisms or ways to crack the user’s credentials. Thus it has always been a challenge to produce a complete secure online test system.

The online test system proposed in this paper provides security and prevents cheating. There have been some online test methods provided till date but they were not completely secure and couldn’t prevent cheating. The online test system proposed in this paper takes a hint from the earlier versions. In this approach, care is taken to provide security to the user credentials and the test question and answers. The system is made very simple and easy to understand. Also there has not been a feature which can record
audio and video continuously. There is also a desktop session recorder to store the activity on the screen during the exam. Thus an online system with visualization will provide great security. This idea has been put into the proposed online test system. A video and audio recording, desktop recording and USB ports disability is merged into the system along with the cryptographic algorithms. [Jung 2009, Castella 2006 and Rowe 2004]
2. NARRATIVE

2.1 Problem Statement

As it was discussed before, there has not been an online test system which had both security and effective cheating control methods. There have been some security mechanisms or some video monitoring techniques but none of them had an integrated system with all the features discussed. The proposed system monitors the user activity besides providing security, assisting the instructor in grading the test easily.

The existing online test methods are all susceptible to some kinds of security attacks and fail to prevent cheating practices implemented by the user like browsing the internet, instant messaging, usage of electronic devices and many other methods. In order to overcome the problem, an online test system with security control was developed. The online test system with visualization would provide more security as it is less vulnerable to the intrusion. Even then, there has not been an efficient online test model which provides high security. There has not been an online test method which not only provides security but also need lesser costs for implementation.

Even in the online test system at remote location, there has not been a technique or a function to monitor user activity wherein the instructor would find it easy to grade and evaluate. In another words, there has not been an online test security system merged with the monitoring techniques to provide effective user evaluation. This has been the problem which is addressed in the proposed project. [Jung 2009]
2.2 Motivation

In today’s scenario, most of the user activity is done online. Each user is having confidential information or important data in the online accounts. Reports have been generated saying that many users’ data is leaked by the hackers and used for false purposes. This is causing a vital problem to the users of the system. Sometimes in the online accounts, there have been plenty of cases wherein the users’ security is compromised and the attacker got access to the resources. This would cause a drastic problem to the users because they might lose huge amounts of money or they might also lose confidential data which is very important.

Many reports say that intruders try to access personal or private information of the users using different types of attacks. Attackers try to gain the personal details of the user’s by using phishing activities. This has been causing many problems to the users personally as well as professionally. There are also hackers who would try to crack the users’ security mechanisms by applying probabilistic methods. Attackers find it extremely fun to work with or they find it something to boast about. The cheating practices implemented by the user also create many problems. There is no effective online monitoring scheme to record users’ activity.

All the above mentioned problems are occurring because of absence of an effective security and monitoring system. Since the existing online test models are not secure and effective, the users have been practicing many cheating methods. This has been my main motivation in implementing the current project.
2.3 Scope

The purpose of developing this project is to produce an online test system with visualization. Cryptographic algorithms will be developed to help both the user and the instructor. The user credentials are secured using the RSA algorithm and the online test environment is secured using DES algorithm. The user activity during the online test will be recorded and stored in the hosting server. The instructor can monitor each user. The proposed system is implemented in a series of steps. The project developed will prevent an intruder from gaining access to the online test and user credentials and stops the user from implementing cheating techniques.

2.4 Functionality of the project

This proposed project can have various functionalities. The project can be used in various places. This project can be implemented in any location with an internet service provided the required software is installed. The project would be very helpful normally in schools, colleges, universities, online contests and in other educational institutions, where the online tests are widely implemented. When the user registers for the online test, the user credentials are automatically encrypted. An attacker or a fraudulent person would not be able to access the user personal details. During the online test, the choices provided by the user are also encrypted. [Jung 2009]

Also, the proposed project can be used as a visualization tool in many real time applications. It would provide more security by notifying the user activity. The USB module also controls the external activity by disabling USB ports. In this way, the user
personal information is secured. The online test environment is also well protected. Most of the cheating techniques are controlled. In this way the current system helps the user and instructor in successful implementation of an online test at remote location. [Jung 2009]
3. PROPOSED SYSTEM DESIGN

3.1 Design and Implementation of a Monitoring System to Prevent Cheating in Online Test

The current project is developed for an online test system using visualization and cryptographic algorithms. The main aspects of the proposed project are as follows:

**User friendliness:** By noticing the earlier methods, enough care has been taken to see that the proposed online test system is easy to understand and implement. Any user with limited knowledge of computers can easily take the online test.

**Cryptographic algorithms:** The proposed project will provide security using cryptography. The user credentials entered during registration and the online test environment are completely protected using RSA and DES algorithms respectively.

**Video & audio recording:** The proposed application will have the capability to record the video and audio of the user. An inbuilt method will record the audio and video of the user, thus helping to monitor user behavior. [Jung 2009, Ko 2004]

**Desktop recording:** In this proposed project, the desktop activity of the user is recorded during the test. The desktop recording starts as soon as the test begins.
USB enable and disable: In the current project, the USB enable and disable mode prevents any external activity of the user by disabling USB ports during online test. [Jung 2009]

3.2 Framework

The current project introduces a visualization method to observe whether a user is trying to implement any kind of cheating methods. Normally, visualization methods are used for different purposes like at shopping malls, banks, business centers and in sensitive areas. The online applications make the user life easier by providing flexibility and convenience. This idea was the main reason to implement the current project. In order to implement a visualization method, a webcam is required. Also, the user must have the required software’s installed to run the visualization method. Thus building visualization techniques and integrating with a secure online test system has become a challenge. Thus the cryptographic algorithms have been merged with visualization tools in the current project.

3.2.1 Steps in the project development

The steps involved in building this project from the inception are given below in brief:

1. Building a graphical user interface
2. Building a database
3. Creation of the visualization, desktop recording and USB modules.
4. Linking the applications with the database
5. Creating modules
6. Setting up the online test system

3.2.2 System requirements

Normally any computer installed with SQL server 2005 and visual studio 2008 will be able to run this project. Sometimes the windows 7 64 bit version and also the 32 bit version are having some compatibility issues. This application runs best on windows XP operating system. The basic system requirements that are required in order to run this project’s application will be given below:

Software requirements: (Minimal requirements)

Front End/GUI Tool : Microsoft Visual studio 2005
Operating System : Windows Family
Language : C#.NET
Back End : SQL SERVER 2005

Hardware requirements: (Minimal requirements)

Processor : Pentium dual core
RAM : 512 MB
Hard Disk Drive : 10 GB
3.3 Proposed Mechanism

The mechanism which is proposed in this project is the visualization method with live monitoring of the user and the desktop activity. A better understanding about the proposed mechanism can be obtained by looking into the figure 1.

Figure 1: Proposed mechanism’s architecture

As shown in figure 1, the administrator manages the database. Here, the database contains test data and user details. The user registers for the online test. The video and desktop recording is started by user. The scores of the test and the recorded video and desktop files are stored in the database.
3.3.1 Working

As it can be seen in the figure 1, there will be two main applications. One is the online test application and the other is the video, audio and desktop recording application. The online test is managed by the administrator. The video, audio and desktop recording is used to monitor the user activity. Initially the client must register to take an online test. The user can register for any number of tests.

Registration phase

In the registration phase, the user needs to enter the valid information in the respective fields. During registration, the user is asked to upload an image for verification. After the registration is successful, a dialog box is displayed with a unique public and private key. The user needs to store the secret keys at a safe location.

Login phase

At the time of login, the user is asked to enter the user id and password provided during the time of registration. Each computer would have a unique username. After entering the login details, the server will validate the details. Upon successful login, user is redirected to a page, where the public and private keys must be entered. Once the secret keys are validated, the user is redirected to the online test.

Video, audio and desktop recording

When the online test begins, the desktop recorder followed by video, audio capture application is opened. The desktop recorder starts recording the activity on the
screen. As soon as the video and audio capture application is activated, the webcam is activated and the user audio and video are recorded.

**USB enable and disable**

The USB enable and disable functionality is implemented in the project. When the online test gets started, the USB ports are disabled automatically. The USB ports are enabled after the test is completed. User cannot use external devices during the exam as the ports are disabled.

Thus, in the proposed project, security and visualization are provided to conduct an online test in the remote successfully. The cryptographic algorithms help in providing security. The visualization is provided to monitor user behavior. Thus, a user friendly and a secure online test environment are implemented in this project.

**3.4 System design**

The proposed application design process will be discussed in this section. Various UML diagrams explaining the design of the proposed application will be presented and explained. The diagrams explained here are:

- Data flow diagram
- Use case diagram
- Sequence diagram
- Collaboration diagram
- State chart diagram
3.4.1 Dataflow diagram

The dataflow diagram explains how data moves or flows in a system. The dataflow diagram concerning the proposed project can be seen in figure 2.

![Dataflow Diagram](image)

**Figure 2: Proposed system’s dataflow diagram**

As it can be seen in the figure 2, the details of the data movement in this proposed application is shown graphically. The user will register for the online test and then enters the login details. As soon as the exam is started, the video capturing and desktop capture applications are opened.
3.4.2 Use case diagram

The purpose of the use case diagram is to graphically represent the functionality of the system with regard to actors, their aims (shown as use cases) and any kind of dependencies arising between the particular use cases. The proposed system’s use case diagram can be seen in figure 3.

![Use case diagram]

**Figure 3: Proposed system’s use-case diagram**

As it can be seen in figure 3, the functionality of the proposed system with respect to the actors, their aims and dependencies are represented graphically. Here, actor ‘Student’ is the user and administrator plays different roles namely ‘Proctor’, ‘Marker’ and ‘Examiner’ depending upon the role.
3.4.3 Sequence diagram

The sequence diagram is a type of interaction figure which shows how various processes operate with each other and in what order they operate. The proposed system’s sequence diagram can be seen in figure 4.

![Sequence Diagram](image)

**Figure 4: Proposed system’s sequence diagram**

As it can be seen figure 4, the proposed system’s interactions are seen in an order with the help of the sequence diagram. Here, actor ‘Student’ is the user and administrator plays different roles represented as actors namely ‘Proctor’, ‘Marker’ and ‘Examiner’ depending upon the role.
3.4.4 Collaboration diagram

Collaboration diagrams are similar to sequence diagrams which show how object would interact over some period of time. But instead of presenting the sequential events on the layout, collaboration diagrams would represent the sequence by giving a number to each message in the diagram. This would make it simpler to show which objects are grouped together.

Figure 5: Proposed system’s collaboration diagram

As it can be seen figure 5, the proposed system is represented in the form of the collaboration diagram which makes it easier to understand what objects are grouped together. Here, actor ‘Student’ is the user and administrator plays different roles namely ‘Proctor’, ‘Marker’ and ‘Examiner’ depending upon the role.
3.4.5 State chart diagram:

The state chart diagram represents the system with a combination of states and transitions. Each state represents the functionality of the system. Change from one state to another state is explained by using transitions in between states.

![State chart diagram](image)

**Figure 6: Proposed system’s state chart diagram**

As it can be seen figure 6, the proposed system is represented in the form of the state chart diagram with each state explains about the behavior of the system.
4. FUNCTIONALITIES OF THE APPLICATION

The proposed application’s modules would be discussed in this section. The modules would be explained with the respective screenshots.

4.1 Modules Description

The proposed project consists of seven modules. Each module will have a unique role in the system. The modules are:

- Administrator
- User
- RSA Algorithm
- DES Algorithm
- Audio Video Capturing
- Desktop Capturing
- USB Enable/Disable

4.1.1 Administrator module

The administrator is the head of the system. The administrator manages the online test system. The functionalities of the administrator module are given below in a sequential order.

- Administrator login to the system
- New test questions update

The mentioned functionalities would be provided with the screenshots and would be explained in detail in accordance with the respective screenshot.
• Administrator login to the system

Administrator logins by providing username and password.

![Login page](image)

**Figure 7: Login stage of the administrator**

As seen in the figure 7, the administrator provides the username and password and clicks the submit button. If the login is successful, the administrator will be redirected to the questions update page. If the login is failed, username and password must be entered again.

• New test questions update

The administrator enters new questions for a selected test.

![New test questions update](image)

**Figure 8: New test questions update**
As seen in figure 8, the administrator selects an exam type first. Then the question and the corresponding choices and answer are entered. The question updated successfully message is display when the submit button is clicked.

4.1.2 User module

The user can by anyone who wants to take an online test. All the actions of the user would be performed in the user module. The user module will have much functionality. The functionalities of the user module are given below in a sequential order.

- New user registration
- User login
- Public and private key entry
- User starts online test
- User submits online test

The mentioned functionalities would be provided with the screenshots and would be explained in detail in accordance with the respective screenshot.

- New user registration

The user registers for the test by entering the required fields on the form.

![New user registration](image)

Figure 9: New user registration
As seen in figure 9, the user enters all the 5 fields to register for an online test. The dialog box registered successfully is displayed upon successful registration. A window with a public key and private key are displayed after the registration process.

- **User Login**

The user enters the user id and password to login into the system.

As seen in the figure 10, the user enters user id and password to login into the system. If the login is successful, the user will be redirected to the page containing public, private key entry. If the login is failed, the user needs to enter the login details again.

- **Public and private key entry**

The user enters public and private key to start the online test.
Figure 11: Public and private key entry

As seen in figure 11, the user enters the public key and private key. The page is redirected to the online test when the public and private keys are validated. The user needs to enter the secret keys again if either of the values entered doesn’t match the original secret keys.

- **User starts online test**

  The user starts the online test by entering the secret key details.

Figure 12: Online test screen

As seen in figure 12, the online test screen is displayed with a question and four choices. One of the four choices can be selected by clicking on the radio button. The
‘pre’ button is used to go to the previous question and the ‘Next’ button is used to navigate to the next question.

- **User submits online test**

The user can end the test by clicking on the submit button.

![Figure 13: Online test submission](image)

As shown in figure 13, the user clicks on the submit button to end the test. As soon as the last question appears, the submit button is displayed on the screen. Once the online test is submitted, the score is stored in the database automatically.

### 4.1.3 RSA Algorithm module

The RSA algorithm is used to generate public and private keys.

![Figure 14: Database table for public, private key](image)
As shown in figure 14, the public and private keys are stored in the dbo.login table. The public and private keys are generated by the RSA algorithm upon successful user registration. The secret keys are used to validate the user during login phase.

4.1.4 DES Algorithm module

The DES algorithm is used to encrypt the new choices and answers for a given test.

<table>
<thead>
<tr>
<th>Subject</th>
<th>One</th>
<th>Question</th>
<th>Choice 1</th>
<th>Choice 2</th>
<th>Choice 3</th>
<th>Choice 4</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java 1</td>
<td>Dev</td>
<td>Computer Science</td>
<td>4Z1YF1R3GQa=</td>
<td>K21JU5ZCtZyf=</td>
<td>GSW6V1R8H=</td>
<td>5D0pB1u4J=</td>
<td>K64uH1ZCq=</td>
</tr>
<tr>
<td>Java 2</td>
<td>Dev</td>
<td>current version</td>
<td>9-M0H3T2Kv=</td>
<td>U1253456T7=</td>
<td>9012345678=</td>
<td>9012345678=</td>
<td>9012345678=</td>
</tr>
<tr>
<td>Java 3</td>
<td>Dev</td>
<td>Generate key</td>
<td>YG9Y3Qa=</td>
<td>F0G34P6R7Q=</td>
<td>F0G34P6R7Q=</td>
<td>F0G34P6R7Q=</td>
<td>F0G34P6R7Q=</td>
</tr>
<tr>
<td>Java 4</td>
<td>Dev</td>
<td>new test</td>
<td>9-M0H3T2Kv=</td>
<td>U1253456T7=</td>
<td>9012345678=</td>
<td>9012345678=</td>
<td>9012345678=</td>
</tr>
<tr>
<td>Java 5</td>
<td>Dev</td>
<td>new test</td>
<td>9-M0H3T2Kv=</td>
<td>U1253456T7=</td>
<td>9012345678=</td>
<td>9012345678=</td>
<td>9012345678=</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Dev</td>
<td>new test</td>
<td>9-M0H3T2Kv=</td>
<td>U1253456T7=</td>
<td>9012345678=</td>
<td>9012345678=</td>
<td>9012345678=</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Dev</td>
<td>new test</td>
<td>9-M0H3T2Kv=</td>
<td>U1253456T7=</td>
<td>9012345678=</td>
<td>9012345678=</td>
<td>9012345678=</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Dev</td>
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<td>9-M0H3T2Kv=</td>
<td>U1253456T7=</td>
<td>9012345678=</td>
<td>9012345678=</td>
<td>9012345678=</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Dev</td>
<td>new test</td>
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<td>9012345678=</td>
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</tr>
<tr>
<td>Grade 5</td>
<td>Dev</td>
<td>new test</td>
<td>9-M0H3T2Kv=</td>
<td>U1253456T7=</td>
<td>9012345678=</td>
<td>9012345678=</td>
<td>9012345678=</td>
</tr>
</tbody>
</table>

Figure 15: Database table for new question and choices

As shown in figure 15, the new test questions and choices entered by the administrator are encrypted and stored in dbo.newquestions database. The 4 choices and the answer are encrypted using the DES algorithm.

4.1.5 Audio Video Capturing module

The audio and video capturing module will record the video and audio of the user while taking online test. The functionalities of the administrator module are given below in a sequential order.

- Capture the video and audio file
- Save the video and audio file
- Verify the user through webcam
- Stop video and audio capture

The mentioned functionalities would be provided with the screenshots and would be explained in detail in accordance with the respective screenshot.

- **Capture the video and audio file**

  The video and audio file is captured by clicking the capture button

![Figure 16: Video and audio file capture](image)

As shown in figure 16, the video and audio capture file is opened as soon the online test is started. The user must select the ‘Device’ name and the ‘Audio Input’. Further, the capture button must be clicked to start the audio and video recording.

- **Save the video and audio file**

  When, the capture button is clicked, the user is asked to save the audio and video file in a desired location.
As shown in figure 17, when the capture button is clicked, a window is opened where the user is asked to save the video and audio file in a desired location. The file is saved in the avi format. The administrator can use the saved video and audio file to evaluate the user.

- **Verify the user through webcam**

  The user must be verified with the webcam for authentication.

---

**Figure 17: Video and audio file saving**

**Figure 18: Verifying user using webcam**
As shown in figure 18, the webcam of the computer is activated as soon as the file is saved. The user video is recorded using the webcam and the audio is recorded by the audio recorder in the executable application.

- **Stop video and audio capture**

  The video capturing must be terminated as soon as the test ends.

![Image](image_url)

**Figure 19: Video and audio capture exit**

As seen in figure 19, the ‘Stop Capture’ button is clicked by the user to exit the video and audio recording for that session. The video and audio file is saved immediately after the ‘Stop Capture’ button is clicked. The close button must be clicked to exit the video and audio recording application.

### 4.1.6 Desktop Capturing module

The desktop recording of the system is done using desktop recorder. All the actions of the desktop recording are performed in this module. The functionalities of the client module are given below in a sequential order.

- Starting the desktop recorder
- Setting compressor rate
- Exit the desktop recorder
The mentioned functionalities would be provided with the screenshots and would explain in detail in accordance with the respective screenshot.

- **Starting the desktop recorder**

The desktop recording is started by clicking on the ‘Start’ button.

![Image of desktop recorder](image)

**Figure 20: Starting desktop recording**

As shown in figure 20, the user must click on the ‘Start’ button when the ‘Desktop’ recorder application is opened. When the start button is clicked, the desktop recorder displays a window to choose a compressor value.

- **Setting compressor rate**

The value for the compressor is entered to start the desktop recording.

![Image of compressor setting](image)

**Figure 21: Desktop recorder compression rate**
As shown in figure 21, a window named ‘Video Compression’ displayed. The ‘Compressor’ value is selected from the list in drop down menu. When a compression value is selected, ‘OK’ button is clicked to start the desktop recording.

- **Exit the desktop recorder**

  The desktop recording is stopped by clicking on the ‘Stop’ button.

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![Desktop recorder](image)

**Figure 22: Stopping desktop recording**

As shown in figure 22, the desktop recording is stopped by clicking on the ‘Stop’ button. As soon as the stop button is clicked, the avi file is stored in the database. The administrator can run the avi file to monitor the user activity during the exam.

**4.1.7 USB Enable/Disable:**

The USB Enable/Disable module is used to disable and enable the USB ports. The USB ports are disabled during the online test and enabled as soon as the test is completed. The USB ports during the test.

- **USB disable**

  The USB ports are disabled when the online exam is started.
As shown in figure 23, the USB ports are disabled during the exam. The access to any external devices connected using USB ports is denied. To check whether the USB ports are disabled during the test, one can check the ‘Removable Storage’ devices in ‘My Computer’

- **USB enable**

The USB port is enabled when the exam is completed.

As shown in figure 24, the USB ports are enabled when the test is completed. The user can have access to the external USB storage devices before the start of the online test and after completing the online test.
5. TESTING AND IMPLEMENTATION

5.1 Testing

- Testing is the procedure to find out whether any errors arise while testing the application.
- Testing is really important in terms of software engineering.
- The main aim of software testing is to prove the developers and customers that the particular software is good to use. In another words, testing is done in order to build confidence.
- Testing consists of a number of activities which can be planned initially and conducted in a systematic manner.
- Software testing can also be synonymous with validation and verification.

5.2 Types of Testing

The following are the types of testing:

- White box testing
- Black box testing
- Unit testing
- Integration Testing
- Validation Testing
- Output Testing
- User acceptance testing
5.2.1 White box testing

- The white box testing can also be referred to as glass box testing. The white box testing makes use of control structure in the procedural design to get the test cases.
- With the help of white box testing, a tester can make test cases that does the following things:
  - It makes sure that all the parts present in the module have been used at least once.
  - The logical decisions will be analyzed with the true criteria and false criteria.

5.2.2 Black box testing

- The black box testing can also be referred to as the behavioral testing. The black box testing stresses mostly on the software’s functional requirements.
- The black box testing is an approach of complementary type to present different type of errors from the white box testing errors.
- Black box testing makes use of some input criteria to fully exercise the program’s functional requirements.

5.2.3 Unit testing

In unit testing, every module would be tested and then would be grouped with the system. Unit testing stresses to test on the tiniest unit of the software to make sure it’s working. It can also be referred to as the module testing.

Each module presented in the system would be tested separately. This testing would be done at the programming time itself. In this testing process, it is made sure that
every module would work as per the requirements. The errors are easy to find in the initial stage itself rather than the final stage.

5.2.4 Integration testing

Integration testing stresses on the fact that data may be lost over an interface. A particular module can have a drastic effect on remaining sub functions and when combined will not give the required functionality. The integration type is like the systematic testing to find out the uncover errors inside the interface. The testing will be done with a small sample of data. The system which is developed will be tested with this sample data whether it will run successfully or not. With the help of integration testing, the system’s overall performance can be evaluated.

5.2.5 Validation testing

When the black box testing is at its peak, software is grouped as one package, interface related errors are corrected, the validation testing begins. There can be many definitions for validation testing. In simple words, validation will be successful only when the software produced will be as per the satisfaction of the customer. So the validation tests will be confirming whether the final user will be satisfied with the product or not.

5.2.6 Output testing

After the completion of the validation testing, output testing would be performed. The output testing would be performed because every system would want the output to be
as per the specified requirements. The output testing will prove whether the output is satisfactory or not.

### 5.2.7 User acceptance testing

This testing is used to find out whether the application developed is user friendly or not. The user acceptance testing will be successful if the users can access the application easily.

**Types of testing performed in this project**

The following testing methods have been performed in the proposed project and were successful:

- Unit testing
- Integration testing
- Validation testing
- Output testing
- User acceptance testing

### 5.3 Test cases

The proposed project will now be tested for all the test cases sequentially. The following test cases will be tested.

- Verifying the registration phase
  - For successful registration
  - For unsuccessful registration
• Verifying the login phase
  • For a genuine user
  • For a fraudulent user
• Verifying the public and private key
  • For valid keys entry
  • For invalid keys entry

5.3.1 Verifying the registration phase

In the registration phase, the user needs to provide his credentials to register for the online test. The user must upload an image during registration. The user would be able to finish the registration successfully only if all the details hold correct values. The two scenarios for a successful registration and unsuccessful registration will be shown with the help of the screenshots.

Successful registration

The user is registered successfully when all the required fields are entered.

![Successful registration](image)

**Figure 25: Successful registration**
As shown in figure 25, the user must complete all the five fields in the registration form. Once all the fields are validated, a dialog box is displayed saying ‘the user is registered successfully’ with an ‘ok’ button. When the user clicks on the ‘ok’ button, a dialog box with a public and private key is displayed.

Unsuccessful registration

The user is not registered if at least one of the fields on the registration form are not validated.

Figure 26: Unsuccessful registration

As shown in the figure 26, the user registration is said to be unsuccessful if any one of the fields on the registration form are not valid. When the user clicks on the submit button, the same registration page is displayed in the case of failed registration.

5.3.2 Verifying the login phase

This is the most important aspect of the proposed project. In this section, the verification of the login phase will be done. The registered user would be verified by
presenting him with user id and password in the registration phase. Now two scenarios would be presented; one for a genuine user and the second one for a fraudulent user.

For a genuine user

The login to the system is said to be successful, only if the provided details are correct.

As shown in figure 27, the user enters user id and password to login into the system. If the login details entered are valid, then the login is said to be successful. Upon, successful login, the user is redirected to the public and private key entry page.

For a fraudulent user

The login by the user is said to be unsuccessful, if either of the details are not valid.
As shown in figure 28, the user enters user id and password to login to the system. If the login details entered are invalid, then the login is said to be unsuccessful. Upon unsuccessful login, the user is redirected to the same login page.

5.3.3 Verifying the public and private key

This is the most important aspect of the proposed project. In this section, the verification of the login phase will be done. The registered user would be verified by presenting him with public and private key in the registration phase. Now two scenarios would be presented; one for a genuine user and the second one for a fraudulent user.

For valid keys entry
The user secret keys are said to be valid if the values matches with the database.

![Figure 29: Successful public and private keys entry](image)

As shown in figure 29, after successful login, a page with public and private key entry is displayed. The user enters the public key and private key and clicks on the submit button. If both the keys entered are valid, the user is redirected to the online test.
For invalid keys entry

The user secret keys are said to be invalid if the values doesn’t matches with the database.

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Figure 30: Unsuccessful public and private keys entry

As shown in figure 30, after successful login, a page with public and private key entry is displayed. The user enters the public key and private key and clicks on the submit button. If both the keys entered are invalid, the user is redirected to the same page again.
6. ADVANTAGES AND DISADVANTAGES

6.1 Advantages

There are many advantages in the proposed system. Some of them are as follows:

- Online test can be taken at remote location
- High security to user data is provided
- Online monitoring of the user
- User friendly interface
- Maintenance is easy

6.2 Disadvantages

Besides all the above features, there are some disadvantages in the system.

- Compatibility issues
- Webcam is compulsory for video monitoring
- User authentication is not done during the online test
- Video and desktop applications must be started by the user
7. CONCLUSION AND FUTURE WORK

Thus, the proposed online test system with visualization and security mechanisms will successfully implement a live video, audio and desktop recording of the user behavior and the desktop session during the online test respectively. The RSA and DES algorithms efficiently help in securing user credentials and online test data. The USB ports Enable/Disable feature prevents the user from connecting any removable storage devices to the USB port. The testing methods unit, integration, validation, output and user acceptance testing have been performed to test the functionalities. My future work has two objectives. First objective is to introduce an authentication method to validate the user by matching the uploaded picture of the user with the webcam. My second objective is to run the video and audio recorder and desktop recorder applications without the user interference.
8. BIBLIOGRAPHY AND REFERENCES


