



SRI LANKA INSTITUTE OF INFORMATION TECHNOLOGY

**Automated Examination Invigilator System
(AEIS)**

**SOFTWARE REQUIREMENTS SPECIFICATION
(PROJECT ID 13-024)**

Author
K.U.S.MADANAYAKE - IT 10 1907 08

Supervisor
Mr. CHATHURANGA MANAMENDRA

May 7, 2013

Automated Examination Invigilator System

(Project ID 13-024)

May 7, 2013

Software Requirements Specification

	Name	Student ID	Signature
1.	K.U.S. Madanayake	IT 10 1907 08	
2.	B.L.S. Deshan	IT 10 1602 44	
3.	R.M.G.S. Rathnayake	IT 10 1504 12	
4.	T.L. Amaradasa	IT 10 0005 40	

Project Supervisor: Mr. Chathuranga Manamendra

Project Co- Supervisor: Mr. Buddhika Hasantha Kasthuriarachchy

Bachelor of Science (Special Honours) in Information Technology

Sri Lanka Institute of Information Technology

7th May 2013

Contents

1	Introduction	3
1.1	Purpose	3
1.2	Scope	3
1.3	Definitions, Acronyms, and Abbreviations	4
1.4	Overview	4
2	Overall Descriptions	5
2.1	Product perspective	5
2.1.1	System interfaces	6
2.1.2	User interfaces	7
2.1.3	Hardware interfaces	16
2.1.4	Software interfaces	18
2.1.5	Communication interfaces	18
2.1.6	Memory constraints	18
2.1.7	Operations	18
2.1.8	Site adaptation requirements	20
2.2	Product functions	21
2.3	User characteristics	26
2.4	Constraints	27
2.5	Assumptions and dependencies	28
2.6	Apportioning of requirements	29
3	Specific requirements	29
3.1	External interface requirements	29
3.1.1	User interfaces	29
3.1.2	Hardware interfaces	31
3.1.3	Software interfaces	31
3.1.4	Communication interfaces	31
3.2	Classes/Objects	32
3.3	Performance requirements	32
3.4	Design constraints	33
3.5	Software system attributes	33
3.5.1	Reliability	33
3.5.2	Availability	33
3.5.3	Security	33
3.5.4	Maintainability	34
3.6	References	34

1 Introduction

1.1 Purpose

The purpose of this document is to provide a complete description of the Automated Examination Invigilator System. It will explain the purpose and features of the system, interfaces of the system, what the system will do, the constraints under which it must operate and how the system will react to external stimuli. This document is intended for both the stakeholders and the developers of the system.

1.2 Scope

The software product to be produced is an Automated Examination Invigilator System (AEIS) which will automate the major invigilation operations. This system will be designed to maximize the invigilator's productivity by providing tools to assist in automating the examination process, which would otherwise have to be performed manually. This system applies face, eye and motion detection techniques to automate some of the most important tasks in the examination process starting from registration of candidates till the marking of answer sheets.

The AEIS consist of five main subsystems and the first subsystem is a Candidate Registration Module to keep track of the candidates who has registered for examinations. Other four main subsystems are Candidate Identity Verification Module, Examinations Invigilation Module, Android Mobile Assistant and Automated MCQ Marking Module which will support the flow of the invigilation process. These five subsystems' functionality will be described in detail in section 2-Overall Description.

The AEIS will be interactive with the end users, in which they allow him/her to choose all of the options from the first display screen. Basically there are four end users for the AEIS; Data Entry Operator, Examinations Manager, Examinations Invigilator and Higher Administration. All user types can access the Reservation Candidate Registration Module. Candidate Identity Verification Module, Examinations Invigilation Module, Android Mobile Assistant and Automated MCQ Marking Module will be restricted to Examinations Manager, Examinations Invigilator and Higher Administration. The AEIS is designed for use directly by Education professionals.

The Automated Examination Invigilator System's objective is to provide a system to automate the examination process and minimize the difficulties faced by examination invigilators as well as the candidates of the examination. Without automation the invigilation of the examinations has become an unwieldy task. Most of the major tasks of an invigilator will be simplified by a considerable amount through the automated system. The system will be able to handle many

services to take care of all requests in a quick manner. The system should be user appropriate, easy to use and have an overall end user high subjective satisfaction. Basically AEIS is the best solution to avoid the costly and time consuming process of producing, delivering, collecting and processing large amounts of data/paper work. Furthermore it will highly contribute in detecting and avoiding examination frauds and cheatings more efficiently.

1.3 Definitions, Acronyms, and Abbreviations

AEIS	Automated Examination Invigilator System
SRS	<i>Software Requirements Specification.</i>
<i>Invigilator</i>	A person who supervises and watches examination candidates.
<i>Subjective satisfaction</i>	<i>The overall satisfaction of the system</i>
End users	The people who will be actually using the system
<i>OS</i>	Operating System
<i>PC</i>	Personal Computer
UML	Unified Modeling Language.
HD	High Definition.
WLAN	Wireless Local Area Network.
LAN	Local Area Network.
RAM	Random Access Memory.
SQL	Structured Query Language
DB	Database. A collection of related records.
OMR	Optical Mark Recognition

1.4 Overview

The remainder of this document is two chapters, the first providing a full description of the system for the users of the AEIS. It gives an overview of the functionality performed by the product and describes the informal requirements. This is used to establish a context for the technical requirements specification in the next chapter.

The final chapter, Requirements Specification section, of this document is written primarily for the developers and describes in technical terms and the details of the functionality of the product. These two sections are cross-referenced by topic; to increase understanding by both groups involved. Both sections of the document describe the same software product in its entirety, but are intended for different audiences and thus use different language.

2 Overall Descriptions

The rest of the SRS examines the specifications of the AEIS in detail. Section 2 of the SRS presents the general factors that affect the AEIS and its requirements, such as user characteristics and project constraints. This section does not state specific requirements. Instead it provides a background for those requirements, which are defined in section 3, and makes them easier to understand. Section 3 outlines the detailed, specific functional, performance, system and other related requirements of the AEIS. Supporting information about appendices is provided in Section 4.

2.1 Product perspective

As a result of the extensive research that we carried out on the field of automating examination invigilation process, it was realized by us that a system with all the automated features built in one single system is difficult to find. But there are automated computer based exams such as Moodle online exams, Lexis examination etc. There is also video surveillance systems used in different contexts used for many different invigilation purposes. Optical Paper Marking also can be applied for different software systems for different purposes.

The purpose of the AEIS project is to provide an automated solution to the examinations invigilators to optimize the process of invigilation and minimize the difficulties faced by the invigilators as well as the candidates. The AEIS will automate most of the important operations in the process of conducting an examination, which are cumbersome to perform manually and needs lot of human resources.

The objectives of AEIS are to improve the efficiency of the invigilation process and minimize the frauds and examination cheatings during an examination using personal computers and to improve the quality and effectiveness of examinations.

Following are the system features which are going to be implemented in AEIS:

- Registration of candidates
- Send SMS for examination candidates prior to each examination
- Send Email to examination candidates prior to each examination
- Candidate Identity Verification
- Examination Invigilation Module
- Display examination hall/halls live video stream in the Android application

- Transmitting images of MCQ Answer Sheets to the desktop application
- Marking of MCQ papers

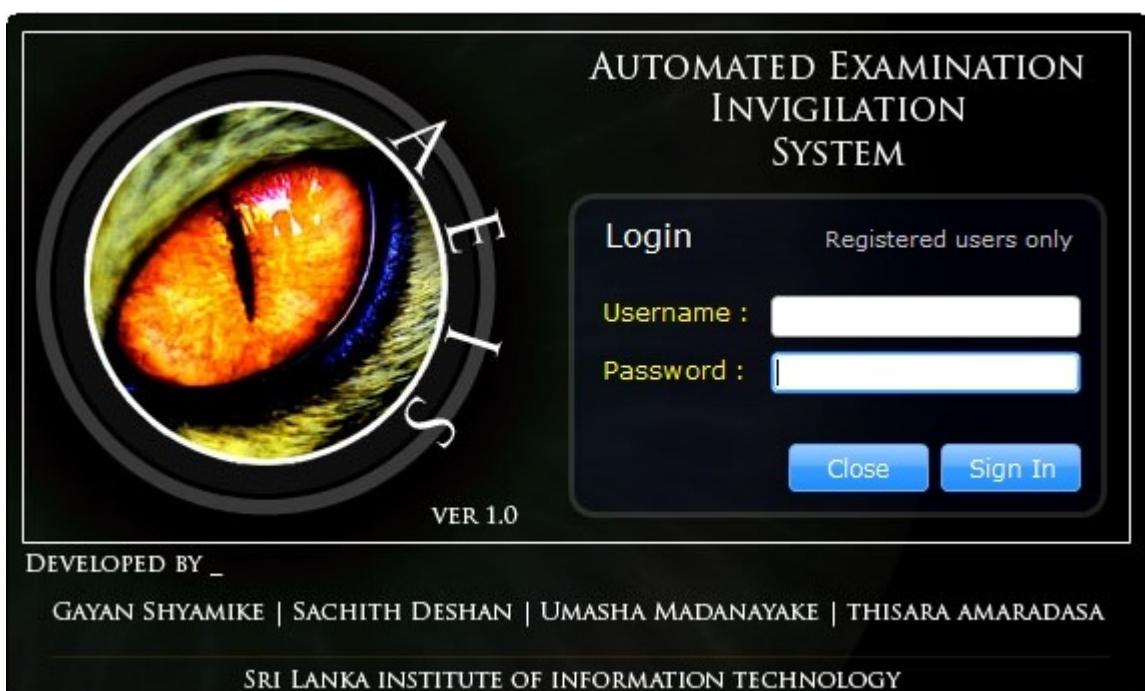
The AEIS is a desktop application which can be operated by installing it in a personal computer (PC) which meets the minimum hardware requirements. An Android application is developed (Android Mobile Assistant) as a supporting application for the main AEIS desktop application, which is used to supports the operations such as MCQ Marking Module, assist mobile invigilators. All modifications done to the AEIS in this project will be software and device driver based.

2.1.1 System interfaces

- The applications main interface to the system is through the .Net Framework. AEIS application uses the functions provided in the .NET framework to manipulate system resources.
- Android Mobile Assistant will receive push notifications using Google Cloud Messaging API.
- API used to connect with Wi-Fi camera.

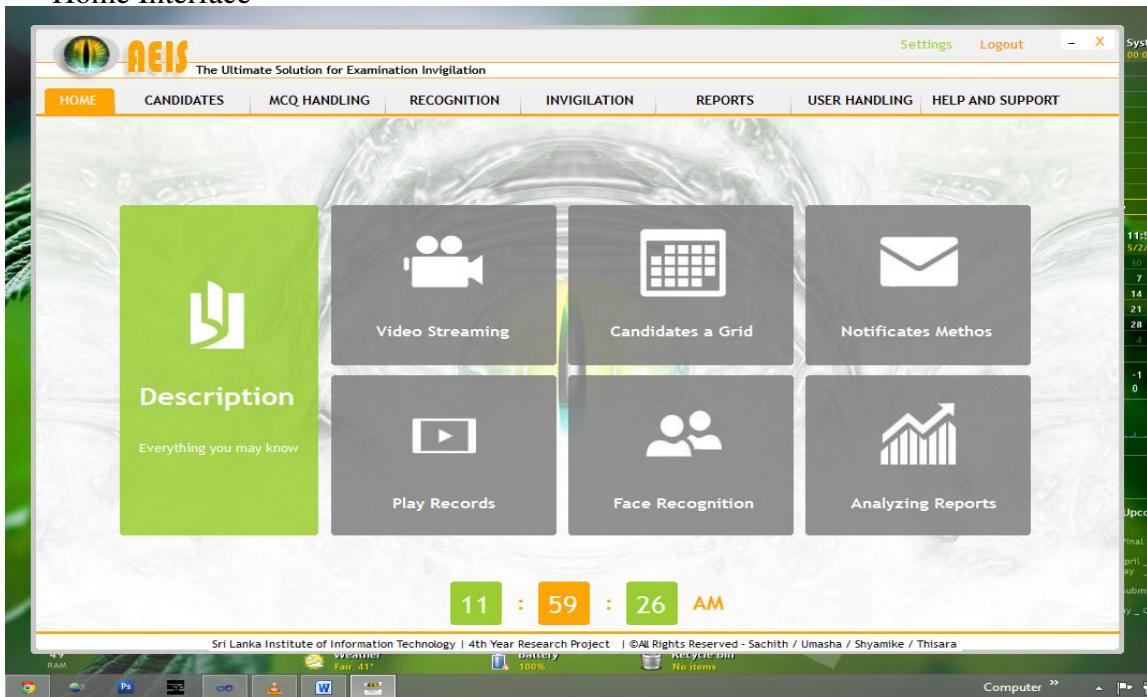
2.1.2 User interfaces

Login Interface

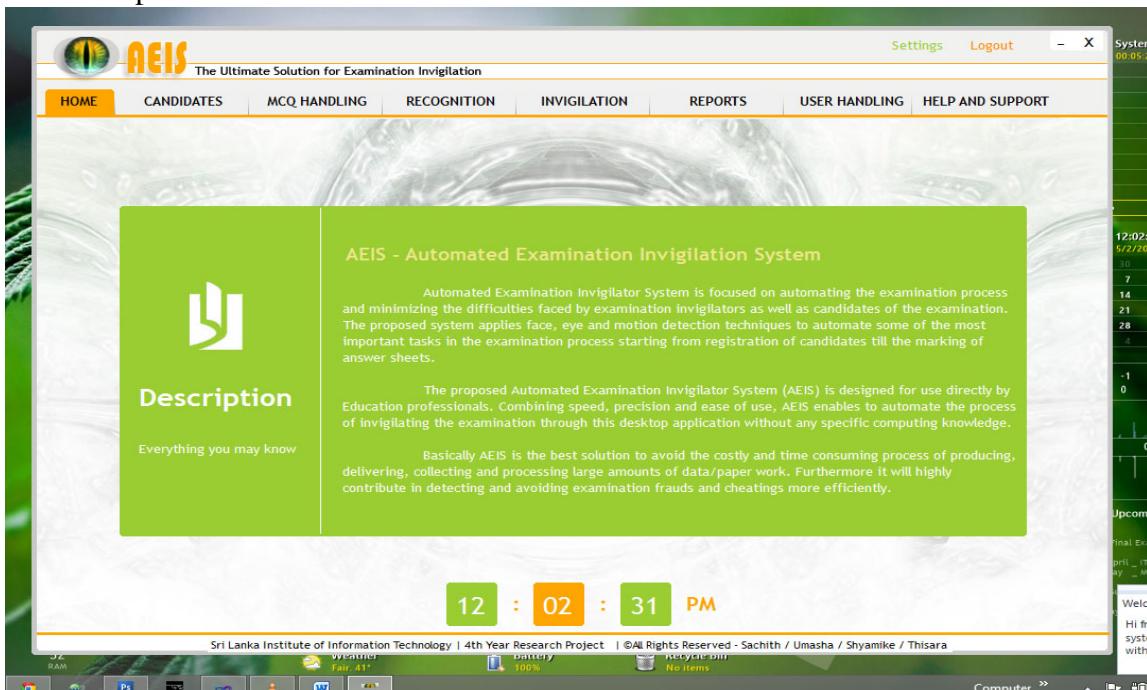


Login Interface

Home Interface



Home Interface Description Interface



Description Interface

Candidate Registration Interface

- Add a new candidate record

The following interface will be used to register a new candidate. The Data entry Operator has to enter the details in the registration form filled by the candidate.

The screenshot shows the AEIS (Automated Examination Invigilator System) web application. The top navigation bar includes links for HOME, CANDIDATES (which is highlighted in orange), MCQ HANDLING, RECOGNITION, INVIGILATION, REPORTS, USER HANDLING, and HELP AND SUPPORT. The top right corner features 'Settings', 'Logout', and a close button ('X').

The main content area is titled 'Registration Form'. A note at the top says: 'CAUTION : Please be kind to fill out the all field which given below. Keeping empty field may occur for warning messages.' The form fields include:

- Candidate ID : [Text input]
- Full Name of the candidate : [Text input]
- Name with the initials : [Text input]
- Title : [Text input]
- Citizenship : [Text input]
- NIC No : [Text input]
- Date of Birth : [Text input] (set to 'Sunday, March 24, 2013')
- Permanent address : [Text input]
- Contact Numbers : [Text input]
- Academic Course name : [Text input]
- Subjects :
 - Subject 1 : [Text input]
 - Subject 2 : [Text input]
 - Subject 4 : [Text input]
 - Subject 5 : [Text input]
 - Subject 3 : [Text input]
- Gender : [Radio buttons for Male and Female]
- Photograph : [Placeholder image of a person's silhouette with a 'Browse' button below it]
- Payment Details (if any) : [Text input]

At the bottom of the form are three buttons: 'Reset', 'Register' (highlighted in blue), and 'Cancel'.

The footer of the page contains the text: 'Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara'.

Add a new candidate record

- Update/ Delete existing candidate record

The screenshot shows the AEIS Candidate Control interface. At the top, there is a navigation bar with links for HOME, CANDIDATES (which is highlighted in orange), MCQ HANDLING, RECOGNITION, INVIGILATION, REPORTS, USER HANDLING, and HELP AND SUPPORT. On the far right of the header are 'Settings' and 'Logout' buttons. Below the header, there is a sidebar titled 'Candidate Control' with three options: 'View Candidate Details' (with a person icon), 'Add New Candidate' (with a person icon), and 'Update / Delete Candidate' (with a pencil icon). The main content area has two sections. The first section, 'Search', contains a search bar with 'Candidate ID : []' and a 'Search' button. Below it, a message says 'No data to display'. The second section, 'Registration Form', contains a note: 'CAUTION : Please be kind to fill out the all field which given below. Keeping empty field may occur for warning messages.' It includes fields for Candidate ID (text box), Full Name of the candidate (text box), Name with the initials (text box), Title (text box), Citizenship (text box), NIC No. (text box), Date of Birth (dropdown menu showing 'Sunday, March 24, 2013'), Permanent address (text box), Contact Numbers (text box), Academic Course name (text box), Gender (radio buttons for Male and Female), and a placeholder for a photograph. At the bottom of the page, there is a footer with the text 'Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara'.

Update/ Delete existing candidate record

The above interface is for updating and deleting existing candidate records. First the particular candidate record should be search and selected among the search results. Once the candidate record is selected, all the text boxes will be filled with the details of the particular candidate.

View candidate details

The screenshot shows the AEIS Candidate Details page. The top navigation bar includes links for HOME, CANDIDATES (which is highlighted in orange), MCQ HANDLING, RECOGNITION, INVIGILATION, REPORTS, USER HANDLING, and HELP AND SUPPORT. The top right corner features 'Settings' and 'Logout' buttons. On the left, a sidebar titled 'Candidate Control' offers options to View Candidate Details (highlighted in orange), Add New Candidate, and Update / Delete Candidate, each with a corresponding icon. The main content area is titled 'Candidate Information' and contains a search bar with 'Candidate ID :'. Below it, a message says 'No data to display'. A photograph placeholder with a 'Browse' button is present. To the right, detailed candidate information is listed:

Candidate ID :	3424234
Full Name of the candidate :	Jhone Smith
Name with the initials :	J. Smith
Title :	Mr.
Citizenship :	American
Gender :	Male
Date of Birth :	12/03/1988
Permanent address :	Chicago
Contact Numbers :	xxx-xxxxxx
Academic Course name :	Software Engineering
Payment Details (if any) :	Rs. 70,000.00
Subjects applied	CDAP , AIES, MTIT

Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara

View candidate details

The above interface is for displaying the details of a particular candidate. First the particular candidate record should be search and selected among the search results. Once the candidate record is selected, all the text boxes will be filled with the details of the particular candidate.

Examination Invigilation Module

The screenshot shows the AEIS Examination Invigilation module. At the top, there's a header with the AEIS logo and the tagline "The Ultimate Solution for Examination Invigilation". Below the header is a navigation menu with links: HOME, CANDIDATES, MCQ HANDLING, RECOGNITION, EXAMINATIONS (which is highlighted in orange), REPORTS, USER HANDLING, and HELP AND SUPPORT.

The main content area is titled "Examination Invigilation". It features a "Camera View" window showing a wide-angle shot of a classroom filled with students at their desks. Below the camera view are several control buttons: "Record" (red circle), "Stop" (blue square), "Zoom" (magnifying glass icon), and "Alert Severity" (a slider). To the right of these controls are two sub-sections: "Grid Layout" (with "On" and "Off" radio buttons) and "Coordinate Details" (with "On" and "Off" radio buttons).

On the far right, there's an "Alerts Window" displaying three entries:

- Suspicious Act: Position : #27, Severity : 70%, Time : 3:34 p.m. (with a "View" button)
- Assistance Needed: Position : #27, Time : 3:34 p.m. (with a "View" button)
- Suspicious Act: Position : #27 (with a "View" button)

Below the alerts is a summary for "Final Examination 2013": Subject Code : IT 300, Date : 12-03-2013, Time : 3:50 p.m., and Venue : D 302.

At the bottom of the interface, there's a footer with the text: Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara.

Examination Invigilation Module Video Archive

This screenshot shows the "Video Archive" section of the AEIS Examination Invigilation module. The layout is similar to the invigilation module, with the AEIS logo and navigation menu at the top.

The main content area is titled "Examination Invigilation". It features a "Camera View" window showing a classroom of students. Below the camera view are control buttons: "Zoom" (magnifying glass icon), "Download Video" (blue button), and "View Log" (blue button). There are also "Coordinate Details" and "Grid Layout" buttons with "On" and "Off" radio buttons.

To the right of the camera view is an "Alerts Window" with a dropdown menu set to "Examination :". It includes fields for "Date Range" (From: Monday, May 6, 2013; To: Monday, May 6, 2013) and "Search" and "Cancel" buttons.

Below the camera view is a "Search Result" panel with the message: "No data to display".

At the bottom, there's a footer with the text: Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara.

Video Archive

MCQ marking module

MCQ Answer Sheets

The screenshot shows the AEIS (Automated Examination Invigilator System) software interface. The top navigation bar includes links for Settings, Logout, HOME, CANDIDATES, MCQ HANDLING (which is highlighted in orange), RECOGNITION, INVIGILATION, REPORTS, USER HANDLING, and HELP AND SUPPORT. On the left, a sidebar titled 'MCQ Paper Handling' lists four options: 'MCQ Answer Sheet' (selected, indicated by an orange icon), 'Marking Schema', 'Marking MCQ', and 'Report'. The main content area is titled 'MCQ Answer Sheets' and contains three sections: 'Save', 'Open', and 'Delete'. Each section has a dropdown menu for 'Select Examination' and a text input field for 'Location', with a 'Browse' button. The 'Save' section also has a 'Save' button. The 'Open' section has an 'Open' button. The 'Delete' section has a 'Delete' button.

MCQ Answer Sheets

This interface will be used to specify a location to save the images of MCQ answer sheets received from the Android Mobile Assistant and save the images accordingly. By using the options Open and Delete, the saved images can be opened and deleted if necessary at a later time.

Marking Schema

The following interface will be used to handle all the tasks related to handling Marking Schemes. Through this interface marking schemes can be uploaded, edited and deleted.

The screenshot shows the AEIS software interface with the 'MCQ HANDLING' tab selected. On the left, there's a sidebar with icons for 'MCQ Answer Sheet', 'Marking Schema' (which is highlighted in orange), 'Marking MCQ', and 'Report'. The main panel has four sections: 'Add' (with fields for 'Marking Schema ID', 'Examination', 'Marking Schema Image' with a 'Browse' button, and 'Gender' with radio buttons for 'Paper is marked' and 'Paper is not marked'), 'Update' (with similar fields), 'Status' (with radio buttons for 'Paper is marked' and 'Paper is not marked' and an 'Update' button), and 'Delete' (with a 'Select Marking Schema' dropdown and a 'Delete' button). The bottom of the screen displays the footer: 'Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara'.

Marking MCQ

Marking Schema

The following interface is the most important user interface related to MCQ Handling module, which performs marking of MCQ papers. First the user will have to select the answer sheet batch, marking scheme and the examination ID. Then by pressing the Start paper marking button the process will get started. In the right panel of the interface, the image of the currently marking answer sheet will be displayed. At the bottom of the interface summary of the progress is shown with the details such as number of papers already marked and number of papers remaining to be marked. The progress bar will indicate the progress of the currently marking answer sheet.

AEIS The Ultimate Solution for Examination Invigilation

HOME CANDIDATES MCQ HANDLING RECOGNITION INVIGILATION REPORTS USER HANDLING HELP AND SUPPORT

MCQ Paper Handling

- MCQ Answer Sheet
- Marking Schema
- Marking MCQ
- Report

Marking Marking

Details

Marking Schema ID :

Select Answer sheet :

Select Marking Schema :

Progress of marking

Progress 

No of papers marked :

No of papers to be marked :

Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara

Marking MCQ

Report Generation

AEIS The Ultimate Solution for Examination Invigilation

HOME CANDIDATES MCQ HANDLING RECOGNITION INVIGILATION REPORTS USER HANDLING HELP AND SUPPORT

MCQ Paper Handling

- MCQ Answer Sheet
- Marking Schema
- Marking MCQ
- Report

Marking Marking

Details

Select Examination

Select Date

Select Date range
From :
To :

Report Viewer

Sri Lanka Institute of Information Technology | 4th Year Research Project | ©All Rights Reserved - Sachith / Umasha / Shyamika / Thisara

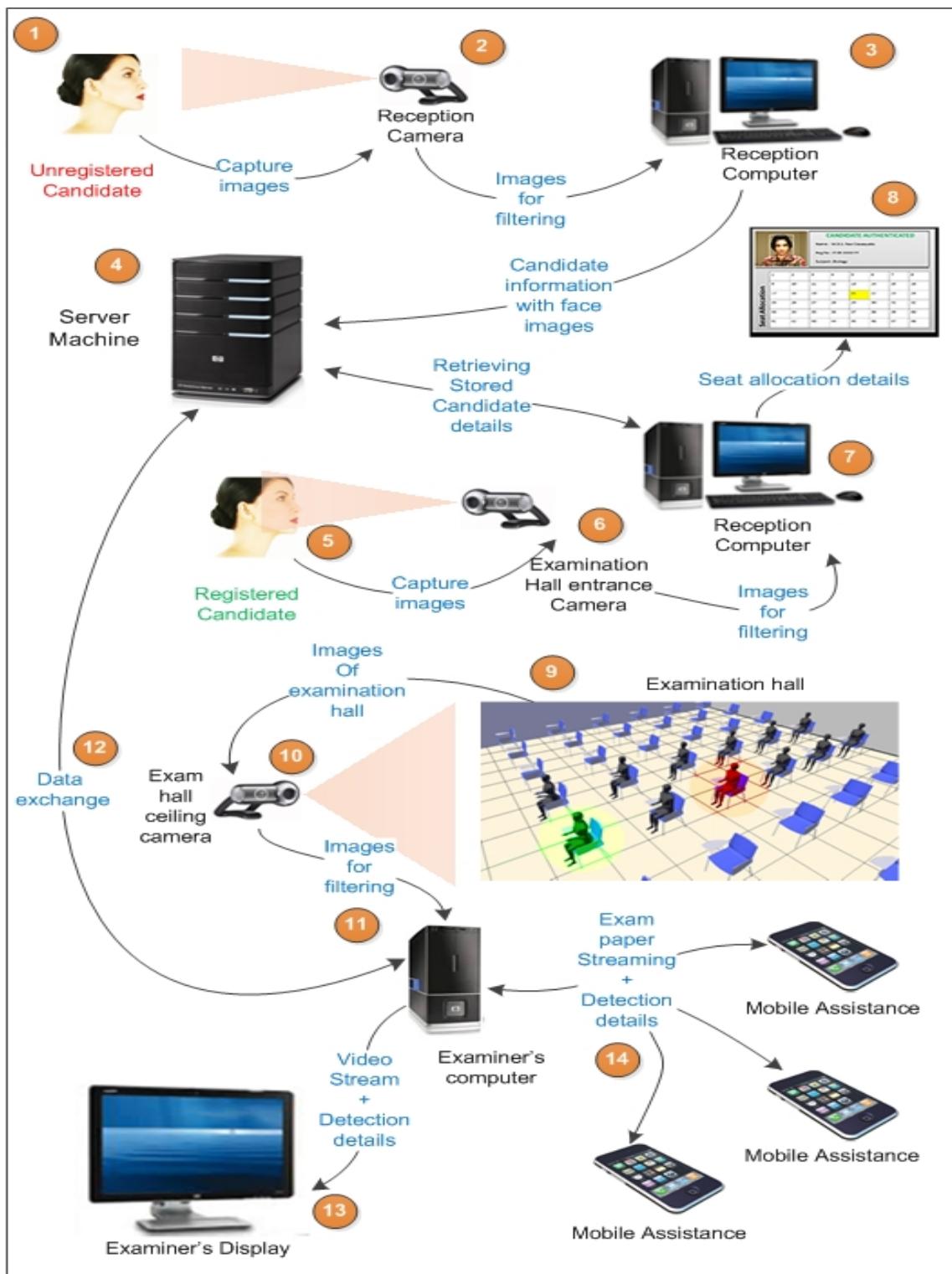
Report Generation

Through this interface reports containing details of MCQ paper marking can be generated easily. The user just has to select the examination, date of examination or a range of dates and click on Generate Report button. In the right panel of the interface there is a report viewer which contains the generated report. These reports will be in PDF format and thus saving and printing options are available.

2.1.3 Hardware interfaces

- Personal Computers with Windows OS
- 17” or higher LCD monitors
- High Quality Video Camera
- Wi-fi Router
- Wi-Fi- supported Android Smart Phone

The AEIS will be placed on PC's throughout the examination halls.



Hardware Interfaces

2.1.4 Software interfaces

- Windows Operating Systems (XP, Vista and Windows7): AIES system will only supports the above cited OSs.
- SQL Server 2005: *The system must use SQL Server 2005 as its database component.*
 - Emgu CV Wrapper: Provides an interface between OpenCV and C#.
 - Android mobile platform: AEIS Mobile Application will only be deployed to android based mobile devices.

2.1.5 Communication interfaces

To send alerts to the candidates prior to the examination via SMS and E-mail, SMS communication gate and an Email service is required respectively.

Communication between the Android Mobile Assistant app and the AEIS desktop application is facilitated by Wi-Fi Router. The Android Mobile Assistant sends notification to the desktop AEIS, when the images of MCQ answer sheets are ready to get downloaded. After receiving the notifications the user can specify a location and the system will download the images using the Wi-Fi connection and store them in a secure location.

2.1.6 Memory constraints

The system is expected to use no less than 1GB of RAM and 200MB of external storage for the PC in which the desktop AEIS will be installed. The minimum and maximum memory used from the SD Card in Android phone should be 50MB and 80MB respectively.

2.1.7 Operations

1. Inserting candidate records.
2. Provide a unique identification to each candidate.
3. Updating & deleting candidate records.
4. Send notifications to candidates regarding the examination prior to each examination.
5. Verify the identity of the candidates before commencing the examination by face recognition.

6. Provide the seating allocation details to each candidate at the examination hall entrance.
7. Tracking the attendance of the candidates and recording the in time.
8. Verify the seated locations of candidates before commencing the examination by face recognition.
9. Observe the candidate activities throughout the examination.
10. Highlight the suspicious activities of candidates.
11. Highlight the candidates who are in need for instructions or additional examination materials by gesture recognition.
12. Generate alerts to invigilator regarding special circumstances as explained in 9 and 10.
13. Provide facility of invigilating the examinations to mobile invigilators through an Android phone.
14. Forward the live video stream and the generated alerts to the Android phone through the desktop application.
15. Recording the suspicious activities of candidates and providing the facility to replay them at a later time.
16. Capturing images of MCQ answer sheets by the Android application for automated marking.
17. Checking the captured images to verify that the quality of the images meets the expected quality required in further phases.
18. Send the captured images of the MCQ answer sheets to the desktop application via Android application.
19. Receive and further refine the images transmitted by the Android application.
20. Rename and Store the images refined images for later retrieval.
21. Retrieval of stored images for marking process.
22. Input the MCQ answer pattern.
23. Automated marking of MCQ answer sheets.

24. Generating the total marks for each answer sheet and storing the marked image for later retrieval.
25. Generating a summary report with total mark for each candidate.

2.1.8 Site adaptation requirements

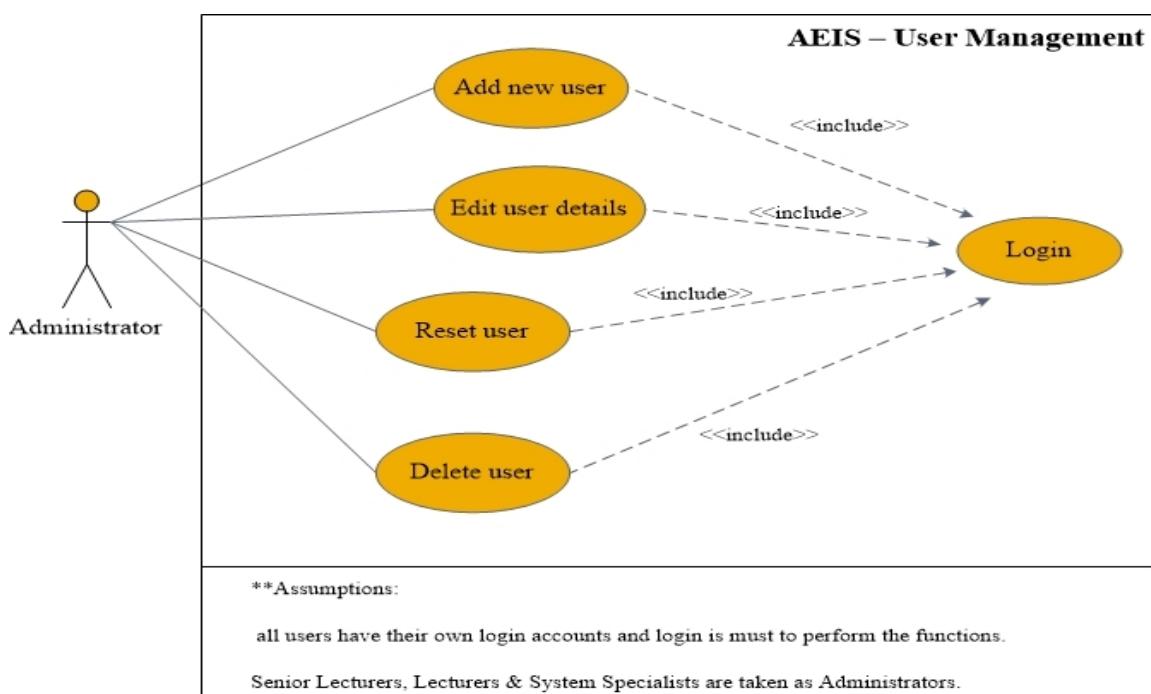
In order to deploy Automated Examination Automation System (AEIS)

1. PC in which the AEIS is supposed to be installed should be connected to a Local Area Network (LAN), located within the Wi-Fi area and the most optimized location to the invigilator to perform parallel tasks.
2. The android phone in which the Android Mobile Assistant is installed and the PC in which AEIS desktop application is installed should be located within the Wi-Fi area.
3. High Quality Video camera should be located in a place where it can capture quality images of candidates at the entrance and within the examination hall and should be connected to the LAN. The camera should be able to get clear videos covering the entire examination hall.
4. Examination hall environment should fulfill the minimum lighting requirements to capture quality and more clear video stream.
5. The seating arrangements of the candidates for each examination and examination details should have to be entered into the system before commencing an examination.
6. For the Candidate Identity Verification, candidate's portrait photographs should be provided to the system in advance and these images should meet at least the minimum quality requirements.
7. For MCQ marking module relevant set of MCQ answer sheets and the correct marking scheme should be entered into the system.
8. Connection of the Wi-Fi router to the LAN should be configured and also android based mobile device which is used to deploy the AEIS mobile application must be compatible with connecting to a LAN via Wi-Fi

2.2 Product functions

System User Management

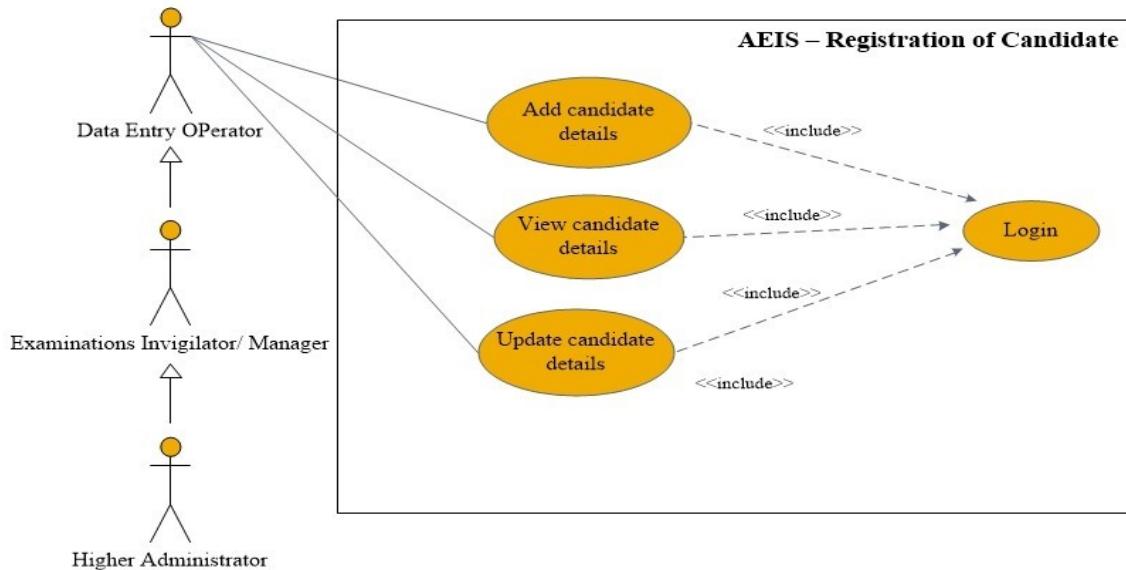
- Add new users to the system.
- Edit existing user information.
- Reset user password.
- Delete existing users.
- System Login.
- Manage user levels & function categories.



System User Management Registration of candidates

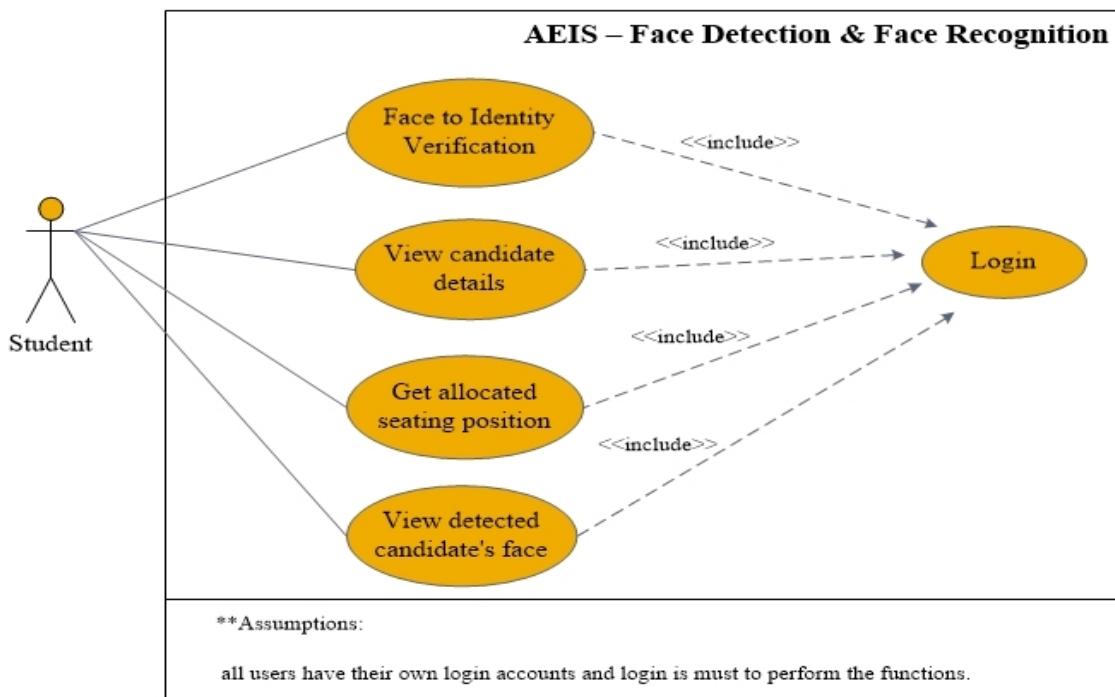
- Add new candidate record
- Update/Delete existing candidate record
- Display candidate details

Initially, all the candidates of an examination should get registered under the system by entering required personal and academic details of the candidates along with their images for identity verification. The system will auto generate a unique registration Number for each candidate. This registration number will be used throughout the system to identify a candidate uniquely. Also these records can be edited and deleted as and when necessary. The data entry operator is responsible for adding new candidates, updating and deleting candidate details from the AEIS. From data entry operator to the higher administration it is possible to view the candidate details by providing the registration number or searching by name of the candidate.



Registration of candidates Candidate Identity Verification

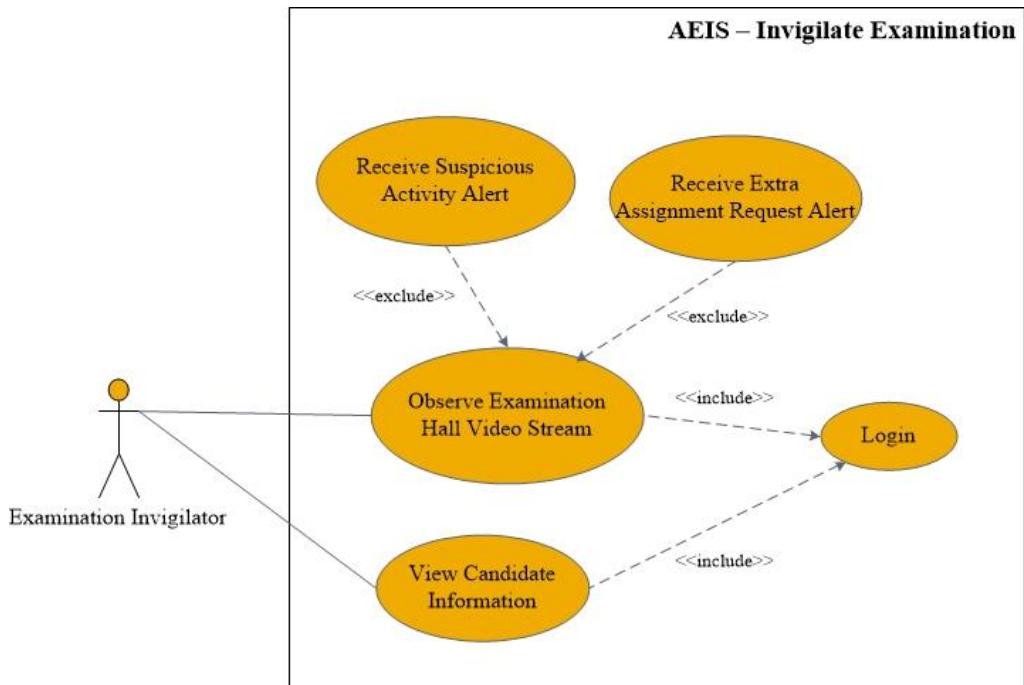
- Detect candidates face from the video stream.
- Identify candidates using Face recognition.
- Show seating position which allocated to relevant candidate.
- Filter & standardize camera input images.



Candidate Identity Verification

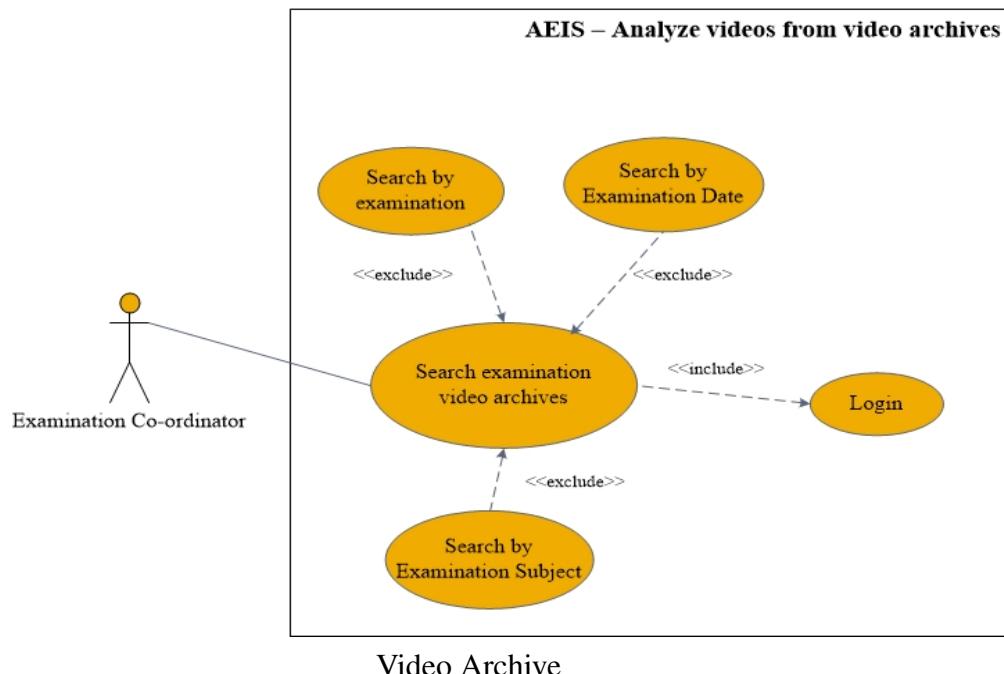
Examination Invigilation Module

- Show examination hall/halls live video stream to the invigilator
- Highlight suspected activities of candidates
- Highlight students who are requesting for assistance



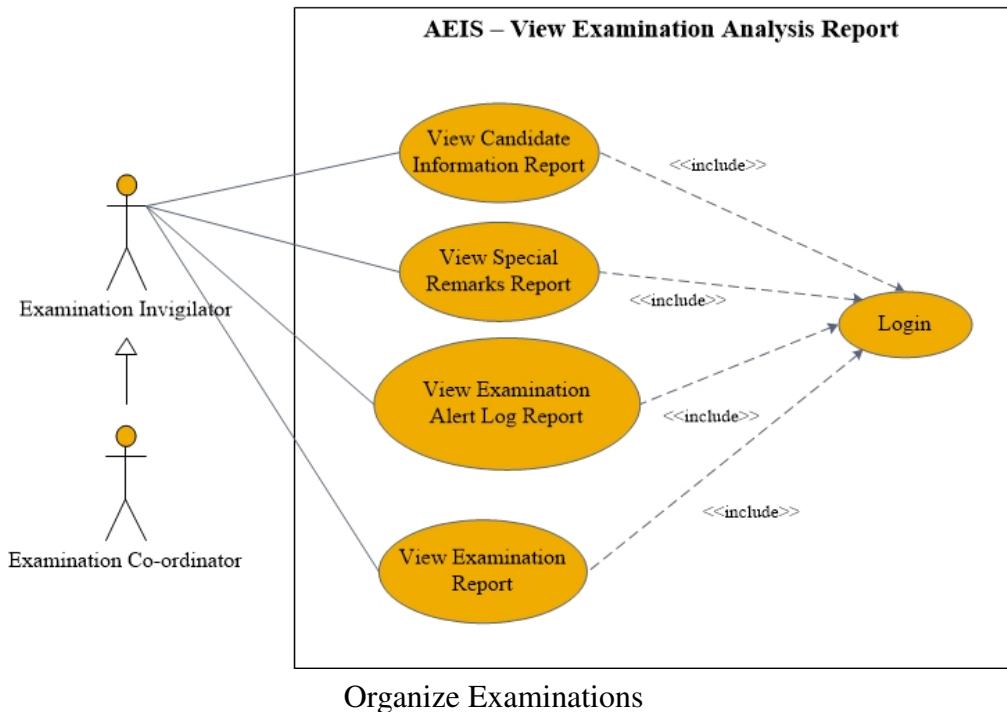
Examination Invigilation Module
Video Archive

- Enable to analyze examination video at a later time.



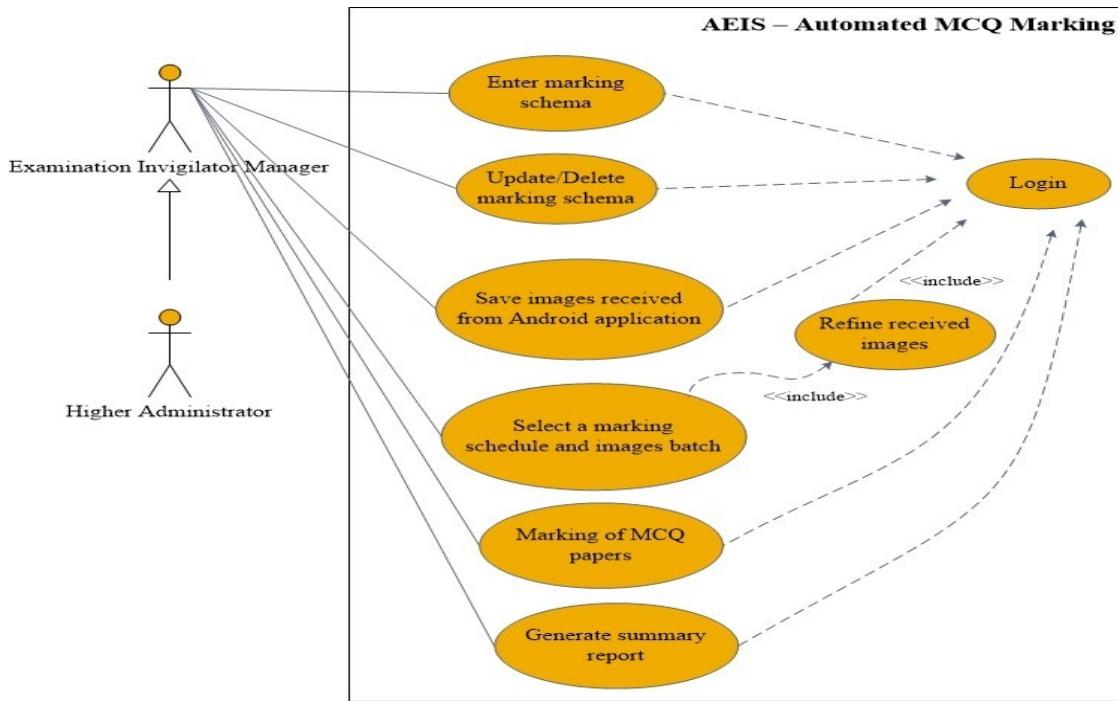
Video Archive

Organize Examinations



Generating Examination Analysis Reports

- View Examination Analysis Reports



View Examination Analysis Reports
Marking of MCQ papers

A special standard answer sheet will be designed to be used by the AEIS in MCQ marking module. Android Mobile Assistant will capture the images of these MCQ answer sheets and transmit those captured image directly to the desktop application via a Wi-Fi connection. Then the system will mark the answers with perfect accuracy by using high-resolution images. These images are archived and accessible at any time for reviewing. Results from the marked scored will be available as soon as the scanning is complete. Finally the system will assembles and generates a statistical report.

2.3 User characteristics

Users of this system will usually be Data Entry Operators, Examination Invigilators/Managers and Higher Administration. The user will have to know basic operations to use a PC to make functional use of the AEIS. Followings are the requirements to be fulfilled by a user to operate AEIS.

- Educational level of AEIS computer software - Low
- Experience of AEIS software - None

- Technical Expertise - Little

As invigilators, prior to commence an examination they can confirm the validity of each candidate entering into the examination hall and then check whether the candidates are seated according to the provided seating arrangements. During the examination they can easily identify the candidates separately, who are doing suspected activities and the candidates who needs assistant. Such suspected activities are recorded and they can replay those videos at a later time. If an invigilator has to look over several examination halls he/she can use the Android Mobile Assistant hence he is not stable in a one particular location. Invigilators are also facilitated with marking of MCQ answer sheets by this AEIS.

Examination Managers can preview candidate details, organize examination details such as candidate seating arrangements, replay suspected activities and generating summary reports of MCQ answer sheet marking etc. Higher administration has the privileges to access all of the system features.

2.4 Constraints

- AEIS shall operate on PCs running Windows XP or later at a minimum speed of 100 MHZ. C# shall be the implementation language.
- The system is a desktop application
- Cannot 100% guarantee on clearly recognizing the candidates at the back rows when using a single camera. This will depend on the quality of the video stream, number of cameras used and angles in which the cameras are setup.
- Video recordings of the examination halls can only be kept for a limited time period considering the server storage used.
- Cannot guarantee 100% that a candidate is cheating during an examination or not. We will be monitoring the candidate's behavior during the examination and use mechanisms to identify the candidates but the security of the exam beyond our control.
- Transmitting live video stream of examination hall to the desktop application while maintaining the high quality and least latency.
- Transmitting the images of the MCQ answer sheets captured by the Android Mobile Assistant app to the desktop application via Wi-Fi connection.

- Detecting the simultaneous actions of the candidates during the examination.

Minimum configurations required to meet by the PC in which the AEIS is supposed to be installed.

- OS : Windows XP or later
- Memory: 256 MB minimum for windows XP, 1 GB minimum for Vista and Windows 7
- CPU: Intel Pentium 4 2GHz or above
- Hard disk : 1 TB or above
- Should run SQL Server 5 or above

2.5 Assumptions and dependencies

Mainly the AEIS will run only on a machine with Windows based operating system.

One of the main parts of our system is the Examination Invigilation System. When implementing a real-time automated examination invigilator system, many limitations arrives since the system will detect the suspicious activities and candidates who needs assistant based on candidate's gesture recognition. In the proposed AEIS, suspicious activities are detected by the movement of head and eyes of each candidate, whereas assistant requests are detected by the hand movements of each candidate. These two activities are identified separately and the system will act according to inform the invigilator regarding the unusual action arisen inside the examination hall. In both situations the virtual cell assigned to the particular candidate will be highlighted in a predefined color in the virtual grid of the examination hall and an alert will be generated to the invigilator regarding those actions. It is assumed that the network connection is always in upstate, because the live video stream must be streamed over to the AEIS throughout the examination duration.

In MCQ marking module the images of answer sheets are transmitted by the Android Mobile Assistant application installed in the Android mobile phone. It is assumed that these MCQ answer sheets transmitted by the Android Mobile Assistant should be downloaded by the desktop AEIS.

2.6 Apportioning of requirements

It is possible in the future that a few additional features be implemented into this system.

1. Automatically read data from filled candidate registration forms and add them to the AEIS using Optical Character Recognition (OCR) techniques
2. Online registration of candidates
3. Setting up cameras for each candidate table to observe them individually.

3 Specific requirements

3.1 External interface requirements

3.1.1 User interfaces

1. Registration of candidates

Registration of candidates is the initial step of the Automated Examination Invigilator System (AEIS). Purpose of this module is to add new candidate's details to the AEIS, edit existing candidate details and delete candidate records as and when necessary. To get registered for a particular examination with the use of AEIS, candidates should duly complete the registration form with their correct personal and academic details and submit it to the Coordinator of the Examinations / Examinations Manager. The Coordinator / Manger will check all the details and if the applicant is eligible to sit for the exam the registration form will be approved or otherwise rejected. Then the Data Entry Operator at the Registration of Examinations Unit will recheck the approved registration form data and add them to the AEIS. The system will check whether that particular candidate has been registered with the AEIS previously. If the applicant is already registered with system his/her new application for registering for the examination will be disregarded. When inserting a new candidate record to the AEIS the system will provide a unique identification number to each candidate. This identification number will be used throughout the examination to identify a candidate uniquely. The data entry operator is provided with facilities to edit and delete candidate records as well.

When inserting a new candidate record, it is essential to add photographs of the candidate with all the other candidate details, because the AEIS uses face recognition techniques to identify each candidate. These photographs should be portrait photographs taken in several predefined angles because the number of portraits

of candidate is directly proportional with the accuracy rate of face recognition. These photographs will be added to the system and will be used in the Candidate Identity Verification module later on to verify the identity of the candidate before commencing an examination. All the data inserted into the Registration module will be validated at the time of insertion.

After a successful data insertion, the Data Entry Operator will confirm the registering of the candidate. Then the applicant is referred to perform a test with the Candidate Identity Verification module to check whether that the AEIS is capable of identifying the particular candidate and verify his/her identity. After completing all the above steps successfully finally an Admission Slip will be auto generated by the system in a printable format, including all the examination details such as Registration number, Examination date, venue, time and any other information regarding the examination.

2. Send SMS for examination candidates prior to each examination
3. Send Email to examination candidates prior to each examination
4. Candidate Identity Verification
5. Examination Invigilation Module
6. Display examination hall/halls live video stream in the Android application
7. Transmitting images of MCQ Answer Sheets to the desktop application
8. Marking of MCQ papers

The OMR process has mainly 3 process components:

1. MCQ answer sheet Design & Print
2. Capturing images of MCQ answer sheets
3. Reading of images of answer sheets to get results

To mark the MCQ answer sheets using the automated MCQ marking module a pre-printed standard answer sheet should be used by each candidate. Candidates indicate their answers by darkening circles marked on this sheet and the images of those answer sheets are used to mark and prepare the final result.

First, the images of these answer sheets filled by the candidates are captured with the use of Android Mobile Assistant. After verifying the quality of these images they are transmitted to the desktop AEIS via Wi-Fi connection. The AEIS accepts files scanned at 100-200 dpi in B/W, grey scale or color modes and saved in BMP or TIFF formats using the MCQ Answer Sheets interface in the MCQ Handling main interface. Using the same interface these images can be opened and deleted as and when necessary.

Marking scheme details are handled with the use of Marking Scheme sub-interface. It can be used to add, update and delete marking schemes, which will be later used in the process of automated MCQ marking.

Once the answer sheets and the marking scheme are ready the marking process can be started, by using the MCQ Marking sub-interface. The user will have to provide the answer sheet batch, marking scheme and the examination details. Progress of the marking process is also shown to the user as a summary. Further using the Report Generation interface reports can be generated which contains the details of MCQ paper marking history.

3.1.2 Hardware interfaces

- Personal Computers with Windows OS
- 17” or higher LCD monitors
- High Quality Video Camera
- Wi-fi Router
- Wi-Fi- supported Android Smart Phone

3.1.3 Software interfaces

- AIES system will only supports the windows operating systems (XP, Vista, Windows7).
- Automated Examination Invigilator System (AEIS) shall interface with SQL Server 2005 as its database component.
- AIES shall interface with Emgu CV Wrapper which essentially provides an interface between OpenCV and C#.
- AEIS Mobile Application will use Android mobile platform and will only be deployed to android based mobile devices.

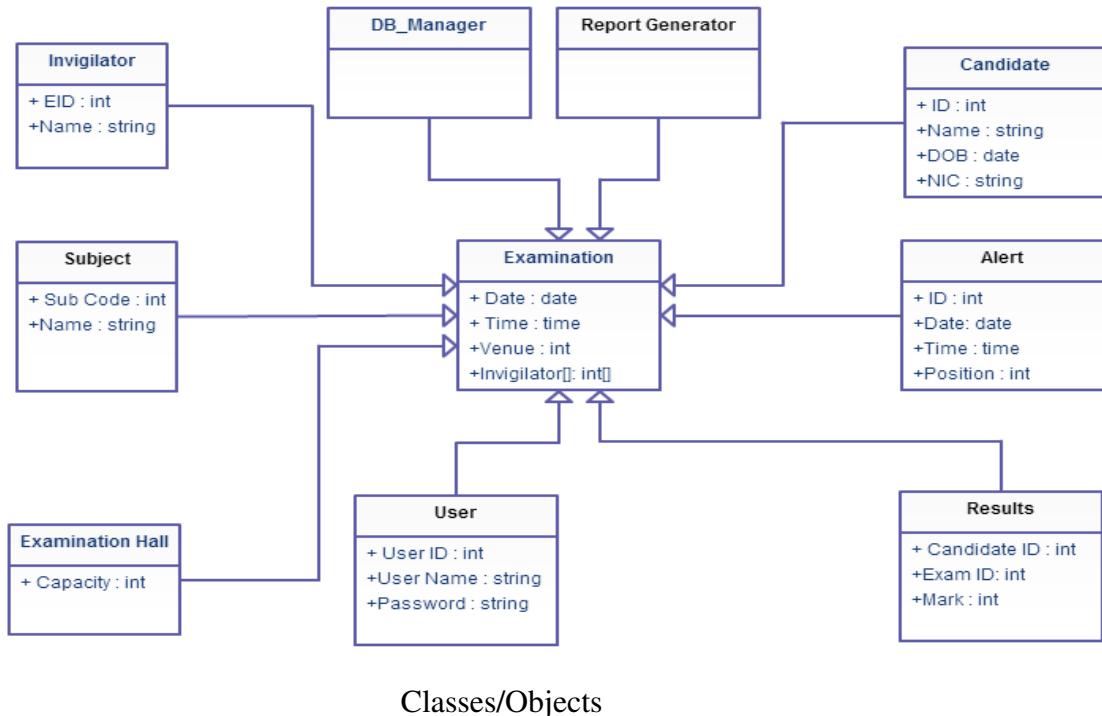
3.1.4 Communication interfaces

To send alerts to the candidates prior to the examination via SMS and E-mail, SMS communication gate and an Email service is required respectively.

Communication between the Android Mobile Assistant app and the AEIS desktop application is facilitated by Wi-Fi Router. The Android Mobile Assistant sends notification to the desktop AEIS, when the images of MCQ answer sheets are ready to get downloaded. After receiving the notifications the user can specify

a location and the system will download the images using the Wi-Fi connection and store them in a secure location.

3.2 Classes/Objects



3.3 Performance requirements

Performance requirements are the extent to which a function must be executed, and is generally measured in terms of quality, quantity, coverage, timeliness or readiness. Also the performance of the application will be measured using speed, capacity and scalability.

Basically AEIS is based on lot of image processing. In Candidate Identity Verification process the captured images of the candidate should be processed in high speed as the user is going to see the processed results within very short time. Since the invigilation is based on the examination hall video stream it must be real time, it might have a minimum delay as possible.

The system should have enough capacity to store MCQ answer sheets.

The video quality at each end will depend on the webcam quality and also the network bandwidth.

3.4 Design constraints

There will only a single database for the entire system. It is deployed in the SQL server with the database name 'aeis'. Only the administrators have direct access to the 'aeis' SQL Server database. No users are given direct access to the database. All database operations will be performed using the database functions which implemented at the database platform.

All the user accounts details, candidates and examination details, MCQ paper marking details will be stored in the 'aeis' database. The video recordings will not be stored in the database. It will be stored in the secondary storage on the server and database will contain the file location.

The examination hall video stream needs to be in high quality as it is used in the invigilation process to identify candidates. The examination hall light condition should be moderated.

The system needs several images of the candidate in several angles to be used in Candidate Identity Verification process. These images need to be captured using high quality camera which would be high in cost. In that case the total cost for the project would be increased.

The MCQ marking module will be implemented based on a standard MCQ answer sheet. Only the answers marked on these standard formats will be eligible to automatically mark by the AEIS.

3.5 Software system attributes

3.5.1 Reliability

All data storage for user variables will be committed to the database at the time of entry.

3.5.2 Availability

The system shall be available during normal operating hours. All cached data will be rebuilt during every startup. There is no recovery of user data if it is lost. Default values of system data will be assigned when necessary.

As a matter of fact the quality of the performance of the system will depend upon the LAN connections. Therefore network performance is directly related to the system performance.

3.5.3 Security

The PC on which the AEIS resides will have its own security. Only the invigilator will have physical access to the machine at the time of the examination.

Data Entry Operators will be able to log in to the Candidate Registration Module. Examinations Invigilators and Managers will have access to the Examination Invigilation Module, Android Mobile Assistant and Automated MCQ Marking Module. Higher Administration will have access to the all the subsystems. Access to the various subsystems will be protected by a user log in screen that requires a user name and password.

3.5.4 Maintainability

Object oriented programming is followed to develop the AEIS and shall be easy to maintain.

3.6 References

- [1] Banana Hammocks, *Calculator Advance*, Version: (1.0), 2004, 22
- [2] *General Requirements Specification for Software Implementing Federal Aviation Administration Criteria for Instrument Flight Procedure Design*, Version 1.0, FAA - Flight Standards Service - Flight Procedure Standards Branch, July 2009, 58
- [3] SWE 626 Team 1, *Hotel Management System Software Requirements Specification Document*, Version: (1.1), 2002, 12
- [4] Jahanzeb Sherwani, Nosheen Ali, Nausheen Lotia, Zahra Hayat , *Libra: An Economy-Driven Cluster Scheduler Software Requirements Specification*, Version 1.0, 2001, 18
- [5] Joan, Paul Adams, Bobbie Baker, Charles Charlie, *Web Publishing System Software Requirements Specification, Version 1.0*, 2004, 31
- [6] Michael J. Reaves, *Web Accessible Alumni Database Software Requirements Specification*, Version 1.1, 2003, 20
- [7] VitoSalerno, Jeff Segall, IanYoder, JoshZenker, *Software Requirements Specification*, WarRoomSystems, Revision1.1, 2009, 12