SOFTWARE DESIGN DOCUMENT (SDD)

SDD-FSES-SG-V1.00

For the

First Stage Evaluation System **(FSES)**

Prepared For:
Faculty of Artificial Intelligence

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CHANGE HISTORY

REVISION	DESCRIPTION
1.0	First draft.
2.0	
3.0	
4.0	

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PREFACE

The Software Design Description (SDD) for the First Stage Evaluation System (FSES) offers an in-depth exploration of the system's architecture, components, and design choices. This document is intended to serve as a detailed guide for developers and stakeholders, providing a clear understanding of the system's design, functionality, and interaction among components. By outlining the system's structure and design rationale, this SDD ensures alignment with the project objectives and facilitates effective implementation of the system. The SDD also outlines the technical blueprint that drives the development process, thereby supporting quality assurance, risk mitigation, and adherence to the project schedule.

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1 OVERVIEW

1.1 PURPOSE

The purpose of this Software Design Description (SDD) is to present a detailed and structured representation of the First Stage Evaluation System's architecture and design. This document provides a comprehensive guide for developers and stakeholders, facilitating the development, testing, and maintenance processes. It aims to ensure that all parties involved have a shared understanding of the system's design and functionality, promoting consistency, quality, and efficiency throughout the project lifecycle.

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1.2 SCOPE

The scope of the Software Design Description (SDD) encompasses the architecture, design, and functionality of the First Stage Evaluation System. It defines the system's modules, components, and their interactions, detailing the design patterns. Additionally, the SDD outlines relevant constraints, assumptions, and dependencies, ensuring comprehensive coverage of all design aspects necessary for the software project's successful development and implementation.

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1.3 OBJECTIVES

The primary objectives of this SDD are:

1. **Provide Clarity and Understanding**
    Ensure that all stakeholders have a clear and common understanding of the system's design, thereby facilitating effective communication and collaboration.

2. **Guide Development and Implementation**
    Serve as a blueprint for developers, guiding the coding, integration, and testing phases with detailed and unambiguous design specifications.

3. **Ensure Consistency and Quality**
    Promote consistency in design and implementation, ensuring that all components align with the overall architectural vision and quality standards.

4. **Facilitate Maintenance and Upgrades**
    Provide a reference for future maintenance and enhancement activities, ensuring that changes can be made efficiently and with minimal disruption.

5. **Support Risk Management and Mitigation**
    Identify potential design risks early in the project, allowing for proactive mitigation strategies to be implemented.

6. **Align with Project Goals**
    Ensure that the design aligns with the project's goals and objectives, delivering a system that meets the needs of its users and stakeholders effectively.

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1.4 INTENDED AUDIENCE

The intended audience for the Software Design Description (SDD) of the First Stage Evaluation System includes:

1. **Developers**
   To provide detailed design specifications that guide the implementation of the system.

2. **Quality Assurance (QA) Managers**
   To understand the design for creating comprehensive test plans and test cases.

3. **Project Manager**
   To gain insights into the technical aspects of the project for better planning, monitoring, and control.

4. **Configuration Manager**
   To understand the design of the system to ensure the current configuration system is suitable for the current project.

5. **Stakeholders and Clients**
   To verify that the design aligns with their requirements and expectations.

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2 REFERENCES

This section shall list by document number and title all documents referenced in this plan.

1. FAI (Man_Doc_004) Preliminary Design Review Invitation
2. IEEE Std 1016-2009 (Revision of IEEE Std 1016-1998), IEEE Standard for Information Technology--Systems Design--Software Design Descriptions
3. SG Co. (2024), Software Project Management Plan (SPMP-FSES-SG-V1.00)
4. SG Co. (2024), Software Requirement Specification (SRS-FSES-SG-V1.00)

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3 DEFINITIONS

The definitions for the acronyms used in this document are listed in Table 1 below.

Table 1: List of Acronyms and Their Definitions

Acronyms	Meaning
CSC	Computer Software Components
CSU	Configuration Software Units
FAI	Faculty of Artificial Intelligence
FSE	First Stage Evaluation
FSES	First Stage Evaluation System
IEEE	Institute of Electrical and Electronics Engineers
MVC	Model View Controller
SDD	Software Design Document
UML	Unified Modelling Language
UTM	Universiti Teknologi Malaysia

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4 DESIGN

4.1 IDENTIFIED STAKEHOLDERS

The identified stakeholders of this document are:

1. **The Client**
    Ts. Dr. Haslina Binti Md. Sarkan

2. **The Development Team**
    SG Co.

3. **The Users**
    Office Assistant, Research Supervisor and Program Coordinator for First Stage Evaluation

4.2 DESIGN LANGUAGE

The Software Design Description (SDD) for the First Stage Evaluation System employs Unified Modeling Language (UML) as the primary design language to represent the design viewpoint. UML is utilized to provide a clear and standardized method of depicting the system's architecture, components, and interactions.

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4.3 DESIGN CONCERN

The design of the First Stage Evaluation System addresses several critical concerns to ensure the system meets its functional and non-functional requirements. These concerns include functionality, reliability, performance, and maintainability. By addressing these design concerns— functionality, reliability, performance, and maintainability—the First Stage Evaluation System aims to deliver a robust, efficient, and user-friendly solution that meets the needs of its stakeholders and ensures long-term success.

4.4 DESIGN VIEWPOINTS

Design views assist design stakeholders in concentrating on specific design features and satisfying relevant criteria. This chapter will cover the following eight aspects of the First Stage Evaluation System (FSES) design, as recommended by the IEEE 1016-2009 Standard.

1. Context Viewpoint
2. Composition Viewpoint
3. Logical Viewpoint
4. Dependency Viewpoint
5. Pattern Viewpoint
6. Interaction Viewpoint
7. State Dynamics Viewpoint

Relevant UML diagrams will be provided in each of these viewpoints to enhance the definition and comprehension of the system.

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4.4.1 CONTEXT VIEWPOINT

The Context Viewpoint of the First Stage Evaluation System (FSES) provides an overview of the services offered by the system within its operational environment, emphasizing the interactions with external entities.

4.4.1.1 Design Concerns

The list of actors and the system's functionalities, as well as how they are associated, are among the design considerations of the context viewpoint.

4.4.1.2 Design elements

Key elements of the Context Viewpoint include:
1. Actors: External entities that interact with the FSES, such as users and other systems.
2. Services: Functional capabilities provided by the FSES, depicted as use cases.

The list of actors is as follows:
1. Office Assistant
2. Research Supervisor
3. Program Coordinator

The list of functionalities of FSES is as follows:
1. Login
2. Prepare student list
3. Manage masterlist
4. Nominate Examiners
5. Assign Chairperson

The context diagram in Figure 1 below shows the interactions between the system and the actors who will use the system.
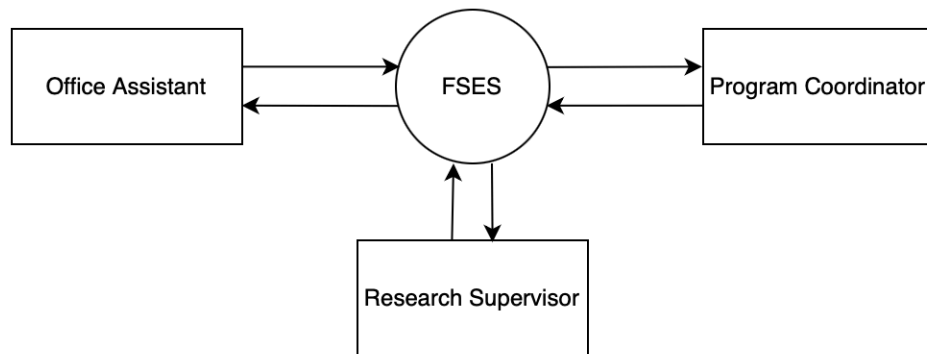

Figure 1: Context Diagram

The use case diagram in Figure 2 below shows the functionality of the First Stage Evaluation System (FSES) by illustrating its interactions with the external actors which are the Office Assistant, the Research Supervisor and the Program Coordinator. The figure provides a view of the services offered by the system and the roles that interact with it.
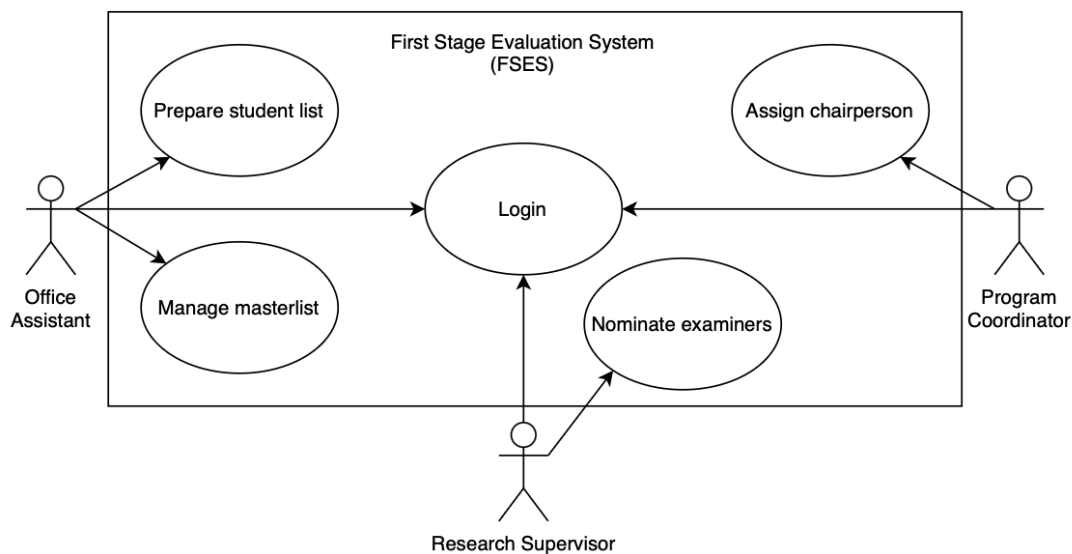

Figure 2: FSES Use Case Diagram

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4.4.2 COMPOSITION VIEWPOINT

The Composition Viewpoint focuses on the internal structure of the First Stage Evaluation System (FSES), detailing how the system is breakdown into smaller components or subsystems. This viewpoint provides insights into the hierarchical organization and relationships between the main components, facilitating a clear understanding of the system's architecture and modular design.

4.4.2.1 Design Concerns

The design concern of the composition viewpoint is the identification of the major design components of the design subject, to localize and allocate functionality, responsibilities, or other design roles.

4.4.2.2 Design elements

The component diagram in Figure 3 below shows the logical decomposition Viewpoint of the FSES. It provides a detailed view of the internal structure of the First Stage Evaluation System (FSES). It illustrates how the system is divided into various components, how these components interact with each other, and how they rely on underlying databases to perform their functions.
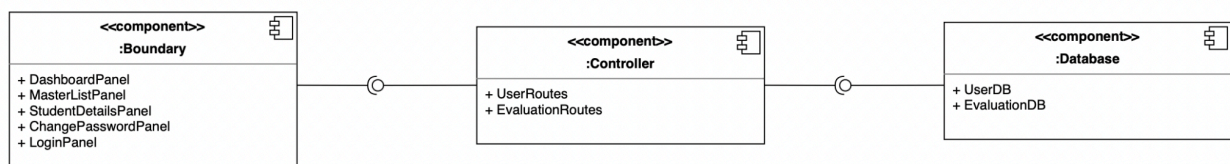

Figure 3: Component Diagram

The deployment diagram below provides an overview of the deployment architecture for the First Stage Evaluation System (FSES). It shows how the system components are distributed across different nodes, including client, server, and database.

Figure 4 below highlights the interactions between these components, ensuring a clear understanding of the system's physical deployment.

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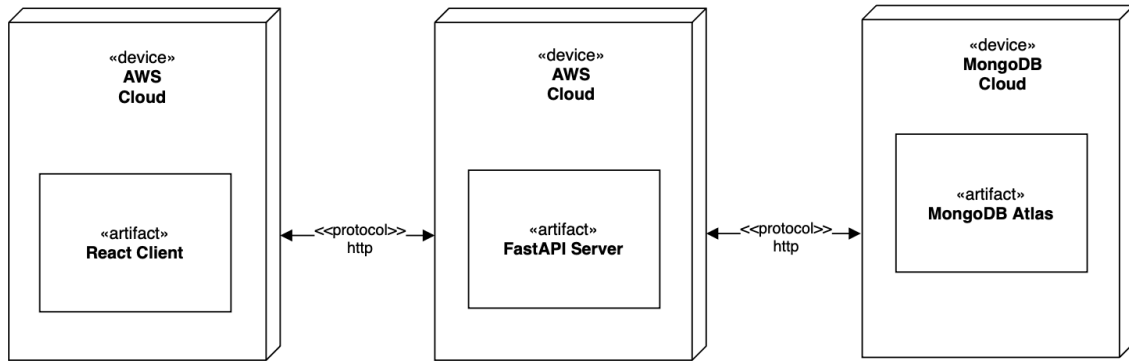
Figure 4: Deployment Diagram

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4.4.3 LOGICAL VIEWPOINT

4.4.3.1 Design Concerns

The Logical Viewpoint focuses on the static structure of the First Stage Evaluation System (FSES), detailing the key elements, their attributes, methods, and the relationships between them. This viewpoint provides a clear blueprint for the system's object-oriented design, aiding developers and system architects in understanding how the various parts of the system interact and are organized.

4.4.3.2 Design elements

The class diagram in Figure 5 below provides a detailed view of the key classes and their relationships within the First Stage Evaluation System (FSES). It illustrates the static structure of the system, including the attributes and methods of each class, and the interactions between different components.
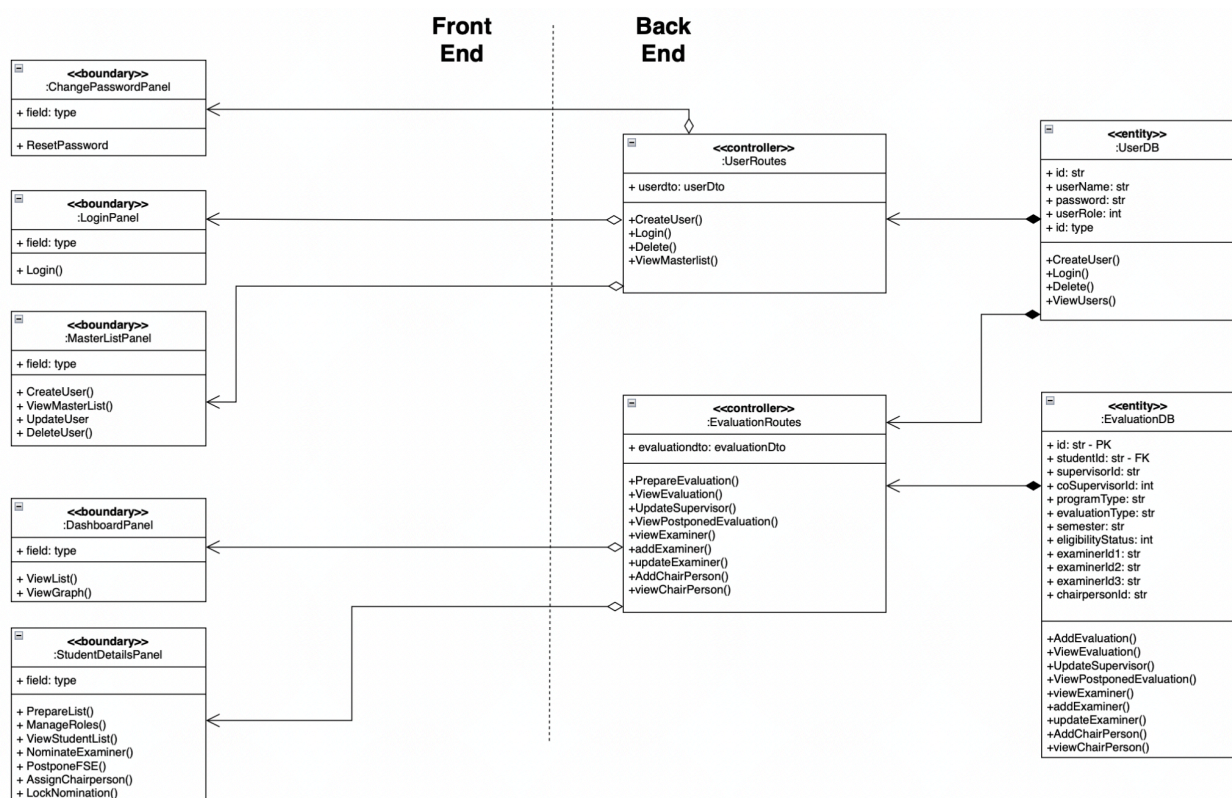
Figure 5: Class Diagram

4.4.4 DEPENDENCY VIEWPOINT

The dependency viewpoint describes the components of the system and dependencies between these components.

4.4.4.1 Design Concerns

Dependency viewpoint design is concerned with the interconnecting, sharing, and parameterizing the design subject to assess the impact of requirements or design changes.

4.4.4.2 Design Element

This system follows a three-tier architecture, client-side tier, business logic tier and data access tier. As shown in Figure 6 below.
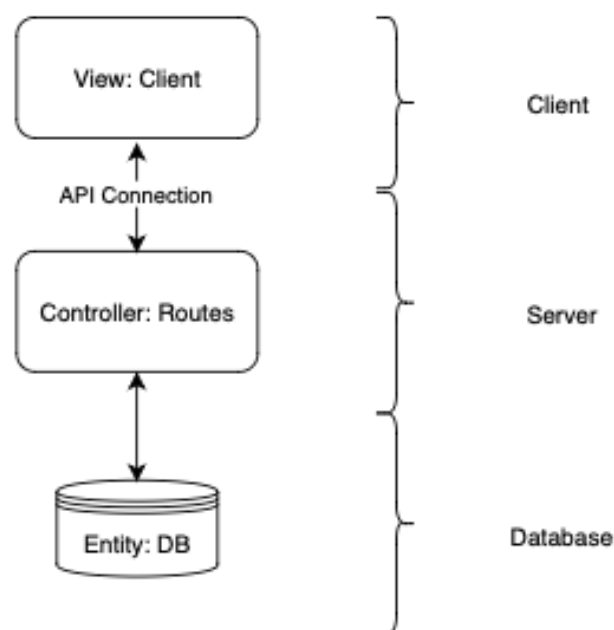
Figure 6: Architecture Diagram

The package diagram in figure 7 also reflects this three-tier structure. Each tier is represented by a corresponding package. For instance, the Boundary package represents the client-side tier, the Controller package represents the business logic tier, and the Entity package represents the data access tier.

Figure 7: Package Diagram

4.4.5 PATTERNS USE VIEWPOINT

The pattern use viewpoint describes design patterns and usage of design patterns which meet design ideas of the project.

4.4.5.1 Design Concerns

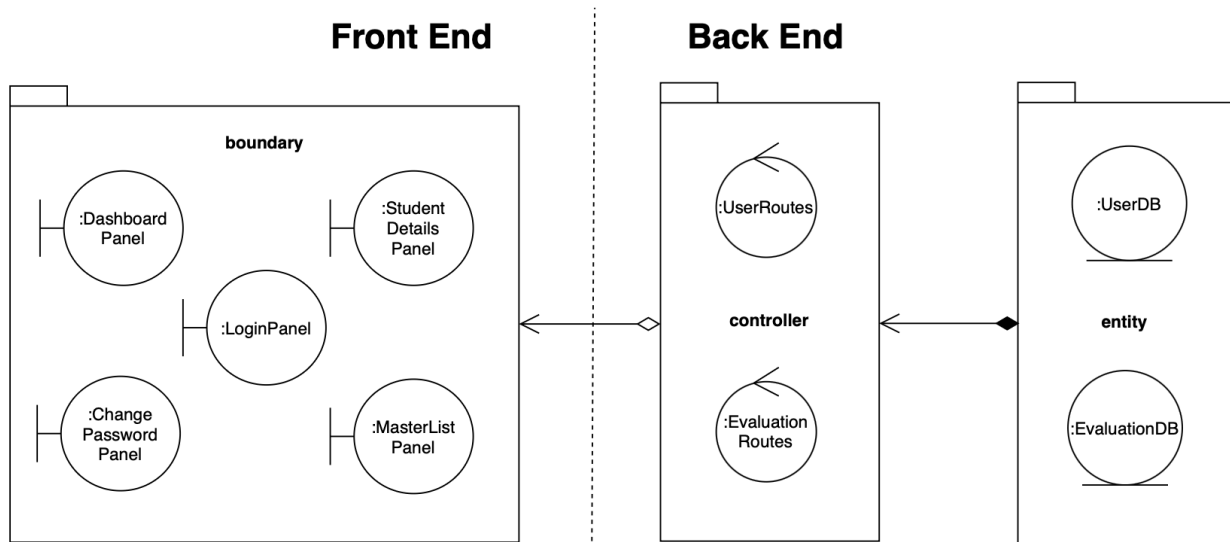The design concern of the pattern use viewpoint is the usability of reusable design ideas (design patterns), and architectural styles.

4.4.5.2 Design Element
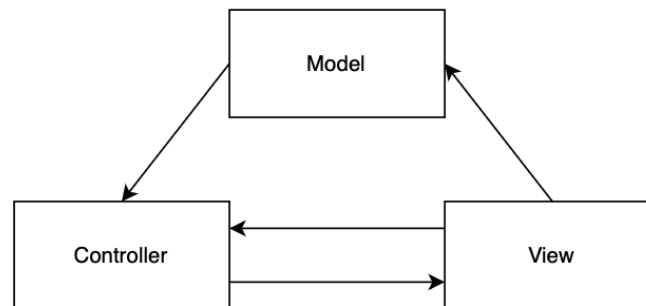
Figure 8: Design Patterns

Figure 8 explains the MVC (Model-View-Controller) design patterns to be implemented in FSES. In this architecture, the Model represents the data, the View deals with the presentation of the FSE details to the user, and the Controller manages the flow and interaction between the Model and View components of the FSES system.

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4.4.6 INTERACTION VIEWPOINT

The Interaction Viewpoint captures the dynamic behavior of the FSES by illustrating how its components interact to perform specific functions. This viewpoint focuses on the sequence of operations and the exchange of messages between objects to achieve desired outcomes. It provides a clear understanding of the runtime behavior of the system, which is essential for developers, testers, and other stakeholders.

4.4.6.1 Design Concerns

The design concerns of the Interaction Viewpoint for the FSES include:
1. Allocation of responsibilities for efficient collaboration.
2. Detailed description of interactions via message exchanges.
3. State transition logic for managing system state transitions.
4. Handling concurrency for simultaneous operations.
5. Tailoring for reactive, interactive, distributed, and real-time scenarios.

These concerns are addressed using sequence diagrams and state transition diagrams to provide a clear understanding of the system's dynamic behavior and interactions.

4.4.6.2 Design Element

4.4.6.2.1 Login (SDD_REQ_100)

Basic Flow
1. This use case begins when the Office Assistant, Research Supervisor and Program Coordinator enters ID & password (SDD_REQ_101) (FSES-100-CSU-101).
2. FSES verifies the ID & password (SDD_REQ_102) (FSES-200-CSU-201) (FSES-300-CSU-301) [R1: Password's Rule]. If ID & password are invalid [E1: Invalid Password].
3. FSES checks if it is the first login. If first login [A1: Change Password].
4. FSES displays Dashboard (SDD_REQ_103) (FSES-100-CSU-103).
5. Office Assistant, Research Supervisor and Program Coordinator may reset their passwords [A2: Reset Password].
6. This use case ends

Alternative Flow
A1: Change Password
1. Office Assistant, Research Supervisor and Program Coordinator enters a new password (SDD_REQ_104) (FSES-100-CSU-102) (FSES-200-CSU-201) [R1: Password's Rule].
2. This use case continues.

A2: Reset Password
1. Office Assistant, Research Supervisor and Program Coordinator requests to reset password (SDD_REQ_105) (FSES-100-CSU-101).
2. FSES sends reset password link to Office Assistant, Research Supervisor and Program Coordinator via email (SDD_REQ_106) (FSES-200-CSU-201).
3. Office Assistant, Research Supervisor and Program Coordinator enters a new password in the link (SDD_REQ_107) (FSES-100-CSU-102) [R1: Password's Rule].
4. This use case continues.

Exception Flow
E1: Invalid Password
1. FSES displays "PASSWORD IS INVALID" message (SDD_REQ_108) (FSES-100-CSU-101).
2. Office Assistant, Research Supervisor and Program Coordinator can reattempt login (SDD_REQ_109) (FSES-100-CSU-101) [R2: Login Attempts].
3. If the number of login attempts exceeds 3, FSES locks the ID (SDD_REQ_110) (FSES-100-CSU-101).
4. This use case ends.

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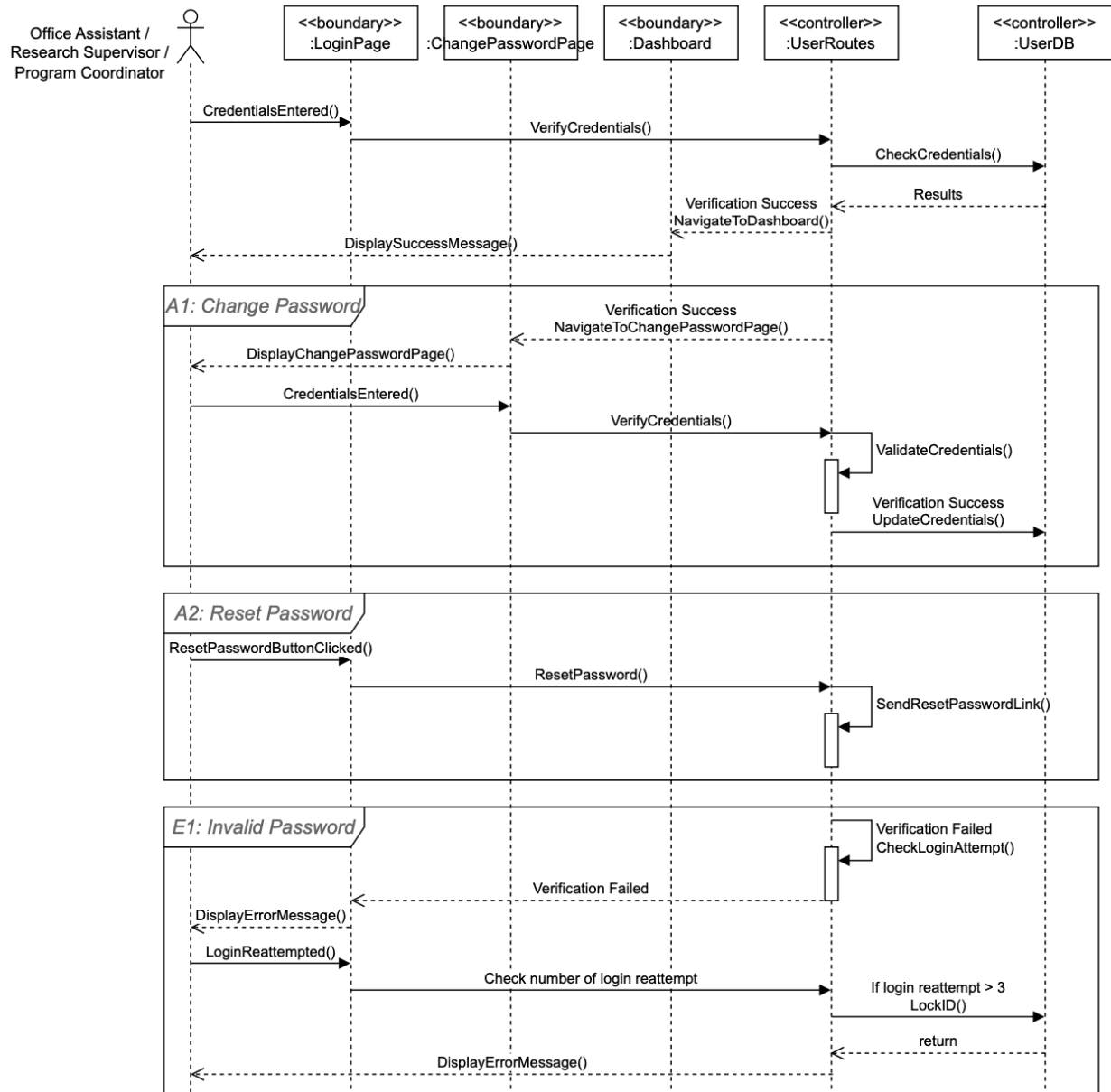
Figure 9: Login - Sequence Diagram

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4.4.6.2.2 Prepare Student List (SDD_REQ_200)

Basic Flow
1. This use case begins when Office Assistant initiates preparing a student list (SDD_REQ_201) (FSES-100-CSU-104).
2. FSES enters the following details (SDD_REQ_202) (FSES-100-CSU-104).
    - Student name
    - Program (PhD, MPhil or DSE)
    - Evaluation type (First Evaluation or Re-Evaluation)
    - Student's current semester
    - Main supervisor
    - Co-supervisor
3. FSES checks eligibility of Main Supervisor and Co-supervisor (SDD_REQ_203) (FSES-200-CSU-202) (FSES-300-CSU-302) [R3: Main supervisor's eligibility] [R4: Co-supervisor's eligibility].
4. If the Main Supervisor or Co-supervisor is not eligible [E2: Main supervisor is not eligible] [E3: Co-supervisor is not eligible].
5. This use case ends.

Exception Flow
E2: Main supervisor is not eligible
1. FSES displays "MAIN SUPERVISOR IS NOT ELIGIBLE" message (SDD_REQ_204) (FSES-100-CSU-104).
2. This use case continues.

E3: Co-supervisor is not eligible
1. FSES displays "CO-SUPERVISOR IS NOT ELIGIBLE" message (SDD_REQ_205) (FSES-100-CSU-104).
2. This use case continues.

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Figure 10: Prepare Student List - Sequence Diagram

4.4.6.2.3 Manage Masterlist (SDD_REQ_300)

Basic Flow

1. This use case begins when Office Assistant initiates managing masterlist (SDD_REQ_301) (FSES-100-CSU-105).
2. Office Assistant can add, update and remove the list of supervisors, examiners and chairpersons (SDD_REQ_302) (FSES-100-CSU-105).
3. This use case ends.
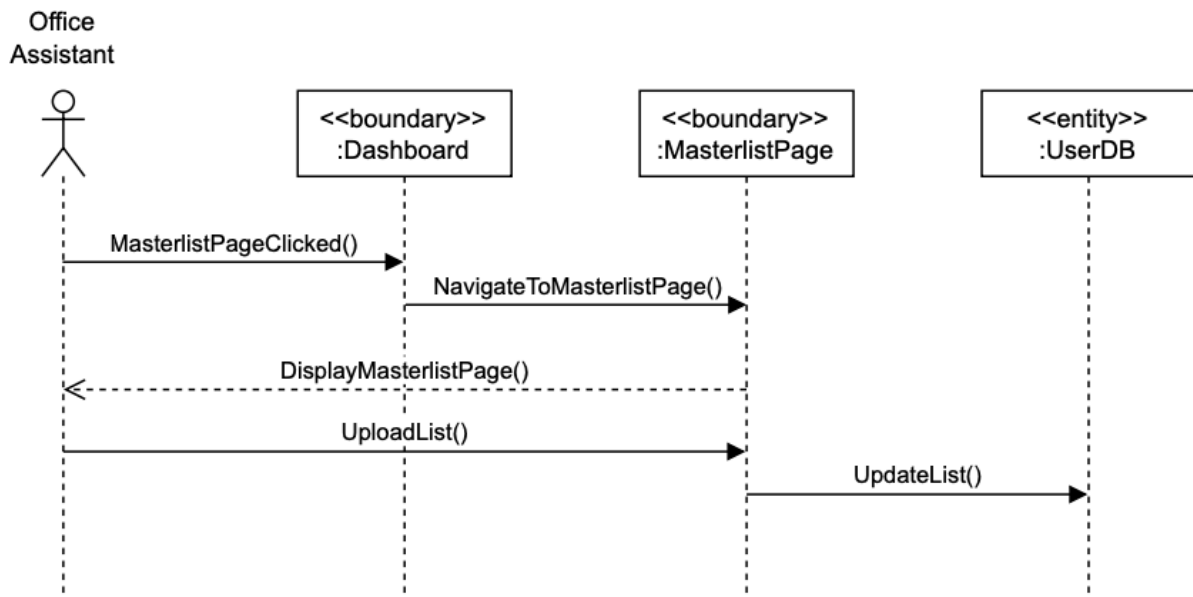

Figure 11: Manage Masterlist - Sequence Diagram

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4.4.6.2.4 Nominate Examiners (SDD_REQ_400)

Basic Flow
1. This use case begins when the Research Supervisor initiates nominating examiners (SDD_REQ_401) (FSES-100-CSU-104).
2. The Research Supervisor enters the student's research title and names three examiners (SDD_REQ_402) (FSES-100-CSU-104).
3. The Research Supervisor may manually nominate examiners from the outside university (SDD_REQ_403) (FSES-100-CSU-104).
4. The Research Supervisor indicates the nomination is completed (SDD_REQ_404) (FSES-100-CSU-104).
5. FSES verifies the nominating examiners (SDD_REQ_405) (FSES-200-CSU-202) (FSES-300-CSU-302) [R5: Examiner's eligibility]. If the nomination is ineligible [E4: Examiner is not eligible].
6. The Research Supervisor can perform these alternatives.
   - A3: Modify research title and examiners
   - A4: Postpone student's FSE
   - A5: View list of students under supervision
7. This use case ends.

Alternative Flow
A3: Modify research title and examiners
1. Research Supervisor modifies research title and examiners (SDD_REQ_406) (FSES-100-CSU-104).
2. This use case continues.
A4: Postpone student's FSE
1. Research Supervisor indicates to FSES to postpone student's FSE (SDD_REQ_407) (FSES-100-CSU-104).
2. This use case continues.
A5: View list of students under supervision
1. FSES displays a list of students under supervision (SDD_REQ_408) (FSES-100-CSU-104).
2. This use case continues.

Exception Flow
E4: Examiner is not eligible
1. FSES displays "EXAMINER IS NOT ELIGIBLE" message (SDD_REQ_409) (FSES-100-CSU-104).
2. This use case continues.

Figure 12: Nominate Examiners - Sequence Diagram

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4.4.6.2.5 Assign Chairperson (SDD_REQ_500)

Basic Flow
1. This use case begins when the Program Coordinator initiates assigning chairperson (SDD_REQ_501) (FSES-100-CSU-104).
2. FSES displays a list of chairperson (SDD_REQ_502) (FSES-100-CSU-104).
3. Program Coordinator requests FSES to assign chairperson automatically (SDD_REQ_503) (FSES-100-CSU-104).
4. Program Coordinator may manually assign or change the chairperson (SDD_REQ_504) (FSES-100-CSU-104).
5. FSES verifies the chairperson's eligibility (SDD_REQ_505) (FSES-200-CSU-202) (FSES-300-CSU-302) [R6: Chairperson's eligibility]. If the chairperson is not eligible [E5: Chairperson is not eligible].
6. The Program Coordinator can perform these alternatives.
   - A6: Lock examiners nomination
   - A7: View list of students
   - A8: View list of students and their FSE details by program and evaluation type
   - A9: View list of students postponing their FSE
   - A10: View list of examiners and how many sessions they are examining
   - A11: View list of chairpersons and how many sessions they are chairing
   - A12: View graph showing a summary of the FSE details
7. This use case ends.

Alternative Flow
A6: Lock examiners nomination
1. Program Coordinator locks examiners nomination (SDD_REQ_506) (FSES-100-CSU-104).
2. This use case continues.

A7: View list of students
1. FSES displays list of students with the following details (SDD_REQ_507) (FSES-100-CSU-104).
   - Student name
   - Program (PhD, MPhil or DSE)
   - Evaluation type (First Evaluation or Re-Evaluation)
   - Student's current semester
   - Main supervisor
   - Co-supervisor
   - Research title
   - Examiner 1
   - Examiner 2
   - Examiner 3
2. This use case continues.

A8: View list of students and their FSE details by program and evaluation type

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1. FSES displays list of students and their FSE details by program and evaluation type (SDD_REQ_508) (FSES-100-CSU-104).
2. This use case continues.

A9: View list of students postponing their FSE
1. FSES displays a list of students postponing their FSE (SDD_REQ_509) (FSES-100-CSU-104).
2. This use case continues.

A10: View list of examiners and how many sessions they are examining
1. FSES displays a list of examiners and how many sessions they are examining (SDD_REQ_510) (FSES-100-CSU-104).
2. This use case continues.

A11: View list of chairpersons and how many sessions they are chairing
1. FSES displays a list of chairpersons and how many sessions they are chairing (SDD_REQ_511) (FSES-100-CSU-104).
2. This use case continues.

A12: View graph showing a summary of the FSE details
1. FSES displays a graph showing a summary of the FSE details (SDD_REQ_512) (FSES-100-CSU-104).
2. This use case continues.

Exception Flow
E5: Chairperson is not eligible
1. FSES displays "CHAIRPERSON IS NOT ELIGIBLE" message (SDD_REQ_513) (FSES-100-CSU-104).
2. This use case continues.

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Figure 13: Assign Chairperson - Sequence Diagram

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4.4.6.2.6 Activity Diagram

Figure 14 depicts the flow of Office Assistant, Research Supervisor and Program Coordinator activities when using the system.

Figure 14: Activity Diagram

4.4.7 STATE DYNAMICS VIEWPOINT

The state dynamics viewpoint depicts the system's internal behavior. Modes, states, transitions, and event responses are all part of system dynamics. It provides step-by-step instructions about the system operation.

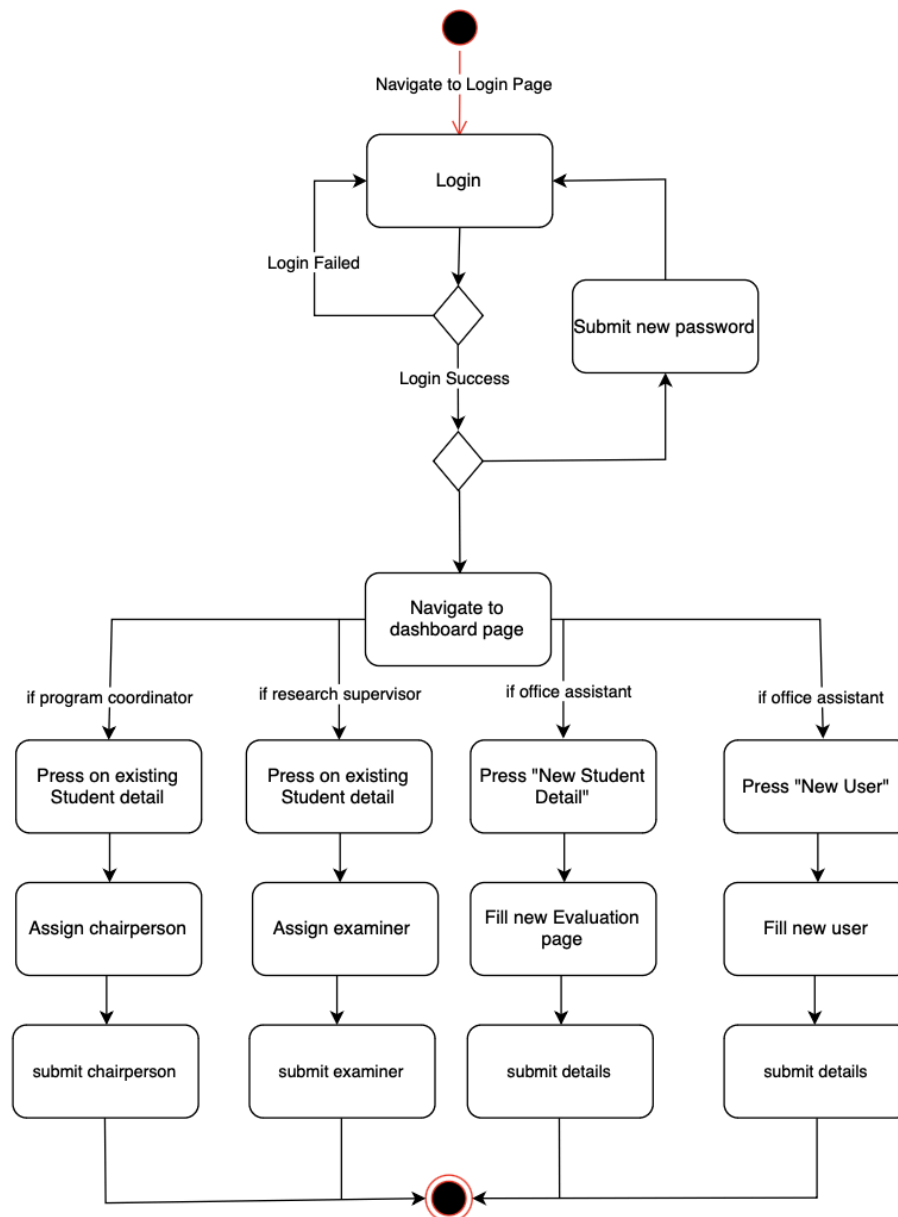| DOCUMENT IDENTIFICATION			
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4.4.7.1 Design Concerns

The design concern of the state dynamics viewpoint is regarding the system's dynamics including modes, states, transitions, and reactions to events

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	SYSTEM NAME	FORMAT	VERSION	PAGE
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4.4.7.2 Design elements

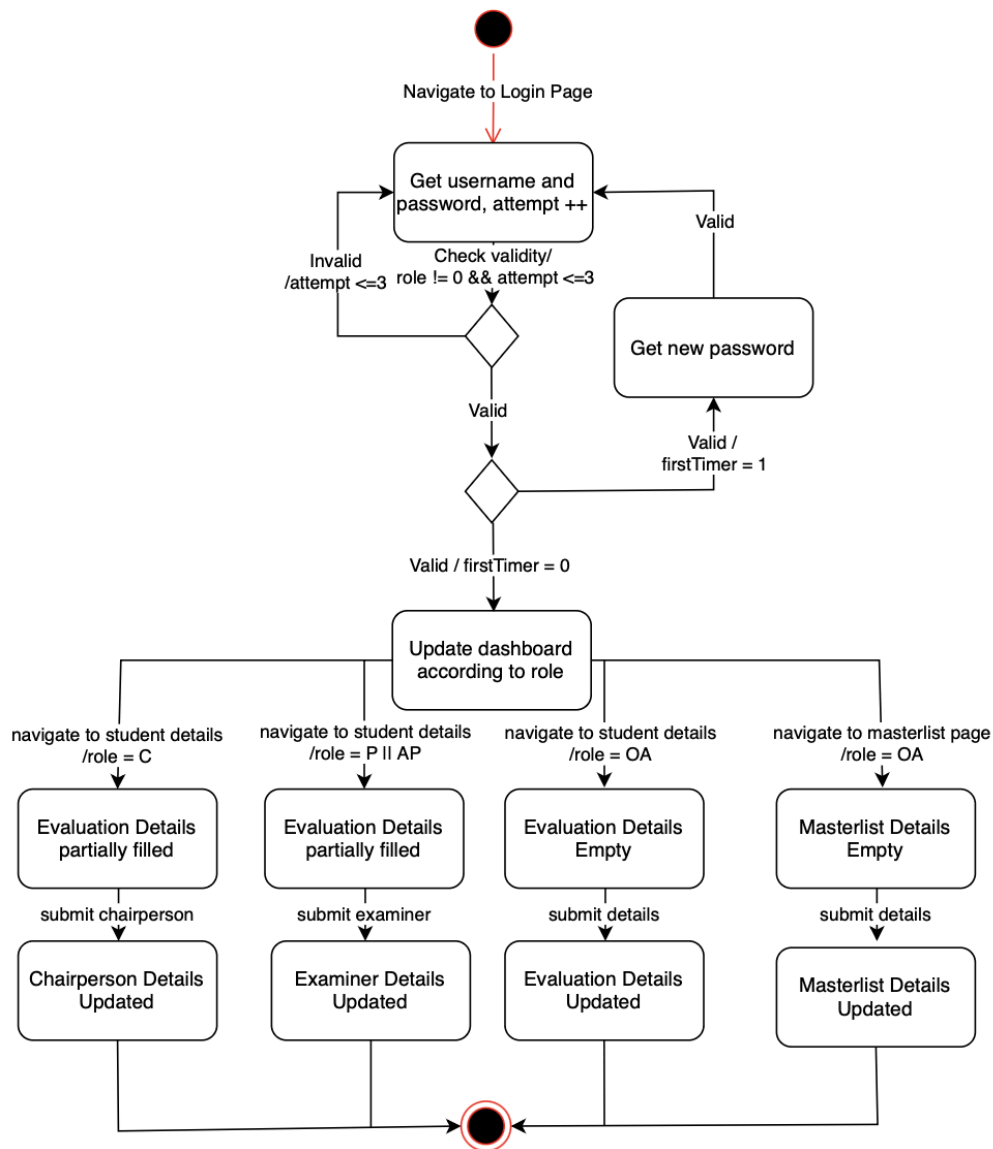Figure 15 below shows the state transition diagram of the overall system.

Figure 15: State Transition Diagram

APPENDIX A

Table 2: Components and Class Item Identification

CSC No.	CSC Name	CSC ID	CSU No.	CSU Name	CSU ID
CSC-1	Boundary	FSES-100-CSC-1	CSU-101	LoginPanel	FSES-100-CSU-101
			CSU-102	ChangePasswordPanel	FSES-100-CSU-102
			CSU-103	DashboardPanel	FSES-100-CSU-103
			CSU-104	StudentDetailsPanel	FSES-100-CSU-104
			CSU-105	MasterlistPanel	FSES-100-CSU-105
CSC-2	Controller	FSES-200-CSC-2	CSU-201	UserRoutes	FSES-200-CSU-201
			CSU-202	EvaluationRoutes	FSES-200-CSU-202
CSC-3	Entity	FSES-300-CSC-3	CSU-301	UserDB	FSES-300-CSU-301
			CSU-302	EvaluationDB	FSES-300-CSU-302

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APPENDIX B

Table 3: Traceability Table

NO	REQ	CSC-1					CSC-2		CSC-3	
		CSU-101	CSU-102	CSU-103	CSU-104	CSU-105	CSU-201	CSU-202	CSU-301	CSU-302
1	SDD_REQ_101	☑								
2	SDD_REQ_102						☑		☑	
3	SDD_REQ_103			☑						
4	SDD_REQ_104		☑				☑			
5	SDD_REQ_105	☑								
6	SDD_REQ_106						☑			
7	SDD_REQ_107		☑							
8	SDD_REQ_108	☑								
9	SDD_REQ_109	☑								
10	SDD_REQ_110	☑								
11	SDD_REQ_111						☑			
12	SDD_REQ_112						☑			
13	SDD_REQ_113						☑			
14	SDD_REQ_201				☑					
15	SDD_REQ_202				☑					
16	SDD_REQ_203							☑		☑
17	SDD_REQ_204				☑					
18	SDD_REQ_205				☑					
19	SDD_REQ_206							☑		
20	SDD_REQ_207							☑		
21	SDD_REQ_301					☑				
22	SDD_REQ_302					☑				
23	SDD_REQ_401				☑					
24	SDD_REQ_402				☑					
25	SDD_REQ_403				☑					
26	SDD_REQ_404				☑					
27	SDD_REQ_405							☑		☑
28	SDD_REQ_406				☑					
29	SDD_REQ_407				☑					

	DOCUMENT IDENTIFICATION			
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30	SDD_REQ_408				✓					
31	SDD_REQ_409				✓					
32	SDD_REQ_410							✓		
33	SDD_REQ_411							✓		
34	SDD_REQ_501				✓					
35	SDD_REQ_502				✓					
36	SDD_REQ_503				✓					
37	SDD_REQ_504				✓					
38	SDD_REQ_505							✓		✓
39	SDD_REQ_506				✓					
40	SDD_REQ_507				✓					
41	SDD_REQ_508				✓					
42	SDD_REQ_509				✓					
43	SDD_REQ_510				✓					
44	SDD_REQ_511				✓					
45	SDD_REQ_512				✓					
46	SDD_REQ_513				✓					
47	SDD_REQ_514							✓		
48	SDD_REQ_515							✓		
49	SDD_REQ_516							✓		