System Combined Requirements and Design Document (SCRD)

SIE Environmental Information System™

Version 1.0 approved

26th April 2023

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1. Introduction

1.1 Purpose

This document specifies the software requirements, analysis, and design for the Environmental Information System (EIS) developed by SIE Corporation. Current release version is 1.0. The scope of this SCRD covers the entire EIS, including its four main subsystems: User Management (UMS), Field Device Management (FDM), Data Collection (DCS), and Decision Support (DSS). This document describes the system's features, functionality, and architecture that are necessary for the successful development, deployment, and operation of the EIS.

1.2 Document Conventions

This SCRD follows standard typographical conventions for technical documentation. The following conventions are used throughout this document:

- Technical terms and jargon are presented in bold font.
- Use cases, system components, and subsystems are presented in the title case.
- UI elements such as buttons, text boxes, and menus are presented in bold font with quotes.
- Sample code and programming elements are presented in a monospaced font.
- System requirements and design decisions are presented in bullet-point format.
- Cross-references to other sections of the document are presented in blue and underlined.

Additionally, diagrams and visual aids are used to supplement textual descriptions of system components and interactions. These diagrams follow standard conventions and notation for the relevant design and modeling language, such as UML.

1.3 Intended Audience and Reading Suggestions

This SCRD is intended for a diverse audience involved in the development, testing, deployment, and use of the Environmental Information System (EIS). The document is primarily targeted towards software developers and architects, project managers, testers, and technical writers. However, it may also be useful for business stakeholders and end-users who are interested in understanding the system's capabilities and limitations.

The document is organized into several sections that cover the software requirements, analysis, and design for the EIS. The overview section provides a high-level description of the system's purpose, scope, and subsystems. The following sections describe the requirements and specifications for each subsystem, along with the system architecture and design decisions. The document concludes with a section on use cases and system testing.

To make the document more accessible to different types of readers, we suggest the following reading sequence:

- Project managers and business stakeholders should start with the overview section to understand the system's purpose and scope. They may also find the system requirements and design decisions relevant for planning and budgeting purposes.
- Developers and architects should start with the subsystems section to understand the specific requirements and specifications for each subsystem. They may also find the system architecture and design decisions relevant for implementation and integration purposes.
- Testers should start with the use cases and system testing section to understand the different scenarios and test cases that need to be covered. They may also find the subsystems section relevant for identifying testable components and interfaces.
- Technical writers should review the entire document to understand the system's features and functions, and use the information to create user manuals and other documentation.

1.4 System Scope

The Environmental Information System (EIS) is an open-source suite of software applications designed and developed by SIE Corporation. The EIS is intended to manage, collect, analyze, and report indoor environmental quality data in real-time using the Internet of Things (IoT) to connect and exchange data from field devices. The system aims to provide current and historical conditions of indoor environmental quality to facilitate informed health and safety decisions for short-term and long-term effects in various facilities such as workplaces, schools, warehouses, and hospitals. The EIS also includes intelligent automation with alarms, alerts, and actionable insights for these decisions. The software is designed with the capability of being hosted in the cloud, and although open-source, companies that wish to deploy this system will need to consider the recurring operating costs for cloud hosting. The EIS is aligned with SIE Corporation's goal of providing innovative software products to help organizations achieve their objectives and improve their processes.

1.5 References

Occupational Safety and Health Administration
Provides working conditions relating to temperature.
Source: https://www.osha.gov/heat-exposure

Occupational Safety and Health Administration
Provides working conditions relating to air purity.
Source: https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134

Occupational Safety and Health Administration
Provides working conditions specific to office air quality.
Source: https://www.osha.gov/laws-regs/standardinterpretations/2003-02-24

Indoor environment monitoring system tested in a living lab
Used for research for further details regarding Monitoring System structuring and design.
Source: https://www.sciencedirect.com/science/article/pii/S0360132322001251

Building an indoor air quality monitoring system based on the architecture of the Internet of Things
Used for research for further details regarding Monitoring System structuring and design.
Source: https://jwcn-eurasipjournals.springeropen.com/articles/10.1186/s13638-021-02030-1

QUADREAL Improves Occupancy Safety and Comfort with MYTHINGS
Case Study pertaining to occupational conditions quality measuring used as reference for better design features.
Source:
https://f.hubspotusercontent10.net/hubfs/4739964/Case%20Studies/Case%20Study-%20QuadReal.pdf?hsCtaTracking=cade2c25-fe12-45d6-819a-69ffca54eef3%7C3c94ec6d-ad85-453b-a20d-a635311ca320

How Short Term Data Collection Helped Downtown Heritage Building Ensure Long Term Tenant Comfort
Case Study pertaining to indoor condition monitoring, used as reference for motivating factors and features.
Source:
https://f.hubspotusercontent10.net/hubfs/4739964/Case%20Studies/ioAirFlow%20Case%20Study%20-%20Data%20Analytics%20Platform%20for%20Building%20Comfort.pdf?hsCtaTracking=b319553c-acee-46af-827c-ce412186c0ac%7C73295eed-d096-41e1-a1b5-b56924b67dbe

Centers for Disease Control and Prevention, Indoor Environmental Quality
Referencing for targeting sensor types and data with design of system.
Source: https://www.cdc.gov/niosh/topics/indoorenv/default.html

Sustainable Facilities Tool from the U.S. General services Administration
Referencing for adequate sensor coverage, data transfer and target sensor types within system design.
Source: https://sftool.gov/learn/about/1/indoor-environmental-quality-ieq

2. Overall Description

2.1 System Perspective

The environment that surrounds us constantly changes over time, and as the environment changes so do our needs. As humans we constantly have to adapt to these changes by making decisions that may affect our health or safety. In order to support these decisions, SIE Corporation developed the Environmental Information System (EIS). EIS is a new, self-contained system developed by SIE Corporation as an open-source suite of software applications. There are four main subsystems to the SIE EIS, which are: User Management (UMS), Field Device Management (FDM), Data Collection (DCS), and Decision Support (DSS).

The User Management subsystem manages user administration and access including user security for authentication, authorization, and auditing.

The Field Device Management subsystem manages field devices including identification, IP Address, and device type.

The Data Collection subsystem collects and stores the data gathered from the Field Device Management subsystem.

The Decision Support subsystem provides data aggregation, analysis, and reporting.

These subsystems work together to form a solution that is used for managing, collecting, analyzing, and reporting indoor environmental quality providing current and historical conditions.

2.2 System Functions

To summarize the main system functions:

- The system will collect, manage, and analyze environmental data.
- The system will provide the user with scheduled reports, as well as on demand reports which can be prescriptive, descriptive, or predictive, based on the user's choice.
- The system will provide real-time monitoring using the Internet of Things to connect and exchange data from field devices.
- The system will allow users to make informed health and safety decisions for long-term and short-term effects in facilities like workplaces, schools, warehouses, and hospitals.
- The system will provide alarms, alerts, and actionable insight for health and safety decisions.
- The system will have the capability of being hosted in the cloud.

2.3 User Classes and Characteristics

System Administrator (Admin): This user class will have full access to all system functionality and will be responsible for managing the system including user management, field device management, data collection, and decision support. The System Administrator will have technical expertise and experience in managing similar systems. The System Administrators are of utmost importance for satisfactory product delivery.

Operator: This user class will be responsible for monitoring the system, analyzing data, maintaining field devices, ensuring data collection is correct, responding to alarms/alerts, and generally assisting the administrator to use the data for making business decisions. Their privileges shall be more limited than the Admin user, but they are expected to be more frequent users. Due to this, their inclusion to the system use is also of high priority.

2.4 Operating Environment

The system is designed to operate on a workstation controlled by Admin and Operators. It is assumed that these workstations are desktop computers, however the design is formatted to run on several operating systems: namely Windows, MacOS, and Linux. The design documentation has been created with cloud hosting in mind, namely the Data Collection subsystem (DCS) has been placed within the container of an arbitrary cloud service provider. This results in an operating environment of a common operating system, on a desktop workstation, with access to internet connection (allowing for access to the cloud service provider). The EIS will run as a desktop application on the user's workstation with no interference of other locally stored applications.

2.5 Design and Implementation Constraints

The following items will limit the options available to developers during the design and implementation of the EIS:

- Corporate policies and standards for software development, including coding standards, documentation requirements, and testing procedures.
- Regulatory requirements for data privacy and security that must be met by the system.
- Hardware limitations, such as memory and processing speed, that may impact the design of the system.
- Interfaces to other applications that must be supported by the EIS.
- Specific technologies, tools, and databases that must be used as part of the system.
- Parallel operations that must be supported by the system.
- Language requirements for the development of the system.
- Communications protocols that must be used by the system to interact with other components.
- Security considerations, such as access control and authentication mechanisms, that must be implemented as part of the system.
- Design conventions or programming standards that must be followed to ensure consistency and maintainability of the delivered software.
- Licensing of software development tools and their restrictions on usability.

2.6 Assumptions and Dependencies

Assumptions:

- It is assumed that the hardware and infrastructure required for the EIS are available and meet the minimum requirements specified in the document.
- It is assumed that the users have basic computer skills and are familiar with the standard operating procedures of the organization.
- It is assumed that the required third-party software and commercial components will be available and compatible with the EIS.
- It is assumed that the development team has the necessary expertise and resources to develop and implement the EIS.

Dependencies:

- The EIS will be dependent on the availability and compatibility of third-party software and commercial components.
- The EIS may be dependent on other systems or applications used by the organization.
- The EIS may be dependent on the availability of necessary data and information from external sources, such as databases or web services.
- The EIS may be dependent on the availability of the required hardware and infrastructure.

3. External Interface Requirements

3.1 User Interfaces

The EIS will have several user interfaces to support various types of users. The main user interface will be a desktop application (accessing the internet) that will be accessed using the worker's workstation. The application will use a responsive design to provide a consistent user experience across different screen sizes and devices.

The user interface will be designed using standard web design principles and will conform to the company's UI/UX design standards. The interface will feature a modern and intuitive design with a clean layout, clear navigation, and easy-to-use controls.

The user interface will have several standard buttons and functions that will appear on every screen, including a help function, a settings function, and a logout button. The interface will also include standard keyboard shortcuts to improve usability.

Error messages will be displayed in a consistent format with clear and concise language to help users understand and resolve any issues. The following depicts the core user interface pages:

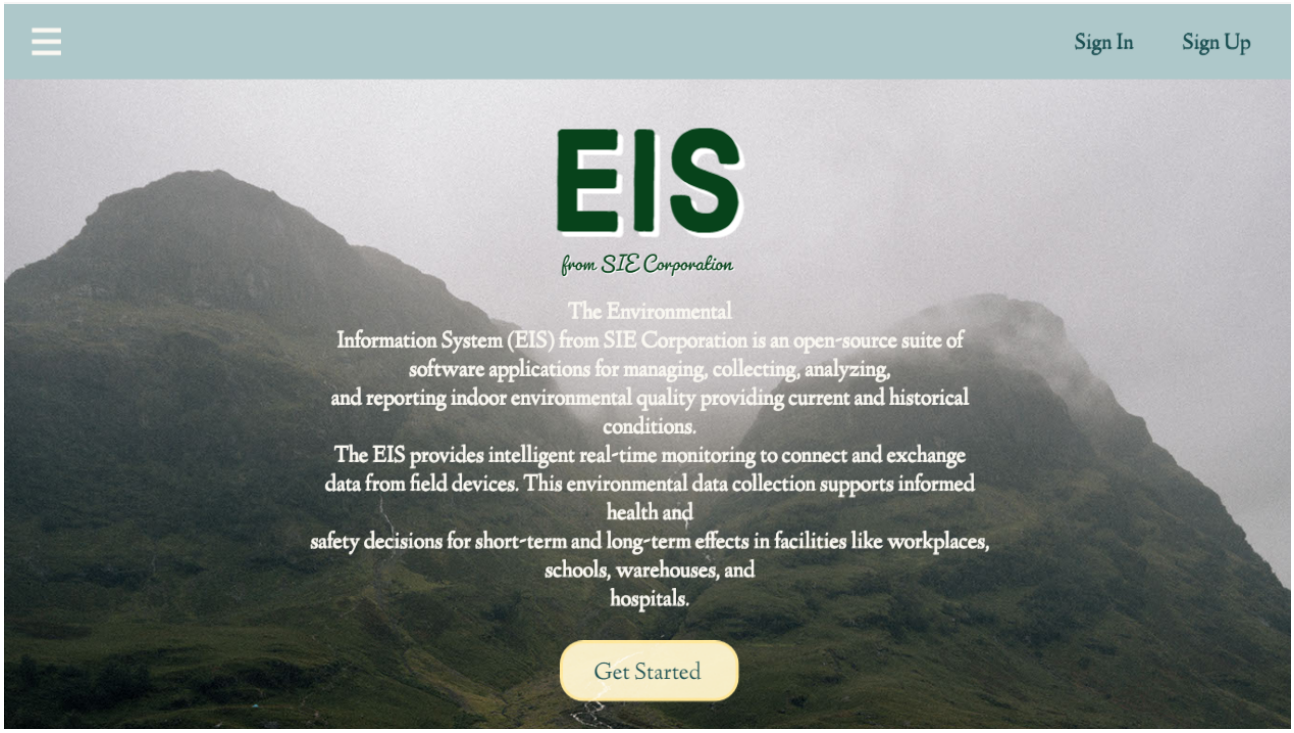


Figure 3.1. Main Page for all users.

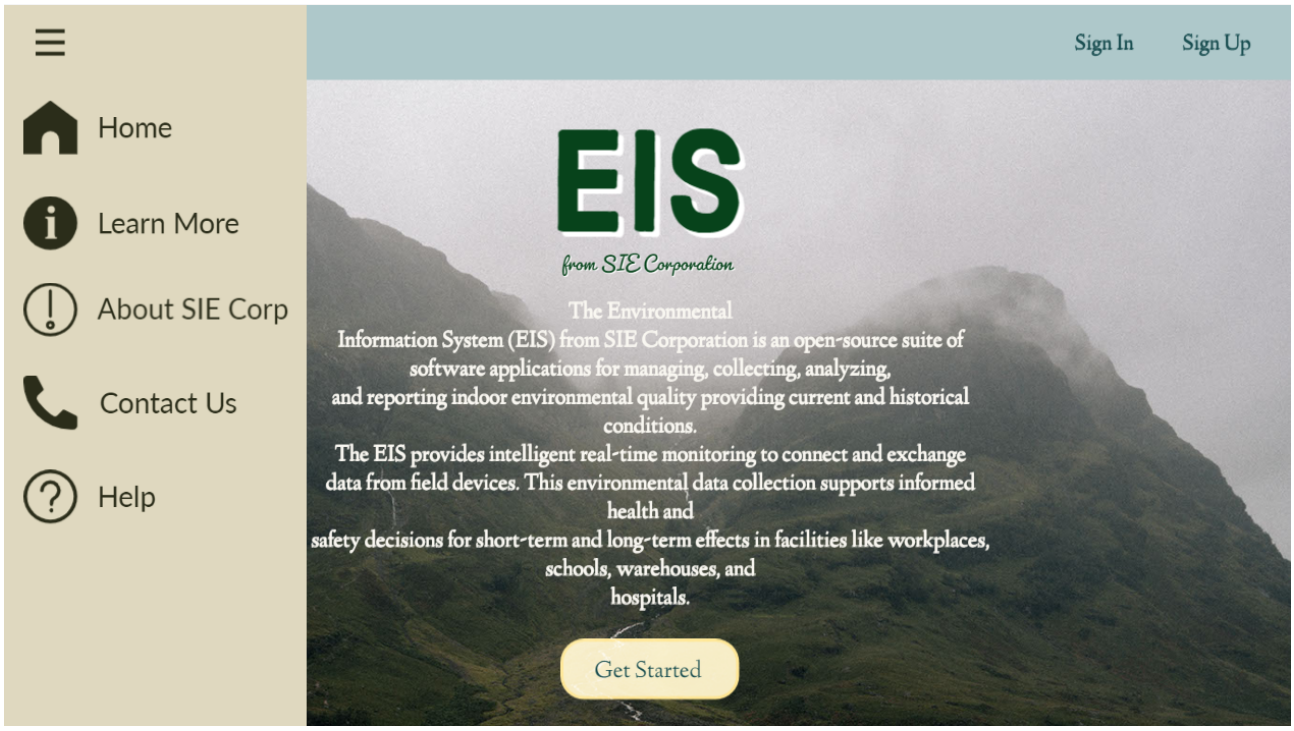


Figure 3.2. Main page for all users with menu expanded.

Figure 3.3. Sign In page for returning users.

Figure 3.4. Login Error in Sign In page.

Figure 3.5. Sign Up page for new users.

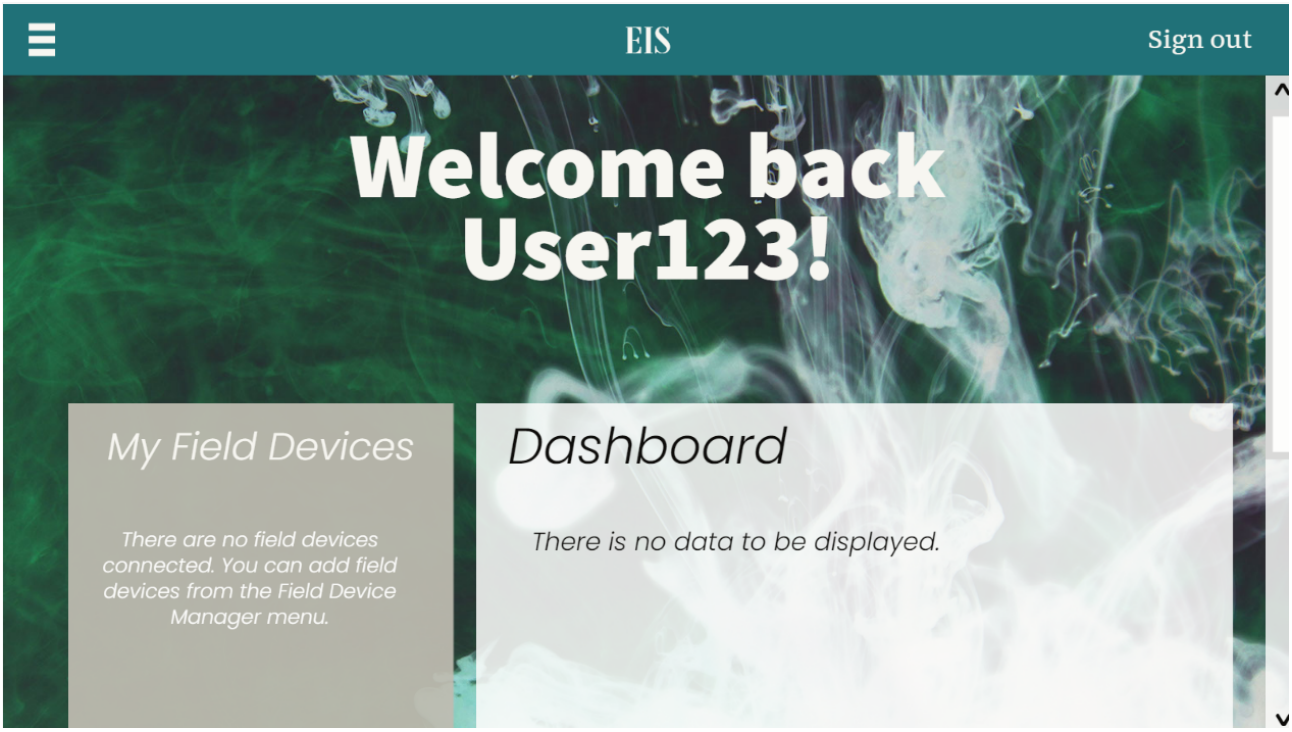


Figure 3.6. General Home Page for users (will vary depending on the user's role and access).

3.2 Hardware Interfaces

The DCS will be hosted with a cloud service provider (or local servers if the clientele wish to do so). The GUI will be run through a desktop application on the workstation desktop. The FDM shall be compatible with wired and wireless transfer of data from the sensors, meaning the sensors can be of any type so long as the conversion of the raw data (via MQTT in binary - with headers and payload) is known. The field sensors shall be placed in adequate positions around the allocated indoor spaces, connecting to a server which shall host the subsystem logic. This server shall have access to the cloud service, or if need be, another server dedicated to hosting the DCS and database.

The processing of field sensor data shall be conducted by the FDM subsystem, turning raw numeric values into manageable data based on the type of sensor the associated data is coming from.

The communication protocols shall be the following:

Sensor-Server: MQTT
GUI-Server: HTTP
Server-CloudService: service API

3.3 Software Interfaces

Software templates have been generated as C++ files. The solutions for this system have been left as customizable dependent on the preference of the clientele development team.

3.4 Communications Interfaces

The system requires communication functions to facilitate data transfer between its various components. The following communication protocols shall be used:

Sensor-Server: The MQTT protocol will be used for communication between the field sensors and the server. MQTT is a lightweight, publish-subscribe messaging protocol that is designed for use in constrained environments, making it an ideal choice for use with field sensors. The messages will be formatted as JSON payloads, containing the sensor data and associated metadata.

GUI-Server: The HTTP protocol will be used for communication between the graphical user interface (GUI) and the server. The GUI will communicate with the server by sending HTTP requests, and the server will respond with HTTP responses. The messages will be formatted as JSON payloads, containing the necessary information for the requests and responses.

Server-CloudService: A service API will be used for communication between the server and the cloud service. The service API will provide a standardized set of endpoints and protocols for the server to access the cloud service. The messages will be formatted according to the specifications of the service API.

Data transfer rates and synchronization mechanisms will be specified in the system's non-functional requirements, which are yet to be defined. Communication security and encryption issues will also be addressed in the non-functional requirements, along with any other relevant communication standards and protocols that may be required.

4. Requirements

4.1 Functional Requirements

Requirements Statements

4.1.1 User Management (UMS):

4.1.1a) The system shall allow administrators to add, modify, or delete user accounts.
4.1.1b) The system shall enforce strong password policies for user accounts.
4.1.1c) The system shall provide a password reset mechanism for users.
4.1.1d) The system shall log all user login attempts, including date, time, and IP address.
4.1.1e) The system shall enforce role-based access control to limit user access to specific system features.

4.1.2 Field Device Management (FDM):

4.1.2a) The system shall allow administrators to add, modify, or delete field devices.
4.1.2b) The system shall automatically discover and add new field devices to the system.
4.1.2c) The system shall provide a mechanism for updating the firmware of field devices.
4.1.2d) The system shall collect data from field devices at regular intervals based on user-defined schedules.
4.1.2e) The system shall provide a mechanism for managing alerts related to field devices, such as low battery or connection failures.
4.1.2f) The system shall allow the user to define and edit the data collection schedule.
4.1.3g) The system shall allow the user to collect data on demand.

4.1.3 Data Collection (DCS):

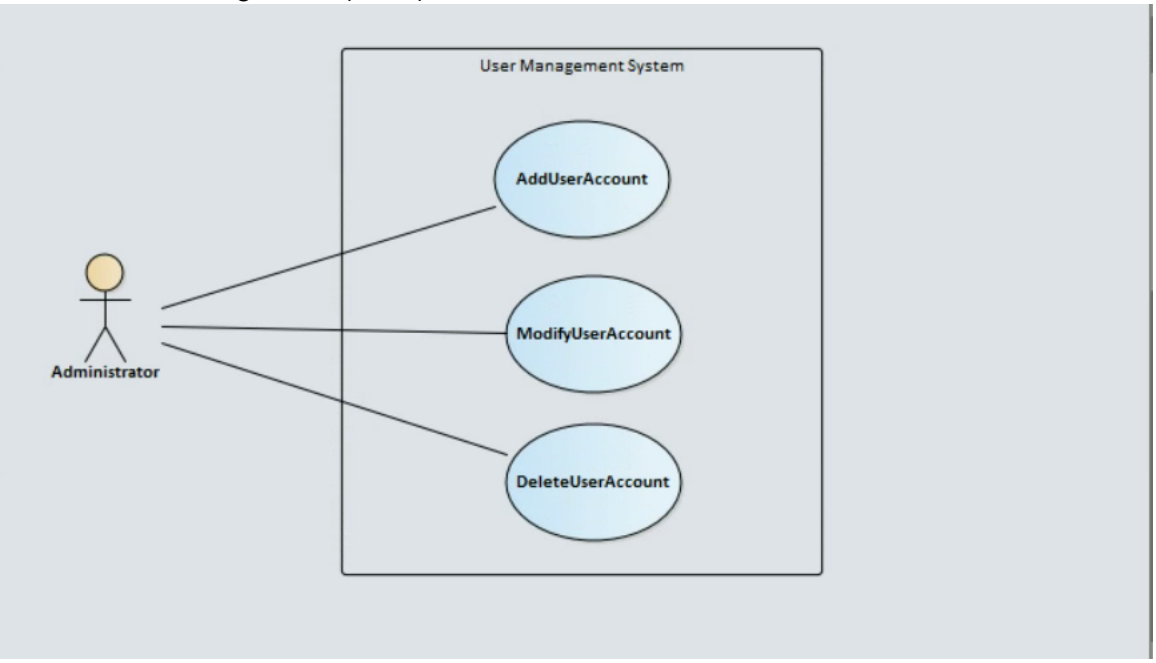
4.1.3a) The system shall store data collected from field devices in a secure and scalable database.
4.1.3b) The system shall allow users to query and retrieve historical data based on time range, device type, or other criteria.
4.1.3c) The system shall provide a mechanism for real-time data streaming to support real-time analytics and visualization.
4.1.3d) The system shall automatically archive and delete data based on user-defined retention policies.

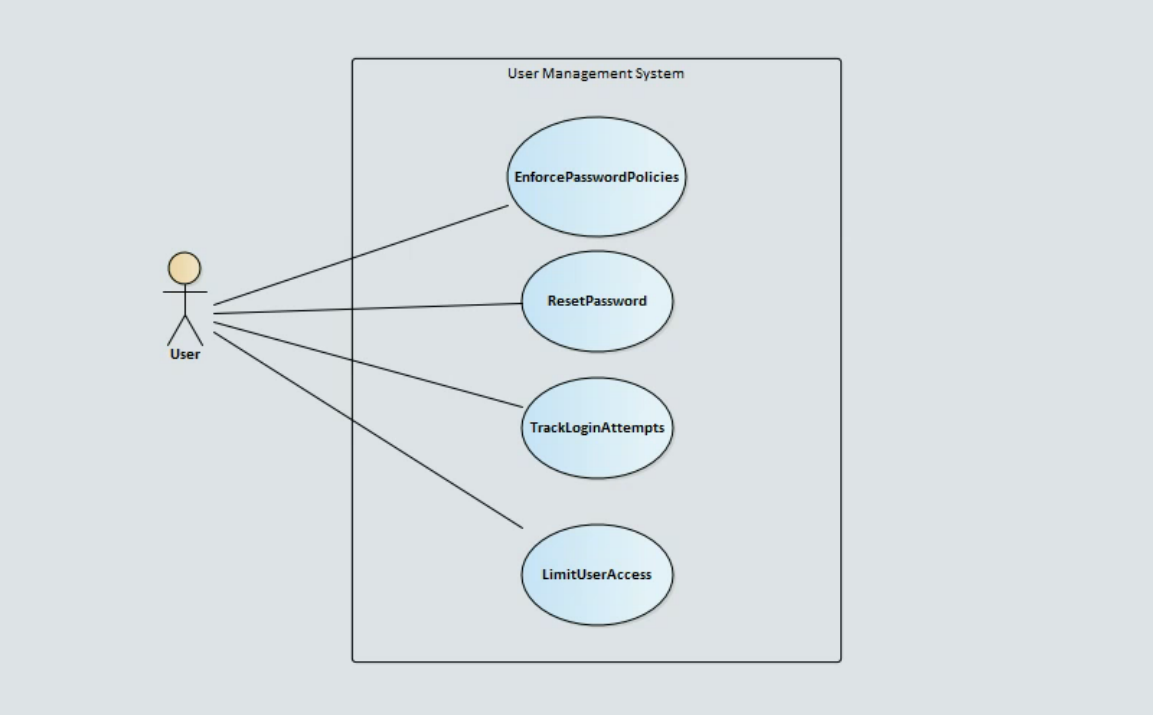
4.1.4 Decision Support (DSS):

4.1.4a) The system shall provide pre-built analytics models for data analysis, such as anomaly detection, trend analysis, and forecasting.
4.1.4b) The system shall allow users to create custom analytics models using machine learning algorithms or other techniques.
4.1.4c) The system shall provide interactive data visualization capabilities to support data exploration and discovery.
4.1.4d) The system shall allow users to create and schedule automated reports and alerts based on analytics results.
4.1.4e) The system shall provide a mechanism for integrating with external data sources or third-party analytics tools.
4.1.4f) The system shall allow users to modify and delete custom analytics models created by the user.
4.1.4g) The system shall allow users to modify the schedule for automated reports and alerts.

Use Case Specifications:

4.1.1 User Management (UMS):





4.1.1a)

Use Case: AddUserAccount
ID: EIS-4-1-1a1
Brief Description: The Administrator adds a new user to the system.
Primary Actor: Administrator
Secondary Actors: None
Precondition: The administrator has accessed the User Management Menu on the EIS.
Main Flow: a. The use case begins when the administrator selects the “add user” button on the User Management Menu. b. The system displays a new window that prompts the administrator to enter the new user’s username, first name, last name, email, role, and temporary password. c. The administrator enters the user’s data and selects the “submit” button. d. The system checks if the username is in existence in the system’s database. e. If the username is not in existence the system saves the user information in the system’s database. Else, the system displays an error message indicating that the username has already been taken and takes administrator back to f. The system displays a confirmation message that the account has been added. g. The use case ends.
Post Condition: The user account has been added to the system.
Alternative Flow: None.

Use Case: ModifyUserAccount
ID: EIS-4-1-1a2
Brief Description: The administrator modifies a user’s account.
Primary Actor: Administrator
Secondary Actors: None
Precondition: The administrator has accessed the User Management menu.
Main Flow: a. The use case begins when the administrator selects the “manage users” button. b. The system prompts the administrator to enter the name or username of the user to be modified.

c. The administrator enters the user's name or username into the prompt and selects the "submit" button. d. The system searches for the user on the system's database. e. If the system finds the desired user in the system's database the system displays a window with the user's information. Else, the system displays an error message and goes back to the prompt. f. The administrator selects the "edit user information" button. g. The system unlocks the user's information. h. The administrator makes the desired changes in the user's information and selects the "save" button. i. The system saves the changes in the system's database and displays a confirmation message that the changes have been saved. j. The use case ends.
Post Condition: The user's information has been modified by the administrator.
Alternative Flow: None.

Use Case: DeleteUserAccount
ID: EIS-4-1-1a3
Brief Description: The administrator deletes a user's account.
Primary Actor: Administrator
Secondary Actors: None.
Precondition: The administrator has accessed the user management menu.
Main Flow: a. The use case begins when the administrator selects the "manage users" button. b. The system prompts the administrator to enter the name or username of the user to be modified. c. The administrator enters the user's name or username into the prompt and selects the "submit" button. d. The system searches for the user's on the system's database. e. If the system finds the desired user in the system's database the system displays a window with the user's information. Else, the system displays an error message and goes back to the prompt. f. The administrator selects the "delete user" button. g. The system deletes the user's information from the database. h. The system displays a confirmation message that the account has been deleted. i. The use case ends.
Post Condition: The user's account has been deleted.
Alternative Flow: None.

4.1.1b)

Use Case: EnforcePasswordPolicy
ID: EIS-4-1-1b
Brief Description: The system enforces a password policy to ensure the security of the system.
Primary Actor: User.
Secondary Actors: None.
Precondition: The user is in the account setup screen.
Main Flow: a. The use case begins when the system prompts the user to set a password to replace the temporary password set by the administrator. b. The user selects the “change password” button. c. The system displays the password requirements of a minimum of 8 characters, one lowercase letter, one uppercase letter, and one special character. d. The system prompts the user to enter the new password. e. The user enters the new password. f. The system checks that the user’s password meets the specified password requirements. g. If the password meets the requirements the new password is saved in the database and the old one is deleted. Else, the system displays an error message that the password does not meet the requirements and goes back to the prompt h. The system displays a confirmation message that the password has been set. i. The use case ends.
Post Condition: The new password is set and the old password is deleted.
Alternative Flow: None.

4.1.1c)

Use Case: ResetPassword
ID: EIS-4-1-1c
Brief Description: The user resets their password.
Primary Actor: User.
Secondary Actors: None.

Precondition: The user is in the login page of the EIS.
Main Flow: a. The use case begins when the user selects the “forgot password” button. b. The system prompts the user to enter their email. c. The user enters their email into the system and selects the “submit” button. d. The system checks the database to find the user associated with the email entered. e. If the system finds the user associated with the email account the system sends an email with a link to reset the password to the email entered. Else, the system displays an error message that the user was not found and goes back to the initial prompt. f. The user receives the email and opens the link sent by the system. g. The link opens and prompts the user to enter a new password. h. The user enters the new password. i. The system checks that the new password meets the password requirements. j. If the password meets the password requirements the system saves the new password in the database and deletes the old password. Else, the system displays an error message that password requirements were not met and goes back to the prompt asking the user to enter the new password. k. The system displays a confirmation message that the password has been set. l. The use case ends.
Post Condition: The user’s password has been reset.
Alternative Flow: None.

4.1.1d)

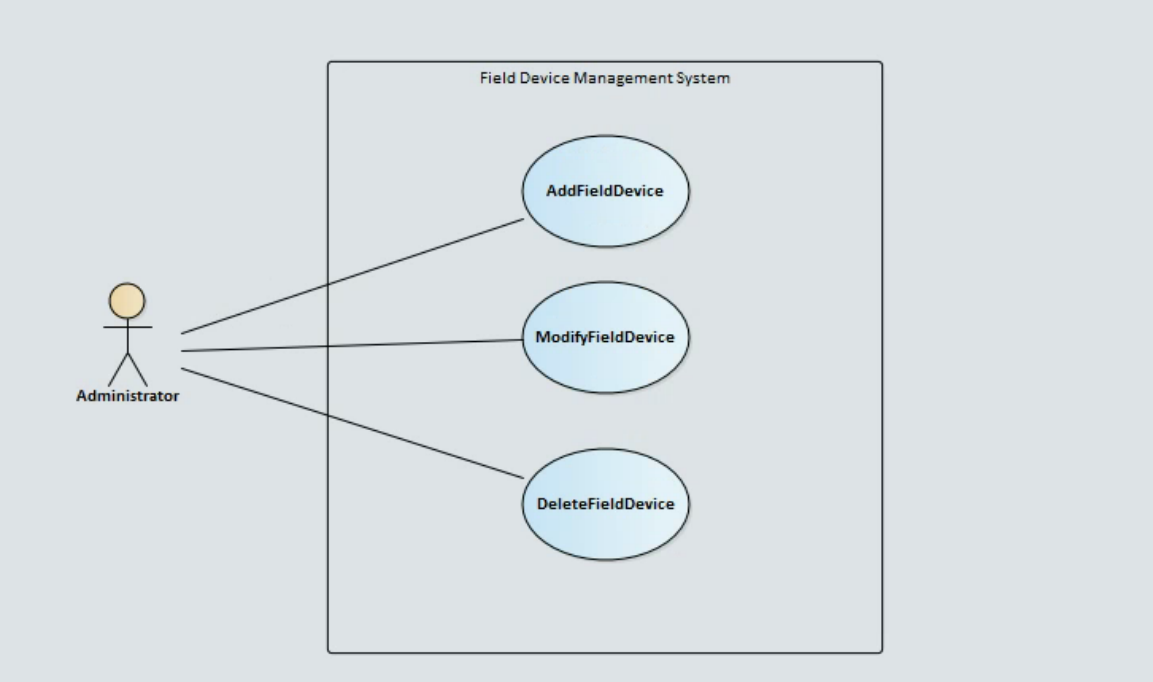
Use Case: TrackLoginAttempts
ID: EIS-4-1-1d
Brief Description: The system keeps a log of all unsuccessful login attempts and blocks the user’s account for 30 minutes after 5 unsuccessful attempts.
Primary Actor: User
Secondary Actors: None
Precondition: The user is on the login page.
Main Flow: a. The use case begins when the user enters the wrong password. b. The system creates a log of the unsuccessful login attempt with the IP Address of the attempt, the time and date of the unsuccessful login attempt. c. The system temporarily stores the log of unsuccessful login attempts for 10 minutes. d. If five unsuccessful login attempts occur within a time period of 10 minutes the

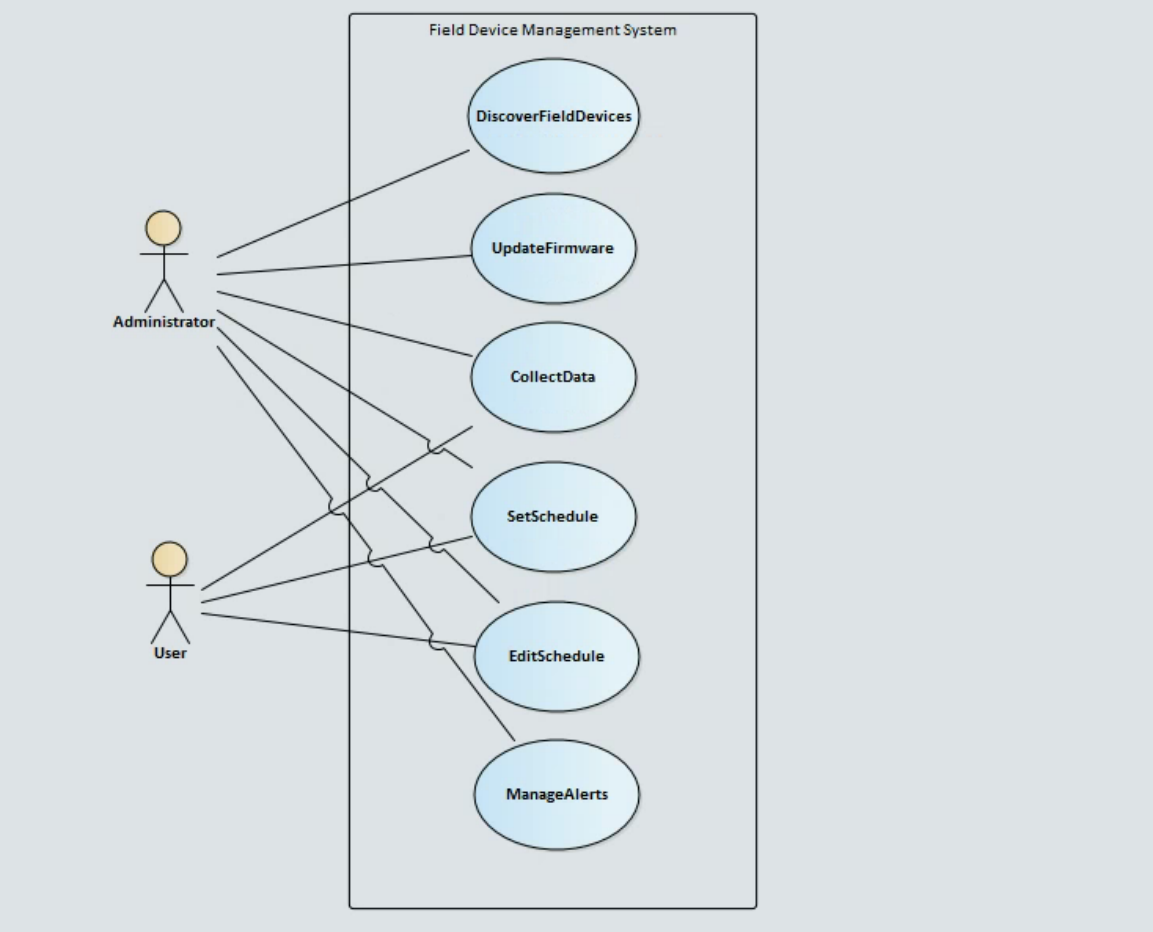
system temporarily locks the account for 30 minutes. Else, the system allows the user to login as usual. e. The use case ends.
Post Condition: The user's account is locked if 5 unsuccessful attempts occur within 10 minutes.
Alternative Flow: None.

4.1.1e)

Use Case: LimitUserAccess
ID: EIS-4-1-1e
Brief Description:The system gives user access to data and modules depending on the role the user was assigned by the administrator.
Primary Actor: User.
Secondary Actors: None.
Precondition: The user is logged in and is on the main page of the EIS.
Main Flow: a. The use case begins when the user accesses the dashboard on the main page of the EIS. b. The system verifies the user's role with the system's database. c. The system displays the data and modules assigned to the user's role. d. The use case ends.
Post Condition: The system hides restricted information from the user and only displays information the user has access to.
Alternative Flow: None.

4.1.2 Field Device Management (FDM):


Field Device Management System
AddFieldDevice
ModifyFieldDevice
DeleteFieldDevice
Administrator


Field Device Management System
DiscoverFieldDevices
UpdateFirmware
CollectData
SetSchedule
EditSchedule
ManageAlerts
Administrator
User

4.1.2a)

Use Case: AddFieldDevice
ID: EIS-4-1-2a1
Brief Description: The administrator adds a field device to the EIS.
Primary Actor: Administrator
Secondary Actors: None
Precondition: The administrator is on the Field Device Manager menu.
Main Flow: a. The use case begins when the administrator selects the “add field device” button. b. The system searches for field devices that are either hardwired to the workstation or in pairing mode over a wireless connection. c. The system displays a list of all field devices found. d. The administrator selects the desired field device and selects the “connect” button. e. The system establishes a connection with the selected field device. f. The system includes the newly added field device into the established system data collection procedures. g. The use case ends.
Post Condition: The field device is connected to the EIS.
Alternative Flow: The system is unable to establish a connection with the field device.

Use Case: ModifyFieldDevice
ID: EIS-4-1-2a2
Brief Description: The administrator modifies the field device settings.
Primary Actor: Administrator.
Secondary Actors: None.
Precondition: The administrator is on the Field Device Manager menu.
Main Flow: a. The use case begins when the administrator selects the “manage field devices” button on the Field Device Manager menu. b. The system displays a list of all field devices connected to the EIS. c. The administrator selects the desired field device and selects the “edit” button. d. The system displays the details for the selected field device, such as the status of

the connection, the data collected by the field device and the set schedules for the selected field device. e. The administrator selects one of the details and makes the desired change. f. The administrator selects the “save” button and the system saves the changes made by the administrator. g. The system displays a confirmation message that the changes were successfully applied. h. The use case ends.
Post Condition: The changes made by the administrator on the field devices are saved.
Alternative Flow: None.

Use Case: DeleteFieldDevice
ID: EIS-4-1-2a3
Brief Description:The administrator deletes a field device from the EIS.
Primary Actor: Administrator.
Secondary Actors: None.
Precondition: The administrator is on the Field Device Manager menu.
Main Flow: a. The use case begins when the administrator selects the “manage field devices” button on the Field Device Manager menu. b. The system displays a list of all field devices connected to the EIS. c. The administrator selects the desired field device and selects the “delete” button. d. The system disconnects the device from the EIS and deletes the field device from the list. e. The system displays a confirmation message that the field device was successfully disconnected from the EIS. f. The use case ends.
Post Condition: The field device is deleted from the field device list and disconnected from the EIS.
Alternative Flow: None.

4.1.2b)

Use Case: DiscoverFieldDevices
ID: EIS-4-1-2b

Brief Description: The system searches for field devices that are hardwired to the workstation and automatically connects to them.
Primary Actor: Administrator.
Secondary Actors: None.
Precondition: The administrator is on the Field Device Manager menu.
Main Flow: a. The use case begins when the administrator selects the “discover field devices” button. b. The system searches for field devices that are hardwired into the current workstation running the EIS. c. The system establishes a connection with the field devices found, if no devices are found the system displays a message to the administrator stating that no devices were found. d. The use case ends.
Post Condition: Field devices are connected to the EIS.
Alternative Flow: None.

4.1.2c)

Use Case: UpdateFirmware
ID: EIS-4-1-2c
Brief Description: The administrator updates the firmware of the connected field devices.
Primary Actor: Administrator.
Secondary Actors: None.
Precondition: The administrator is on the Field Device Manager menu.
Main Flow: a. The use case begins when the administrator selects the “check for updates” button on the Field Device Manager menu. b. The system searches online for updates pertaining to the field devices connected to the EIS. c. The system displays a list of all available firmware updates for all connected field devices. d. The administrator selects the “update now” button. e. The system downloads and installs all listed firmware updates on field devices. f. The system displays a message stating that the firmware has been updated on the field devices. g. The use case ends.

Post Condition: Firmware is up to date on all field devices.
Alternative Flow: There are no available firmware updates.

4.1.2d & g)

Use Case: CollectData
ID: EIS-4-1-2d
Brief Description: The administrator collects data using the field devices.
Primary Actor: Administrator.
Secondary Actors: None.
Precondition:The administrator is on the Field Devices Manager menu or system reaches the time of scheduled data collection.
Main Flow: a. The use case begins when the administrator selects the “collect data” button or the system reaches the set data collection time. b. The system uses the connected field devices to make measurements of the indoor environment. c. The system saves the collected data into the system’s database. d. The system displays the measured data onto the administrators dashboard. e. The use case ends.
Post Condition: The system collected data, saved it, and displayed it on the administrator’s dashboard.
Alternative Flow: Data collection fails.

4.1.2e)

Use Case: ManageAlerts
ID: EIS-4-1-2e
Brief Description: Administrator modifies alerts on the system.
Primary Actor: Administrator
Secondary Actors: None
Precondition: The Administrator is on the “Alerts” tab.
Main Flow: a. Use case begins when the administrator selects the “manage alerts” button. b. The system displays a list of all of the field devices connected to the EIS.

c. The administrator selects the desired field device for which the alarm is to be modified. d. The system displays all of the alarms linked to the selected field device. e. The administrator selects the alarm to be modified. f. The system displays the alarm details. g. The administrator makes the desired changes to the selected alarm and selects the “save” button. h. The system saves the changes and displays a confirmation message to the administrator stating that the changes were successfully saved. i. The use case ends.
Post Condition: The Alert is modified.
Alternative Flow: None.

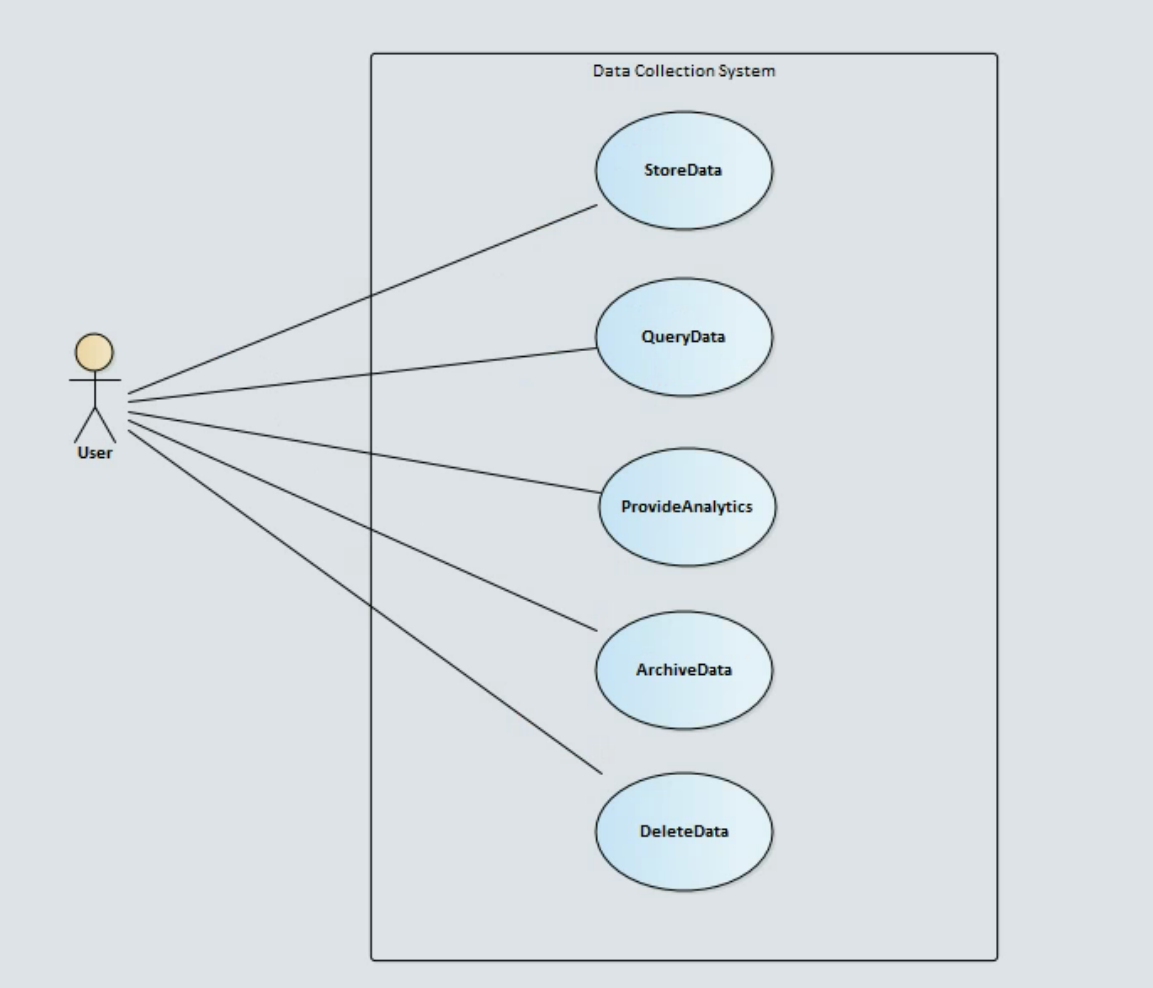
4.1.2f)

Use Case: EditSchedule
ID: EIS-4-1-2f1
Brief Description: The user or administrator modifies the schedule for data collection.
Primary Actor: Administrator/User.
Secondary Actors: None.
Precondition: The administrator/user is on the Field Device Manager menu.
Main Flow: a. The use case begins when the administrator/user selects the “data collection settings” button. b. The system displays the data collection settings menu. c. The administrator/user selects the “edit schedule” button. d. The system displays the current schedule for data collection. e. The administrator/user changes the schedule and selects the “submit” button. f. The system updates the schedule and sets all devices with the new schedule. g. The system displays a confirmation message stating that the schedule has been updated.
Post Condition: The schedule has been modified by the administrator/user.
Alternative Flow: There is no existing schedule to be modified.

Use Case: SetSchedule
ID: EIS-4-1-2f2

Brief Description: The administrator/user sets a schedule for the field devices to collect data.
Primary Actor: Administrator/user.
Secondary Actors: None.
Precondition: The administrator/user is on the Field Device Manager menu.
Main Flow: a. The use case begins when the administrator/user selects the “data collection settings” button. b. The system displays the data collection settings menu. c. The adminstrator/user selects the “create new schedule” button. d. The system displays a window that prompts the user to enter the times at which data should be collected by all connected field devices. e. The user enters the desired times for data collection and selects the “set schedule” button. f. The system applies the new schedule to all connected field devices and displays a confirmation message that the new schedule has been set. g. The use case ends.
Post Condition: A new schedule has been set for all field devices connected to the EIS.
Alternative Flow: None.

4.1.3 Data Collection (DCS):



4.1.3a)

Use Case: StoreData
ID: EIS-4-1-3a
Brief Description: The user saves the data collected by the field devices.
Primary Actor: User.
Secondary Actors: None.
Precondition: The user is in the Collected Data Dashboard.
Main Flow: a. The use case begins when the user selects the “view data” button. b. The system displays a summary of the most recent data collected by the field devices.

c. The user selects the “save data” button. d. The system stores the data in the system’s database. e. The system displays a confirmation message stating that the data was successfully saved. f. The use case ends.
Post Condition: The most recent data collected by the field devices is saved in the system’s database.
Alternative Flow: None.

4.1.3b)

Use Case: QueryData
ID: EIS-4-1-3b
Brief Description: The user queries data from the system’s database.
Primary Actor: User.
Secondary Actors: None.
Precondition: The user is in the Collected Data Dashboard.
Main Flow: a. The use case begins when the user selects the “query editor” button. b. The system displays a query editor window. c. The user enters the appropriate SQL code to query the desired data. d. The user selects the “run” button. e. The system processes the user’s query and retrieves the desired data from the system’s database. f. The system displays the retrieved data to the user. g. The use case ends.
Post Condition: Data has been retrieved from the system’s database.
Alternative Flow: The data requested is not found or the user does not have the required role to access that data.

4.1.3c)

Use Case: ProvideAnalytics
ID: EIS-4-1-3c
Brief Description: The system provides the user with analytics on the selected data.
Primary Actor: User.

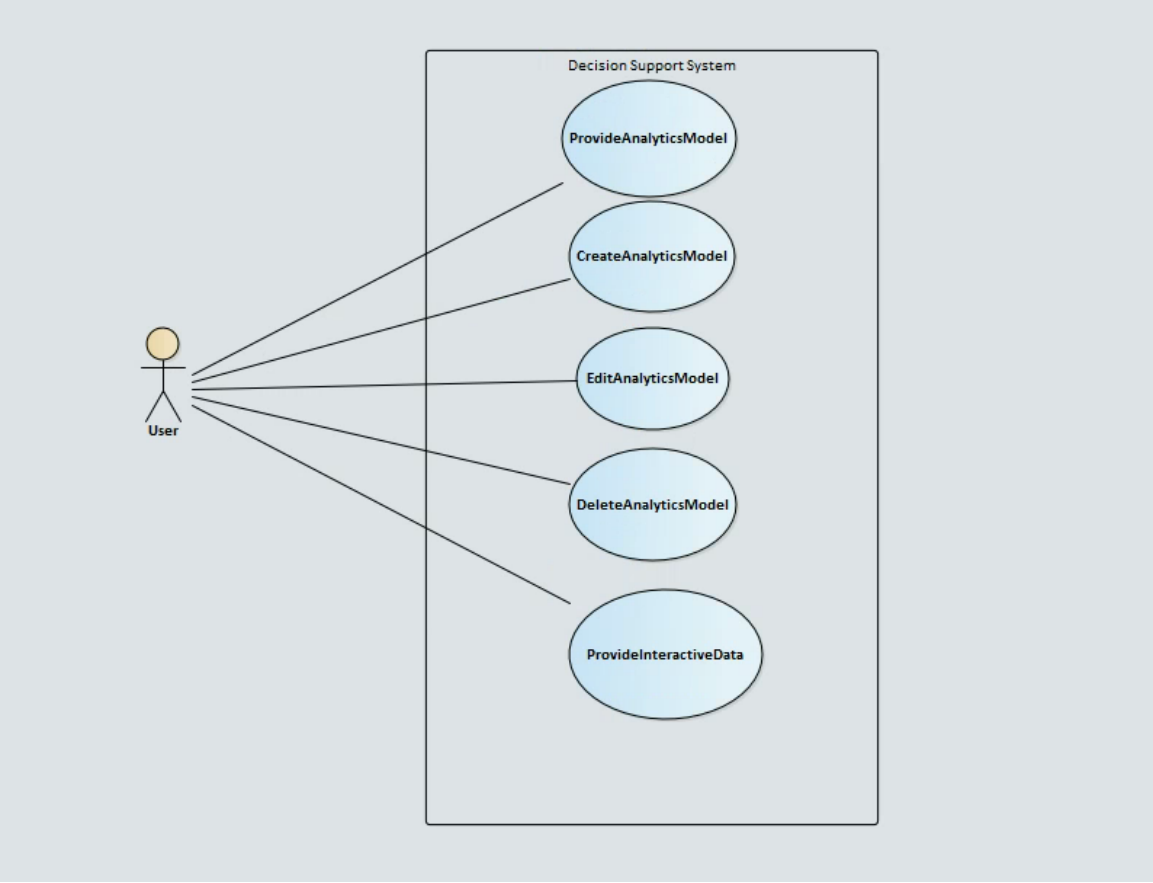
Secondary Actors: None.
Precondition: The user is in the Collected Data Dashboard.
Main Flow: a. The use case begins when the user selects the “analytics” button. b. The system prompts the user to enter the dates of the collected data for which the user wants to request analytics. c. The user enters the dates of the desired data. d. The system searches for the data associated with that date on the system’s database. e. The system prompts the user to select between descriptive, prescriptive, or predictive analytics. f. The user selects the desired type of analytics. g. The system generates analytics of the selected type. h. The system displays the generated analytics to the user. i. The use case ends.
Post Condition: The user has the desired analytics.
Alternative Flow: There is no data for the date entered.

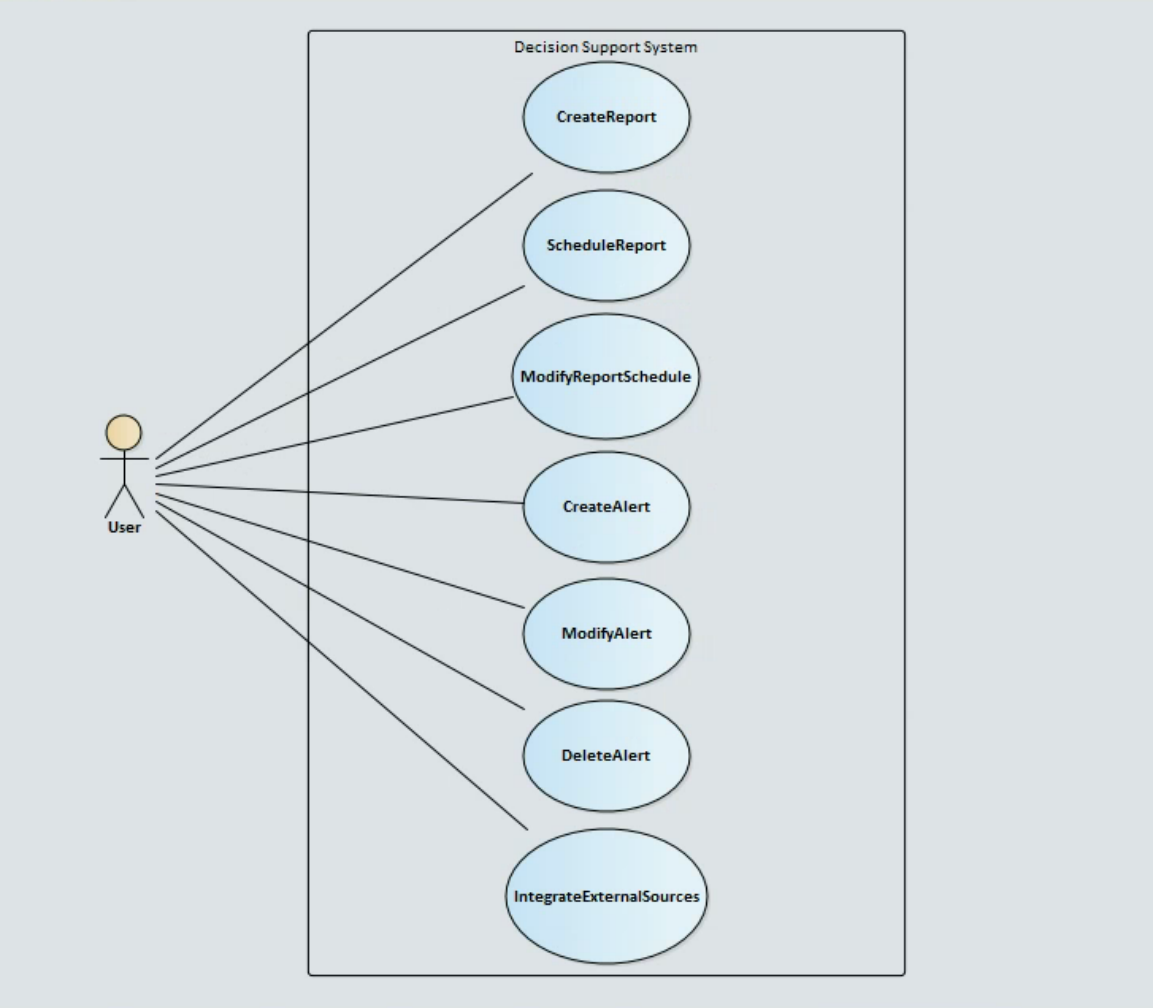
4.1.3d)

Use Case: ArchiveData
ID: EIS-4-1-3d1
Brief Description: Data is archived for long term preservation by the user.
Primary Actor: User
Secondary Actors: None.
Precondition: The user is in the Collected Data Dashboard.
Main Flow: a. The use case begins when the user selects the “view data” button. b. The system displays a summary of the most recent data collected. c. The user selects the “archive data” button. d. The system archives the data in the system’s database. e. The system displays a confirmation message to the user that the data has been successfully archived.
Post Condition: The data is archived in the system’s database for long term preservation.
Alternative Flow: None.

Use Case: DeleteData
ID: EIS-4-1-3d2
Brief Description: The user deletes data from the system's database.
Primary Actor: User.
Secondary Actors: None.
Precondition: The user is in the Collected Data Dashboard.
Main Flow: a. The use case begins when the user selects the "search data" button. b. The system displays a window that prompts the user to enter the date of the data to be searched. c. The user enters the date of the desired data. d. The system searches for the desired data in the system's database using the date of the data. e. The system displays a preview of the desired data to the user. f. The user selects the "delete data" button. g. The system deletes the data from the database. h. The system displays a confirmation message that the data has been successfully deleted from the EIS.
Post Condition: Selected data has been deleted from the system's database.
Alternative Flow: None

4.1.4 Decision Support (DSS):





4.1.4a)

Use Case: ProvideAnalyticsModel
ID: EIS-4-1-4a
Brief Description: The system provides the user with an analytics model.
Primary Actor: User
Secondary Actors: None.
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “analytics model” button. b. The system displays the Analytics Model menu. c. The user selects “use default analytics model” button. d. The system applies the default analytics model to all analytics. e. The system displays a confirmation message stating that the default analytics model for the EIS has been set.

f. The use case ends.
Post Condition: The default analytics model has been established.
Alternative Flow: None.

4.1.4b)

Use Case: CreateAnalyticsModel
ID: EIS-4-1-4b
Brief Description: The user creates a custom analytics model.
Primary Actor: User
Secondary Actors: None.
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “analytics model” button. b. The system displays the Analytics Model menu. c. The user selects “create new analytics model” button. d. The system displays all customizable options for an analytics model. e. The user customizes all of the options provided. f. The user selects the “create” button. g. The system displays the created analytics model. h. The user selects “apply” button. i. The system applies the created analytics model to all analytics in the EIS. j. The system displays a confirmation message that the analytics model was successfully created and applied to all analytics. k. The use case ends.
Post Condition: Custom analytics model is applied to all system analytics.
Alternative Flow: None.

4.1.4c)

Use Case: ProvideInteractiveData
ID: EIS-4-1-4c
Brief Description: The system provides interactive data to the user.
Primary Actor: User.
Secondary Actors: None.

Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “interactive data” button. b. The system prompts the user to enter the date of the data that is desired. c. The user enters the date corresponding to the data. d. The system searches for the data in the system’s database. e. The system retrieves the data and creates interactive graphs and charts. f. The system displays the interactive charts and graphs to the user. g. The use case ends.
Post Condition: User has interactive graphs and charts for the desired data.
Alternative Flow: The data specified is not found in the system’s database.

4.1.4d)

Use Case: CreateReport
ID: EIS-4-1-4d1
Brief Description: The user generates a report that summarizes the selected data.
Primary Actor: User.
Secondary Actors: None.
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “reports” button. b. The system displays the Reports menu. c. The user selects the “new report” button. d. The system prompts the user to enter the date of the desired data. e. The user enters the date of the corresponding data. f. The system searches the system’s database for the data. g. The system retrieves the data and generates a report of the data. h. The system provides the report to the user. i. The use case ends.
Post Condition: Report for selected data is generated and presented to the user.
Alternative Flow: The data specified is not found in the database.

Use Case: CreateAlert
ID: EIS-4-1-4d2

Brief Description: The user creates an alert for a condition in the system.
Primary Actor: User
Secondary Actors: None
Precondition: The user is on the tools menu
Main Flow: a. The use case begins when the user selects the “alerts” button. b. The system displays the Alerts menu. c. The user selects the “create alert” button. d. The system displays the different types of alerts that can be created. e. The user selects one type of alert. f. The system displays the customization options for the selected alert type. g. The user customizes the alert and selects the “create” button. h. The system creates the alert. i. The user selects the “enable alert” button. j. The system enables the alert on the system. k. The system displays a confirmation message stating that the alert has been successfully created and enabled. l. The use case ends.
Post Condition: An alerts has been created and enabled on the system.
Alternative Flow: None.

Use Case: ScheduleReport
ID: EIS-4-1-4d3
Brief Description: The user creates a schedule for reports to be generated in a recurrent manner.
Primary Actor: User.
Secondary Actors: None.
Precondition:The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “reports” button. b. The system displays the Reports menu. c. The user selects the “report schedule” button. d. The system displays the current schedule for report generation. e. The user selects “modify schedule” button. f. The system displays the editable schedule. g. The user modifies the schedule and selects the “apply schedule” button. h. The system saves the schedule and generates reports based on the schedule.

i. A confirmation message is displayed by the system stating that the schedule has been saved and applied to the system. j. The use case ends.
Post Condition: A custom schedule for report generation has been created and applied to the EIS.
Alternative Flow: None.

4.1.4e)

Use Case: IntegrateExternalSources
ID: EIS-4-1-4e
Brief Description: The system integrates external sources requested by the user.
Primary Actor: User
Secondary Actors: None
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “compatible software” button. b. The system displays a list of all software that can be used in conjunction with the EIS. c. The user selects a specific program that they want to use with the EIS. d. The system establishes a connection with the selected software via an API. e. The system displays a confirmation message that the system has successfully connected to the desired program. f. The use case ends.
Post Condition: The external source requested by the user has been connected to the EIS and is ready for use.
Alternative Flow: None.

4.1.4f)

Use Case: EditAnalyticsModel
ID: EIS-4-1-4f1
Brief Description: The user edits the current analytics model.
Primary Actor: User

Secondary Actors: None
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “analytics model” button. b. The system displays the Analytics Model menu. c. The user selects the “edit analytics model” button. d. The system displays the current analytics model and allows the user to edit it. e. The user modifies the analytics model and selects “apply changes” button. f. The system saves the changes and applies analytics model to all analytics. g. The system displays a confirmation message stating that the analytics model was successfully changed and applied to all analytics. h. The use case ends.
Post Condition: The current analytics model has been edited and changes have been applied to all analytics.
Alternative Flow: None.

Use Case: DeleteAnalyticsModel
ID: EIS-4-1-4f2
Brief Description: The user deletes the current analytics model.
Primary Actor: User
Secondary Actors: None
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “analytics model” button. b. The system displays the Analytics Model menu. c. The use selects the “delete analytics model” button. d. The system deletes the current analytics model. e. The system applies the default analytics model to all analytics. f. The system displays a confirmation message that the analytics model was successfully deleted and the analytics model will go back to the default settings. g. The use case ends.
Post Condition: Current analytics model has been deleted and default analytics model has been applied.
Alternative Flow: The current analytics model is the default analytics model, which can’t be deleted.

4.1.4g)

Use Case: ModifyReportSchedule
ID: EIS-4-1-3g1
Brief Description:The user modifies the current report generation schedule.
Primary Actor: User
Secondary Actors: None
Precondition: The user in on the Tools menu.
Main Flow: a. The use case begins when the user selects the “reports” button. b. The system displays the Reports menu. c. The user selects the “reports schedule” button. d. The system displays the current reports schedule. e. The user selects the “edit report schedule” button. f. The system unlocks the report schedule for the user to make changes. g. The user modifies the schedule and selects the “save changes” button. h. The system saves the changes and generates reports based on the new schedule. i. The system displays a confirmation message stating that the reports schedule has been successfully changed and applied to the system. j. The use case ends.
Post Condition: The current report generation schedule has been modified.
Alternative Flow: None.

Use Case: ModifyAlert
ID: EIS-4-1-3g2
Brief Description: The user modifies an existing alert.
Primary Actor:User
Secondary Actors: None.
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “alerts” button. b. The system displays all existing alerts. c. The user selects “edit” button on the alert that is to be modified. d. The system displays the details of the alert and allows the user to make changes. e. The user makes the desired changes to the alert and selects the “save” button.

f. The system saves the changes and applies them to the system. g. The system displays a confirmation message stating that the changes have been saved and applied. h. The use case ends.
Post Condition: The desired alert has been modified.
Alternative Flow: None.

Use Case: DeleteAlert
ID: EIS-4-1-3g3
Brief Description: The user deletes an alert from the EIS.
Primary Actor:User
Secondary Actors: None
Precondition: The user is on the Tools menu.
Main Flow: a. The use case begins when the user selects the “alerts” button. b. The system displays all existing alerts. c. The user selects the “delete” button on the alert that is to be deleted. d. The system deletes the selected alert and displays a confirmation message stating that the alert has been successfully removed from the system. e. The use case ends.
Post Condition:The selected alert has been deleted from the system.
Alternative Flow: None.

4.2 Nonfunctional Requirements

4.2.1 *Performance Requirements*

4.2.1a) The system shall respond to user requests within 3 seconds.
4.2.1b) The system shall be able to handle 1000 concurrent users.
4.2.1c) The system shall be able to handle expected growth in user demand or workload over time, by forecasting future resource requirements and scaling up the system accordingly.
4.2.1d) The system shall use system resources efficiently, such as memory, processing power, or network bandwidth, to avoid excessive use of resources that could lead to poor performance or system crashes.

4.2.2 *Safety Requirements*

4.2.2a) The system shall have a consistent and intuitive user interface.
4.2.2b) The system shall ensure the integrity of data, to prevent unauthorized modification, deletion, or corruption of data that could lead to errors or harm.
4.2.2c) The system shall provide strong authentication and authorization mechanisms to prevent unauthorized access, use, or modification of data or functionality.
4.2.2d) The system shall undergo regular risk assessments to identify and mitigate potential risks and vulnerabilities that could result in loss, damage, or harm.
4.2.2e)The system shall have a robust disaster recovery plan in place to minimize the impact of unexpected events, such as natural disasters or cyber attacks, that could result in loss, damage, or harm.

4.2.3 *Security Requirements*

4.2.3a) The EIS system shall have a role based access control mechanism to ensure that only authorized users have access to sensitive data and functions.
4.2.3b) The EIS system shall encrypt and backup all data to ensure the confidentiality, integrity, and availability of data.
4.2.3c) The EIS system shall maintain detailed audit logs of all system events and user activities.
4.2.3d) The EIS system shall have regular security assessments to identify, assess, and mitigate security risks.

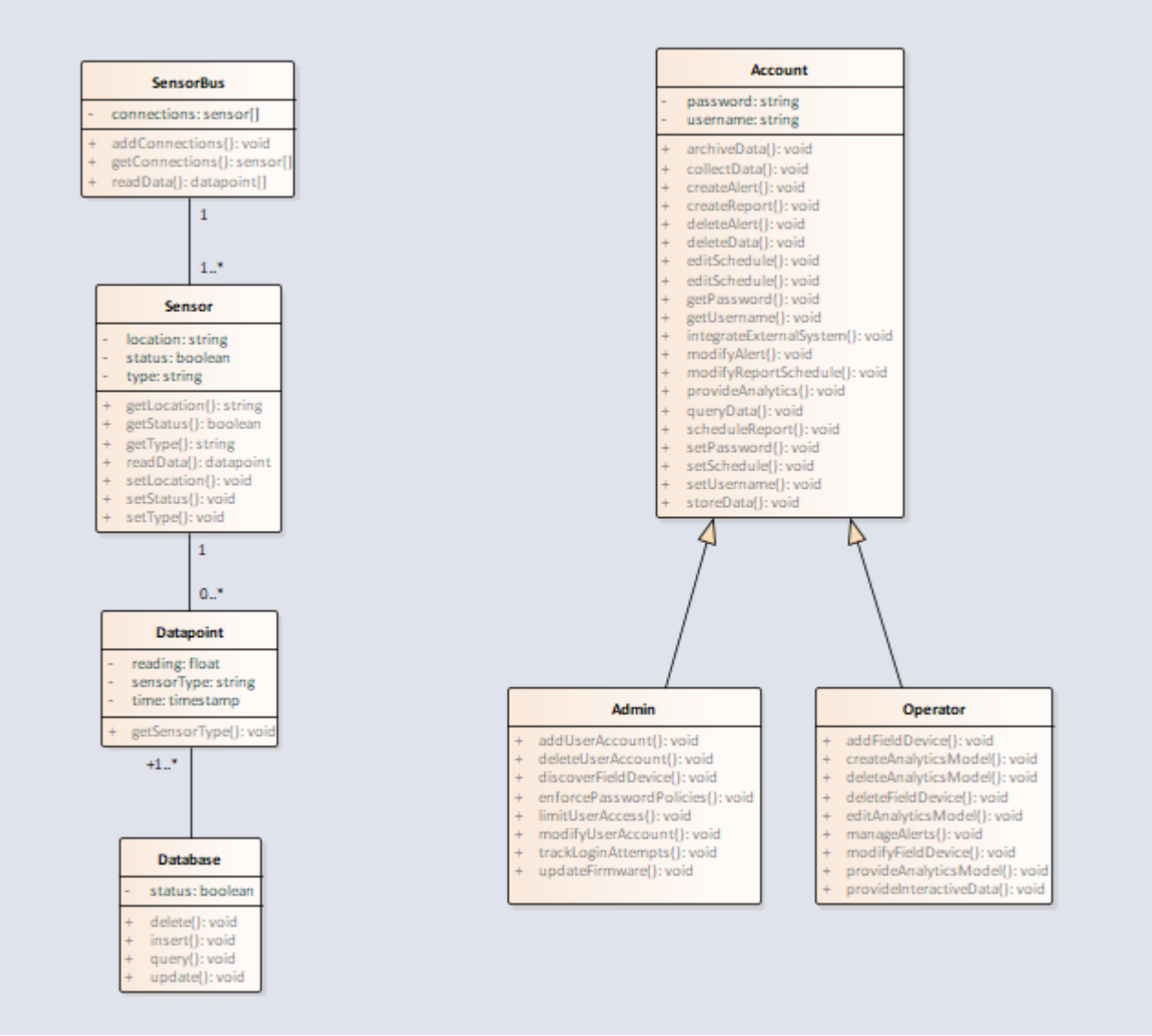
4.2.4 *Software Quality Attributes*

4.2.4a) The system shall be designed and implemented in a way that makes it easy to maintain and modify, with clear documentation, modular code structure, and version control, with a maximum downtime of 2 hours for maintenance.
4.2.4b) The system shall be reliable and stable, with a low frequency of system crashes, errors, or data loss, with a maximum downtime of 1 hour per month.
4.2.4c) The system shall be testable, with a comprehensive set of test cases and test plans, covering all system components and functionality, with at least 90% test coverage.

4.2.4d) The system shall be scalable, able to handle increased user demand or workload by adding more resources, without significant degradation in performance, with the ability to handle at least 1000 concurrent users.

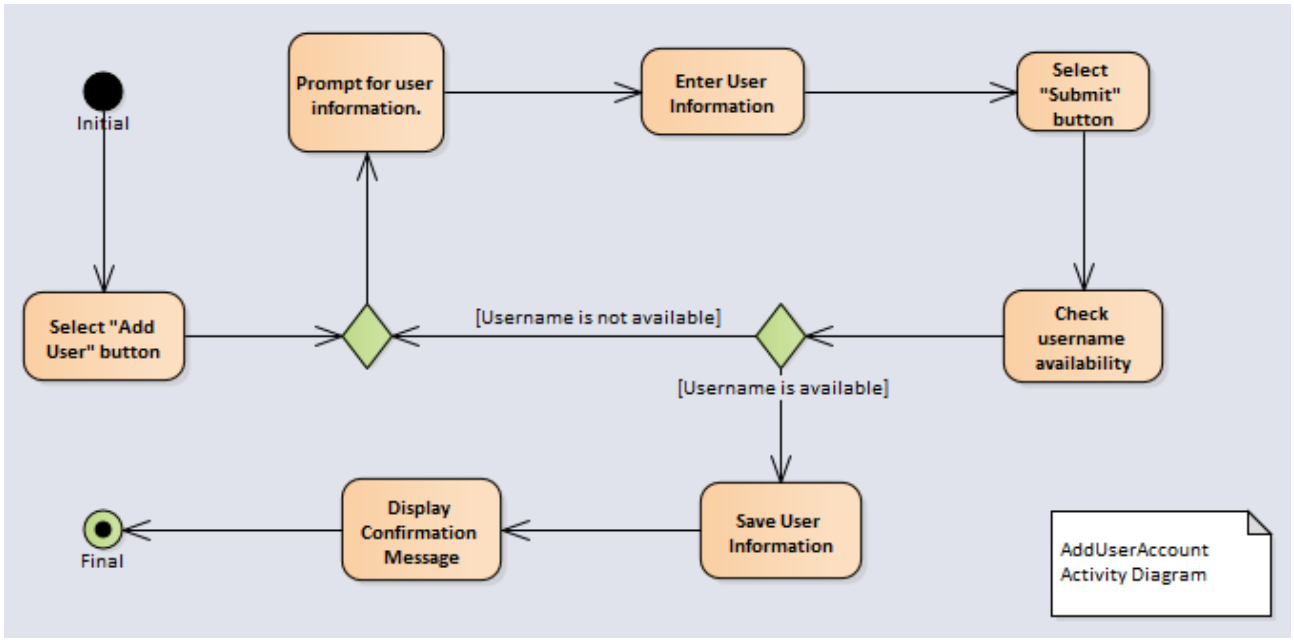
5. Analysis

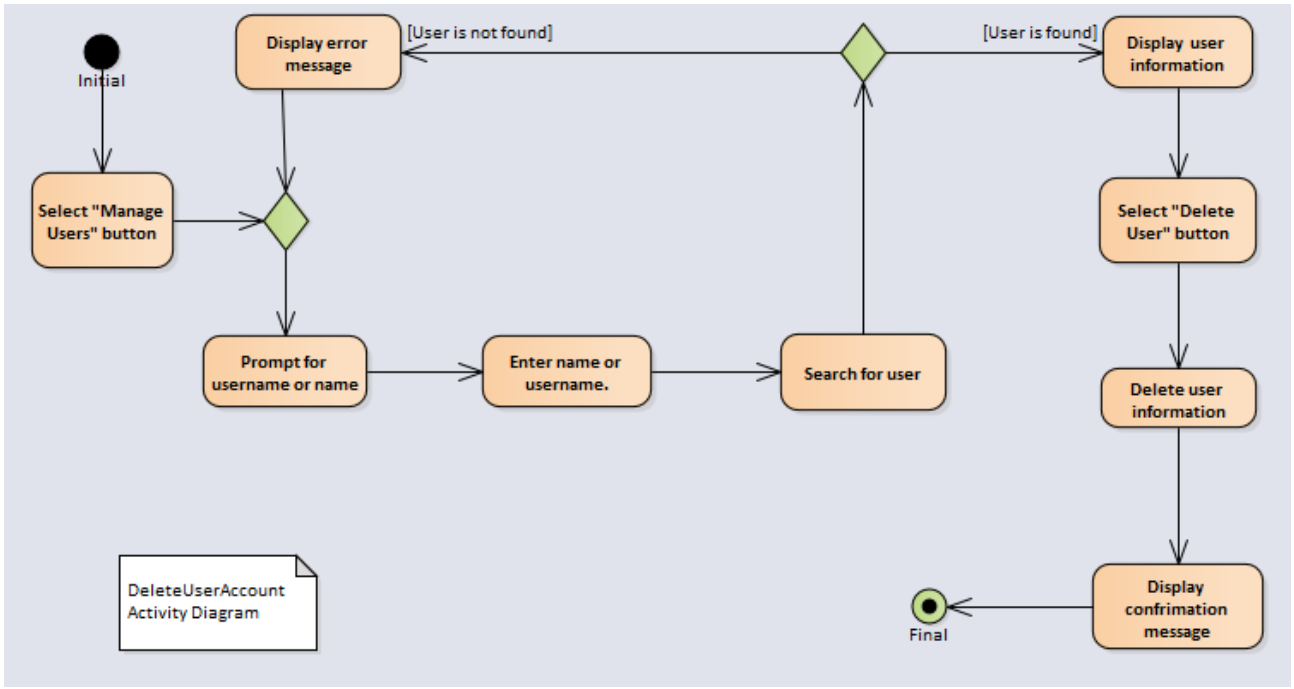
Class Diagrams

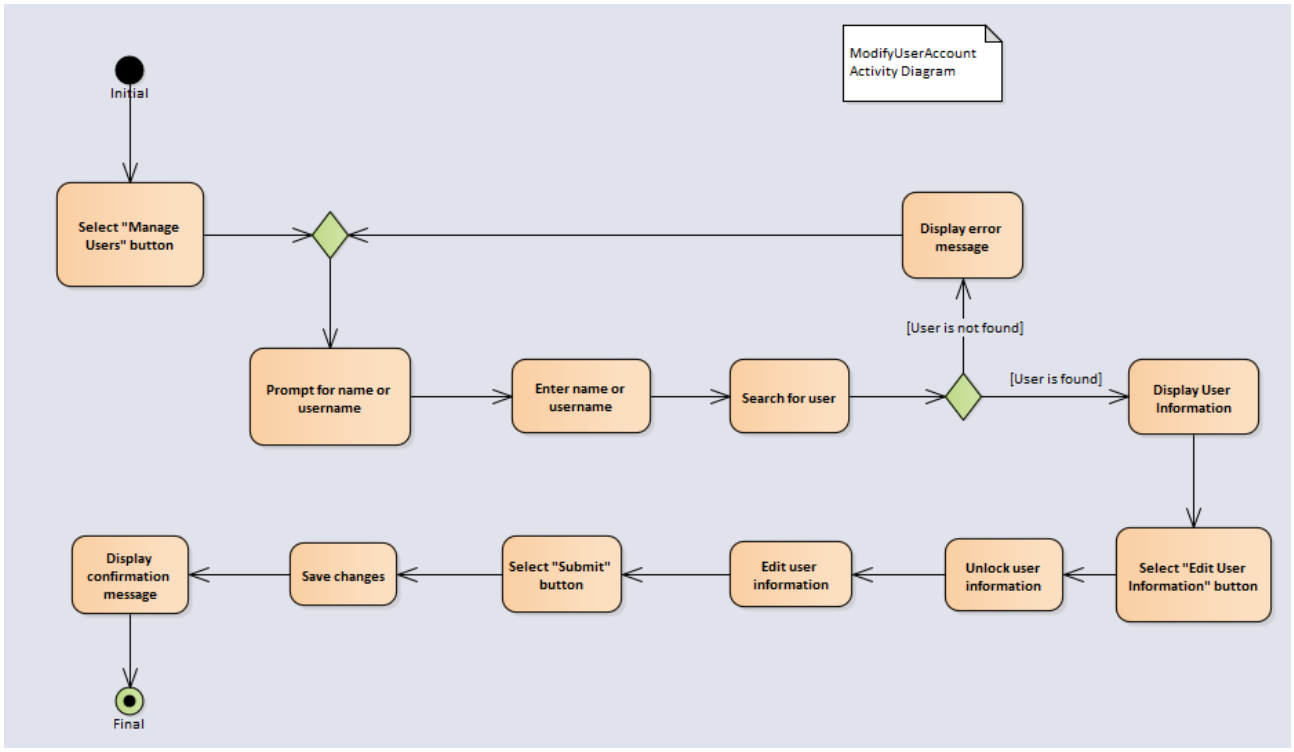


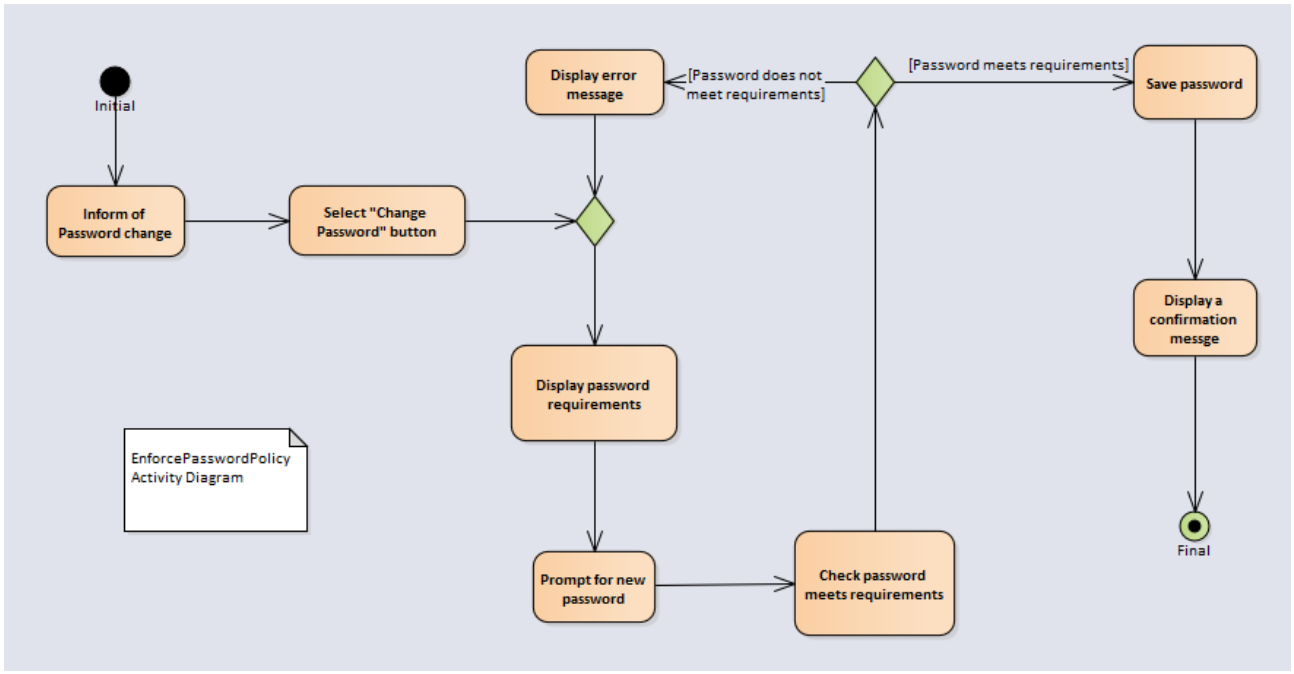
Sequence/Activity Diagrams

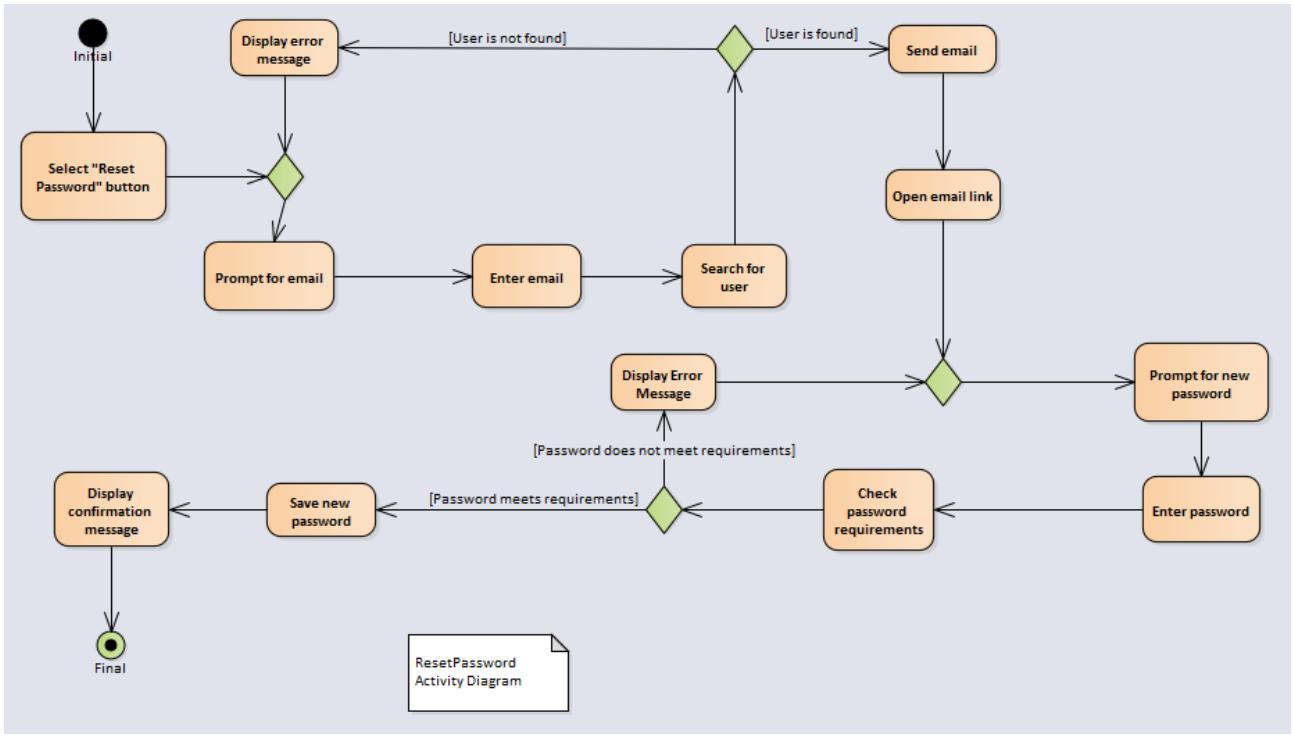
UMS:

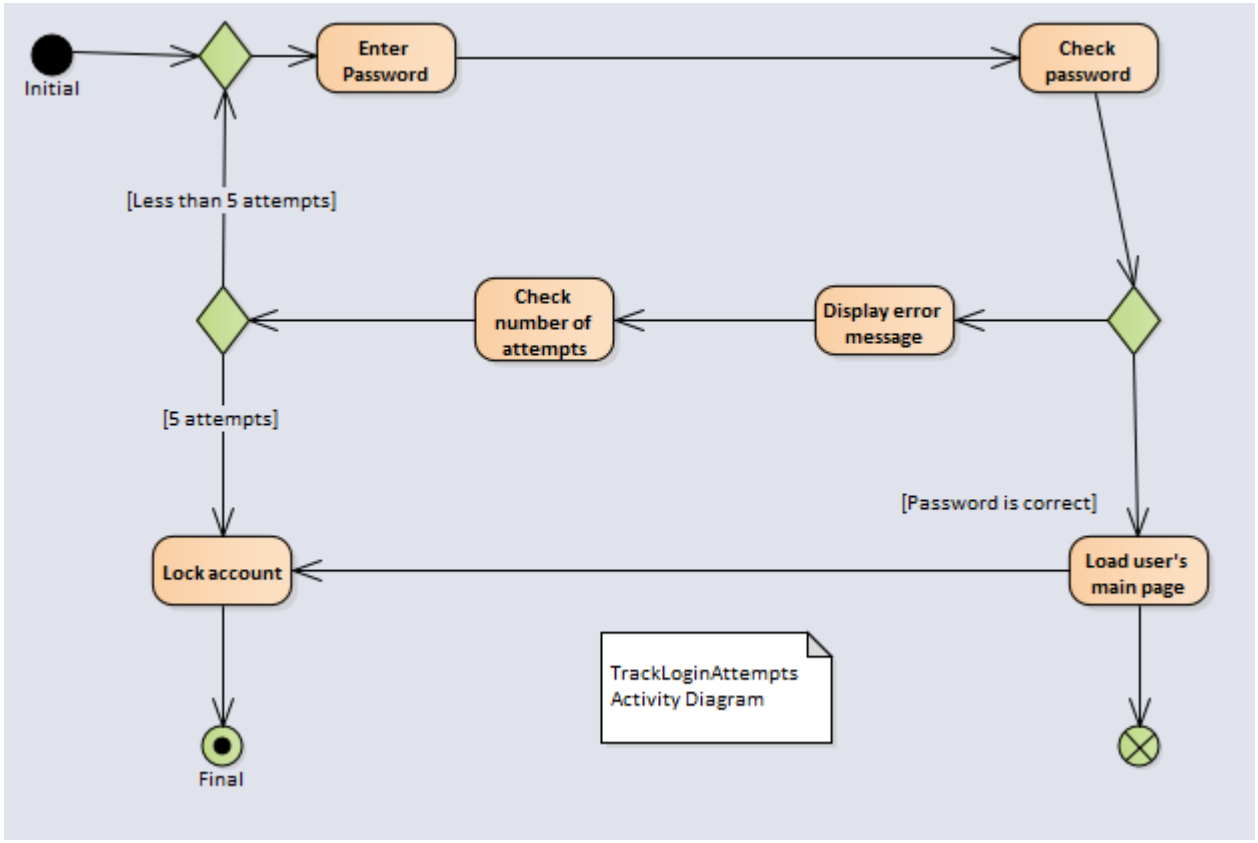

Initial
Prompt for user information.
Enter User Information
Select "Submit" button
Select "Add User" button
[Username is not available]
Check username availability
[Username is available]
Final
Display Confirmation Message
Save User Information
AddUserAccount Activity Diagram

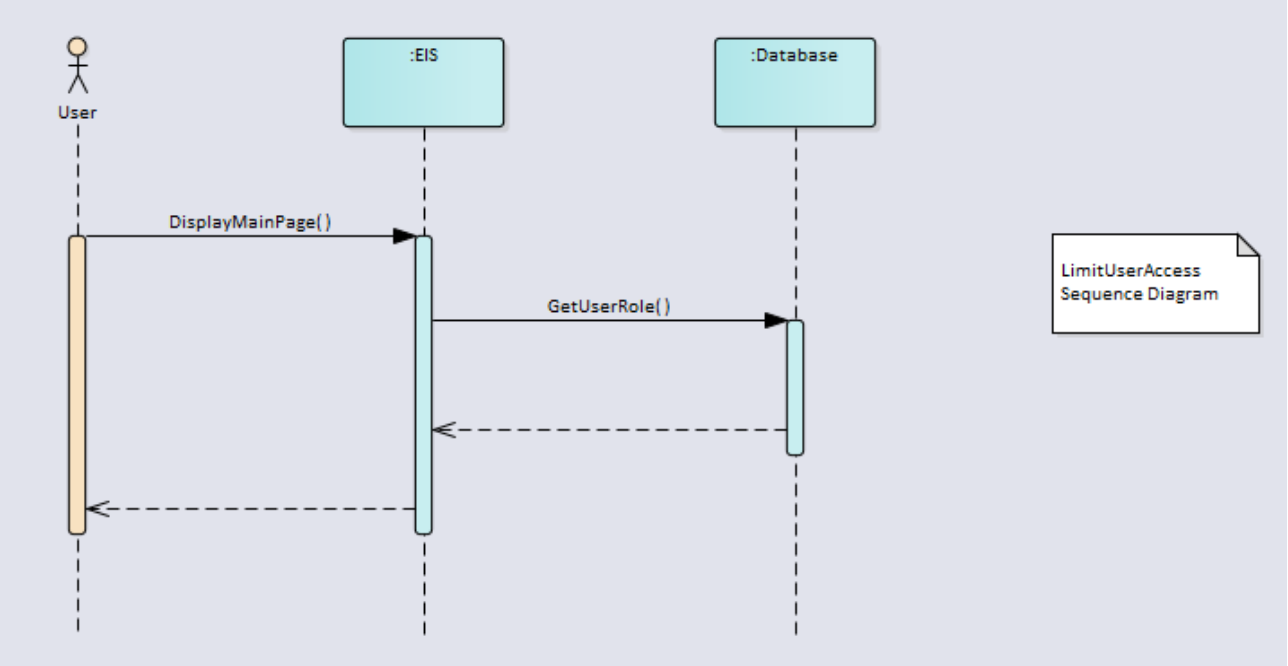

Initial
Display error message
[User is not found]
[User is found]
Display user information
Select "Manage Users" button
Select "Delete User" button
Prompt for username or name
Enter name or username.
Search for user
Delete user information
DeleteUserAccount Activity Diagram
Final
Display confirmation message


ModifyUserAccount
Activity Diagram
Initial
Select "Manage Users" button
Display error message
[User is not found]
Prompt for name or username
Enter name or username
Search for user
[User is found]
Display User Information
Select "Edit User Information" button
Unlock user information
Edit user information
Select "Submit" button
Save changes
Display confirmation message
Final

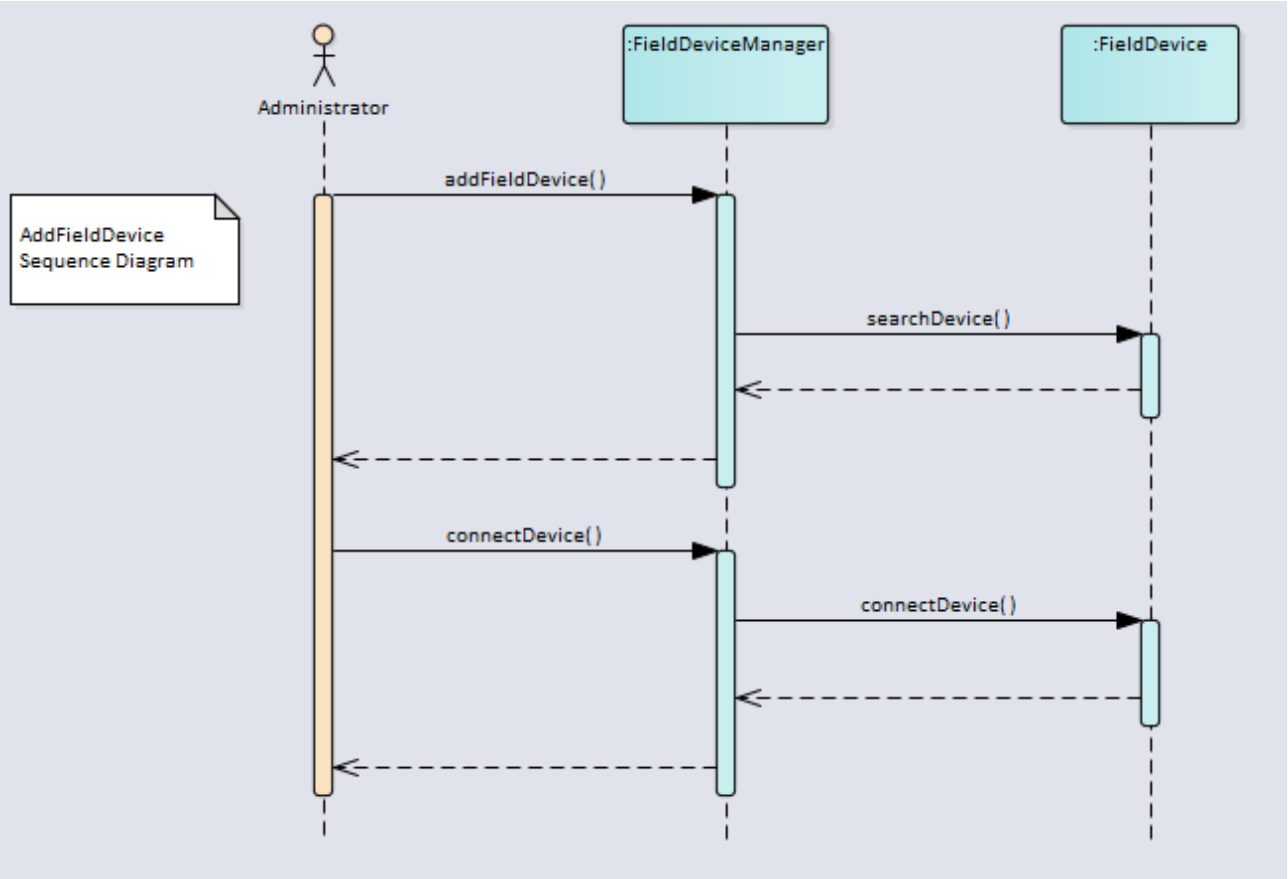

Initial
Inform of Password change
Select "Change Password" button
Display error message
[Password does not meet requirements]
[Password meets requirements]
Save password
Display password requirements
Display a confirmation messge
EnforcePasswordPolicy
Activity Diagram
Prompt for new password
Check password meets requirements
Final

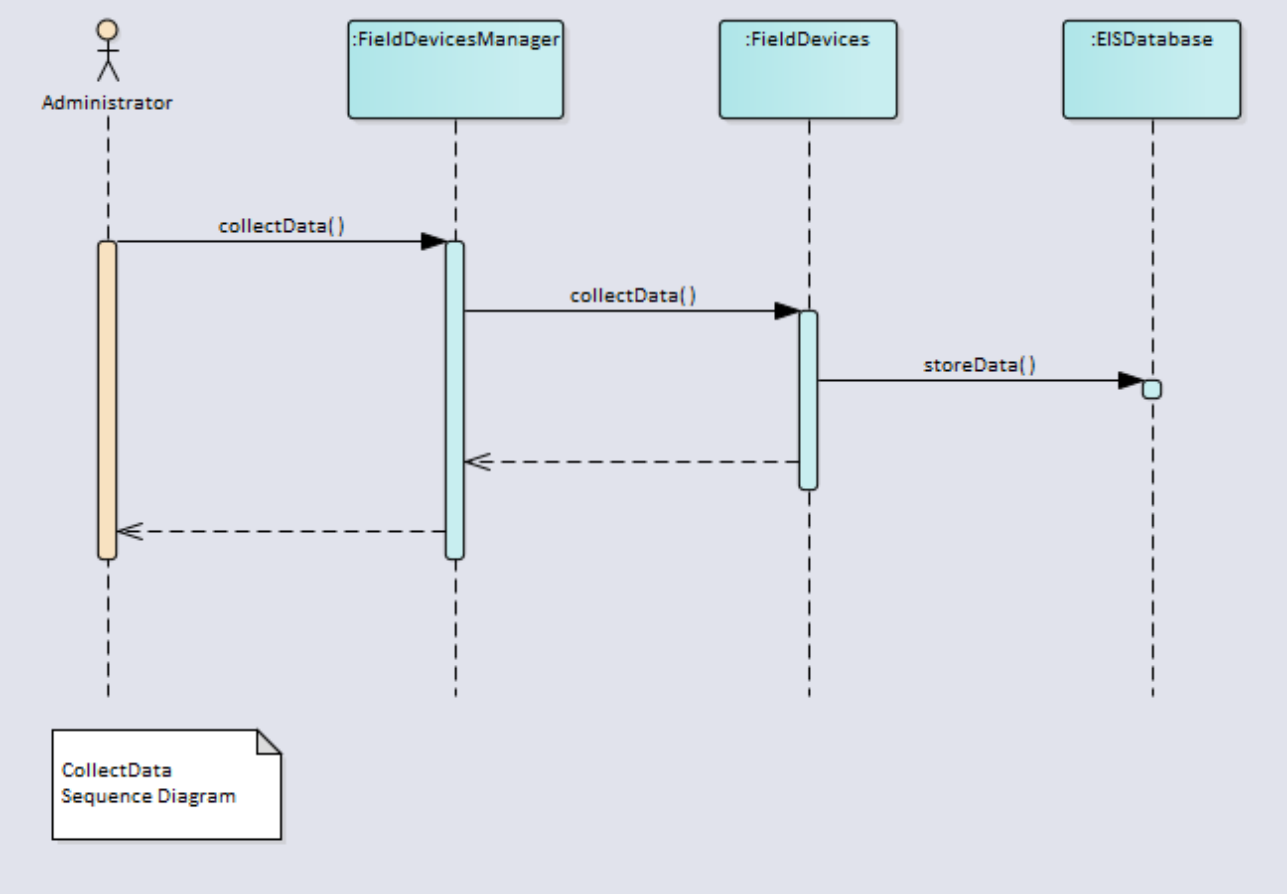

Initial
Display error message
[User is not found]
[User is found]
Send email
Select "Reset Password" button
Open email link
Prompt for email
Enter email
Search for user
Display Error Message
Prompt for new password
[Password does not meet requirements]
Display confirmation message
Save new password
[Password meets requirements]
Check password requirements
Enter password
Final
ResetPassword Activity Diagram

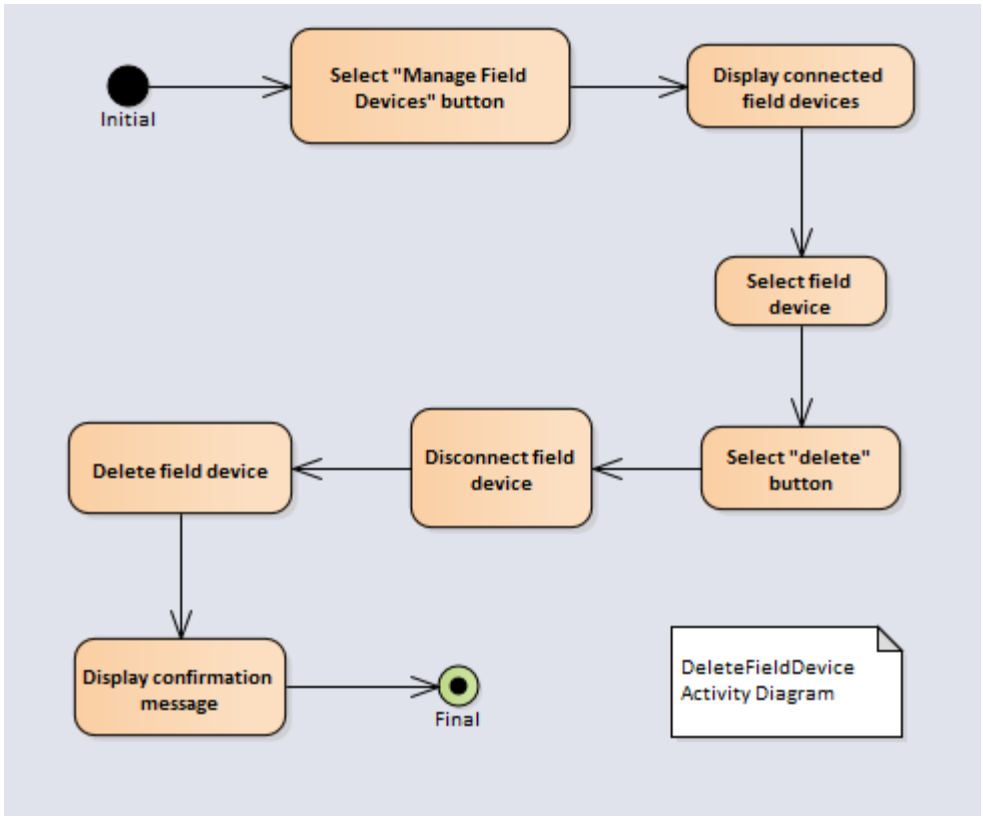

Initial
Enter Password
Check password
[Less than 5 attempts]
Check number of attempts
Display error message
[5 attempts]
[Password is correct]
Lock account
Load user's main page
Final
TrackLoginAttempts Activity Diagram

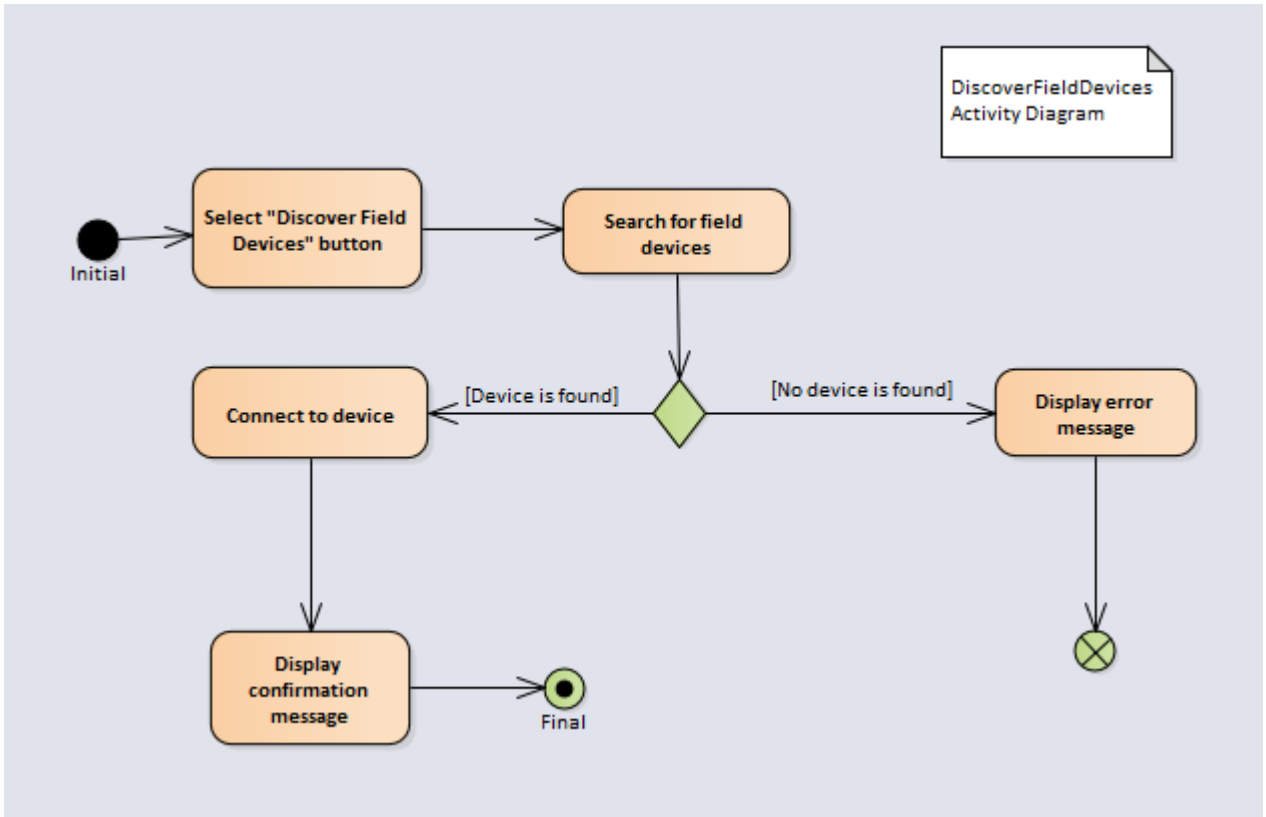

User
:EIS
:Database
DisplayMainPage( )
GetUserRole( )
LimitUserAccess
Sequence Diagram

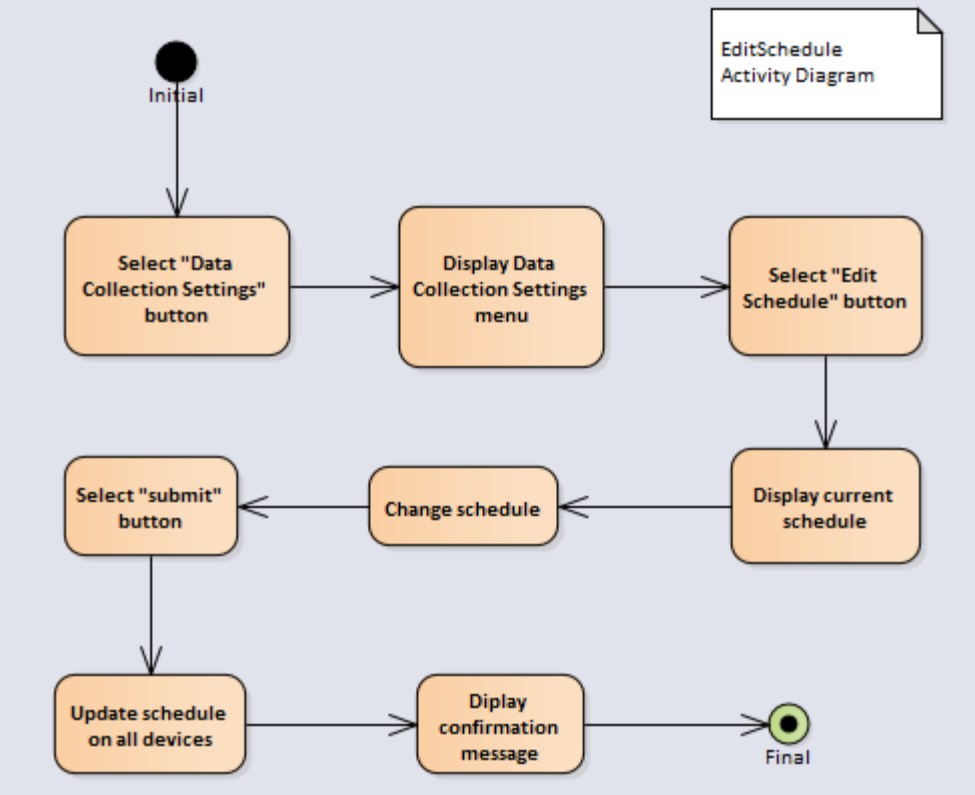
FDM:

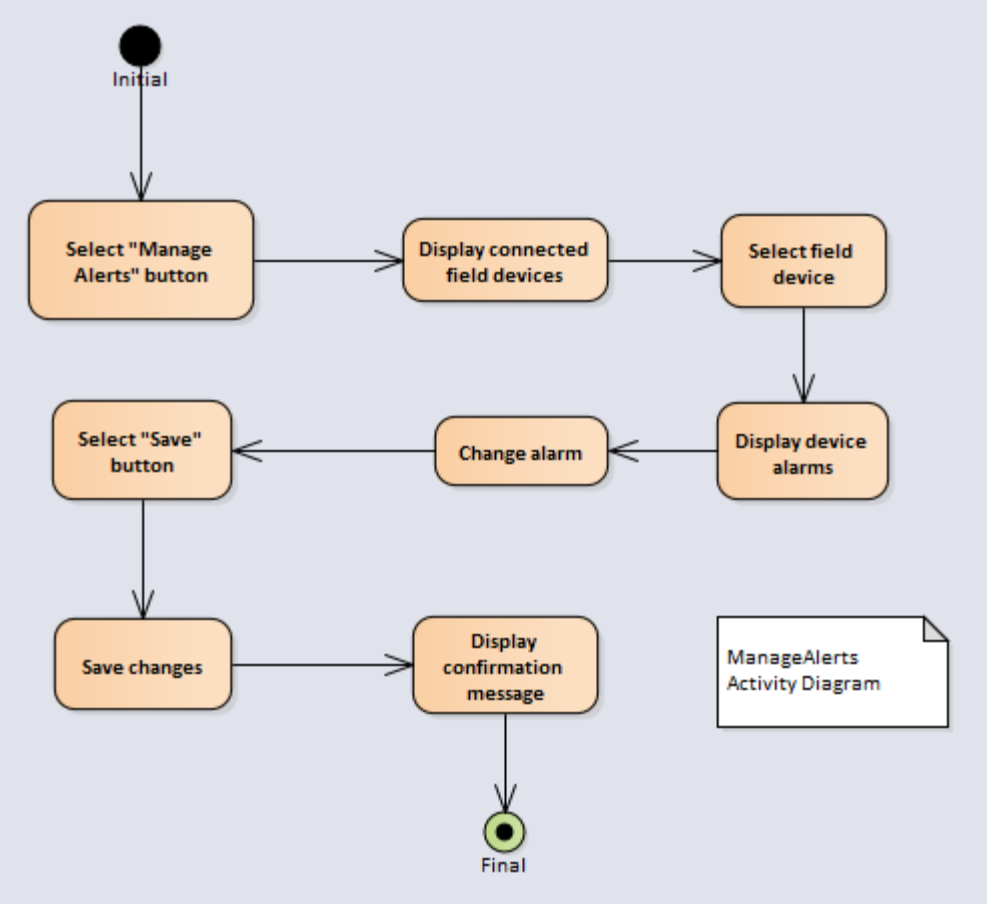

Administrator
:FieldDeviceManager
:FieldDevice
addFieldDevice( )
AddFieldDevice
Sequence Diagram
searchDevice( )
connectDevice( )
connectDevice( )

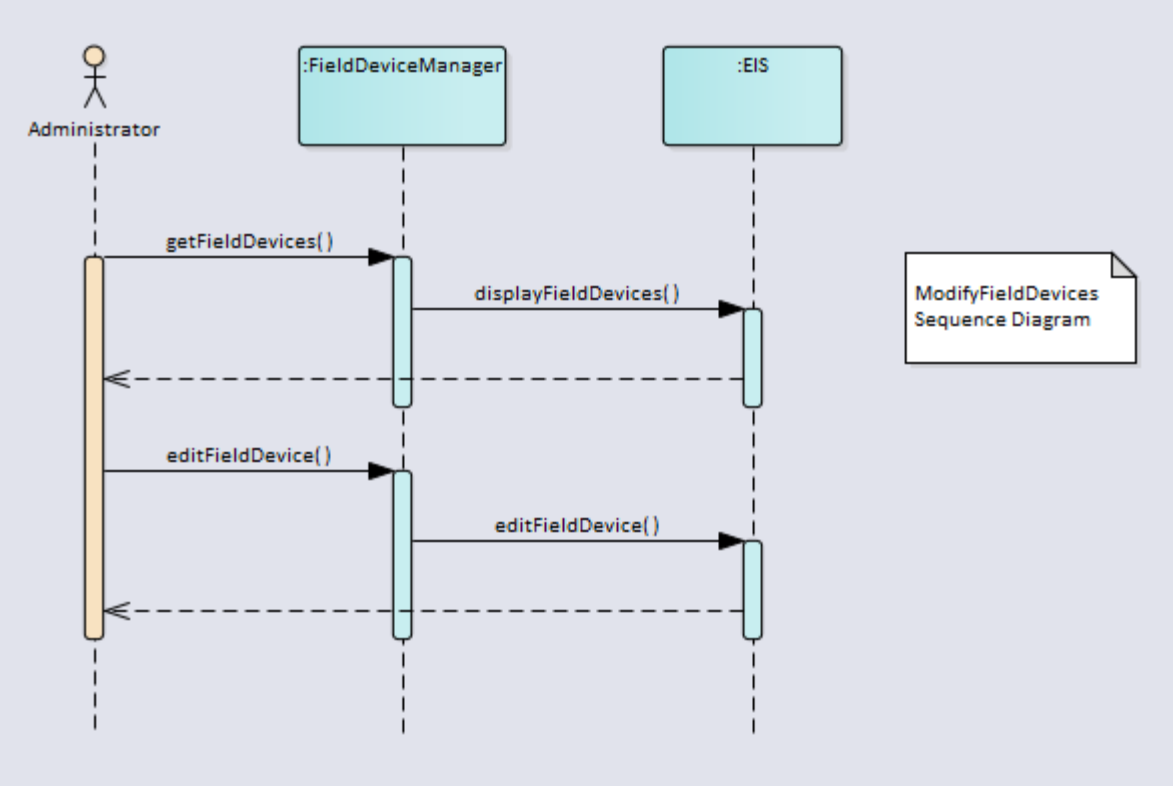

Administrator
:FieldDevicesManager
:FieldDevices
:EISDatabase
collectData()
collectData()
storeData()
CollectData
Sequence Diagram

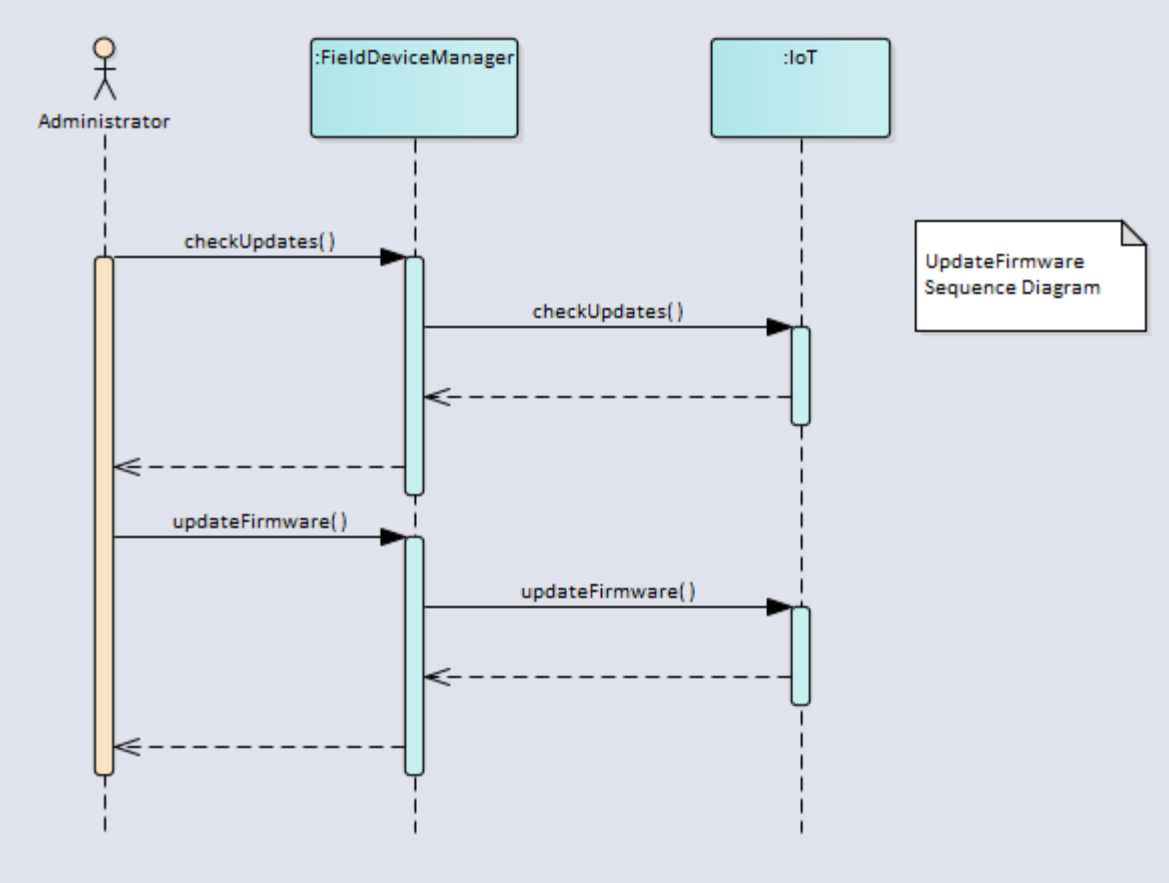

Initial
Select "Manage Field Devices" button
Display connected field devices
Select field device
Select "delete" button
Disconnect field device
Delete field device
Display confirmation message
Final
DeleteFieldDevice Activity Diagram


DiscoverFieldDevices Activity Diagram
Initial
Select "Discover Field Devices" button
Search for field devices
Connect to device
[Device is found]
[No device is found]
Display error message
Display confirmation message
Final

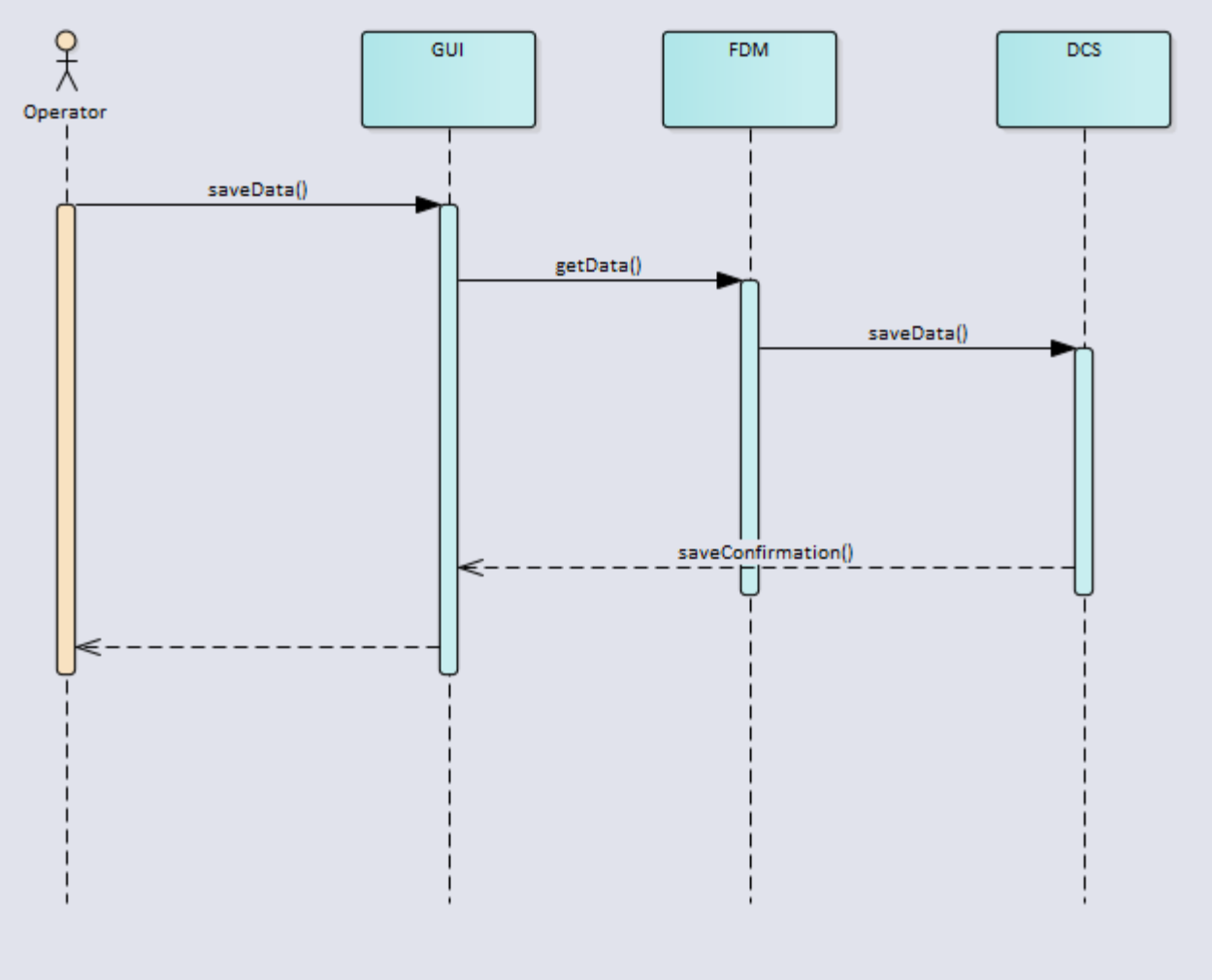

EditSchedule
Activity Diagram
Initial
Select "Data Collection Settings" button
Display Data Collection Settings menu
Select "Edit Schedule" button
Display current schedule
Change schedule
Select "submit" button
Update schedule on all devices
Diplay confirmation message
Final

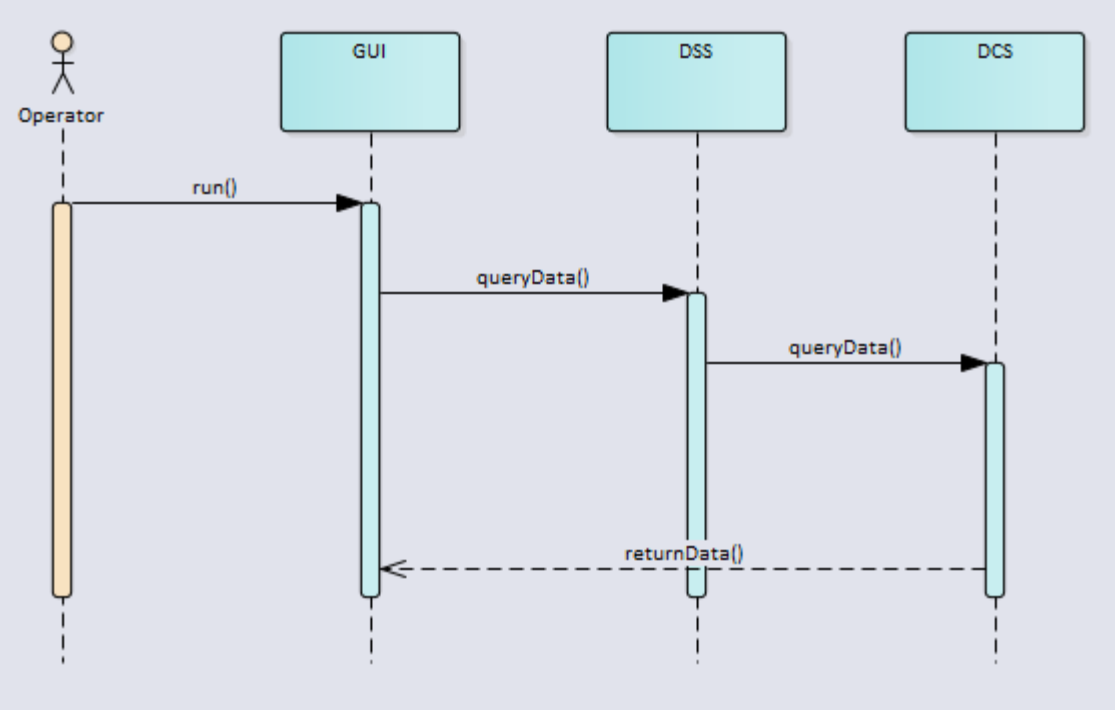

Initial
Select "Manage Alerts" button
Display connected field devices
Select field device
Display device alarms
Change alarm
Select "Save" button
Save changes
Display confirmation message
Final
ManageAlerts
Activity Diagram

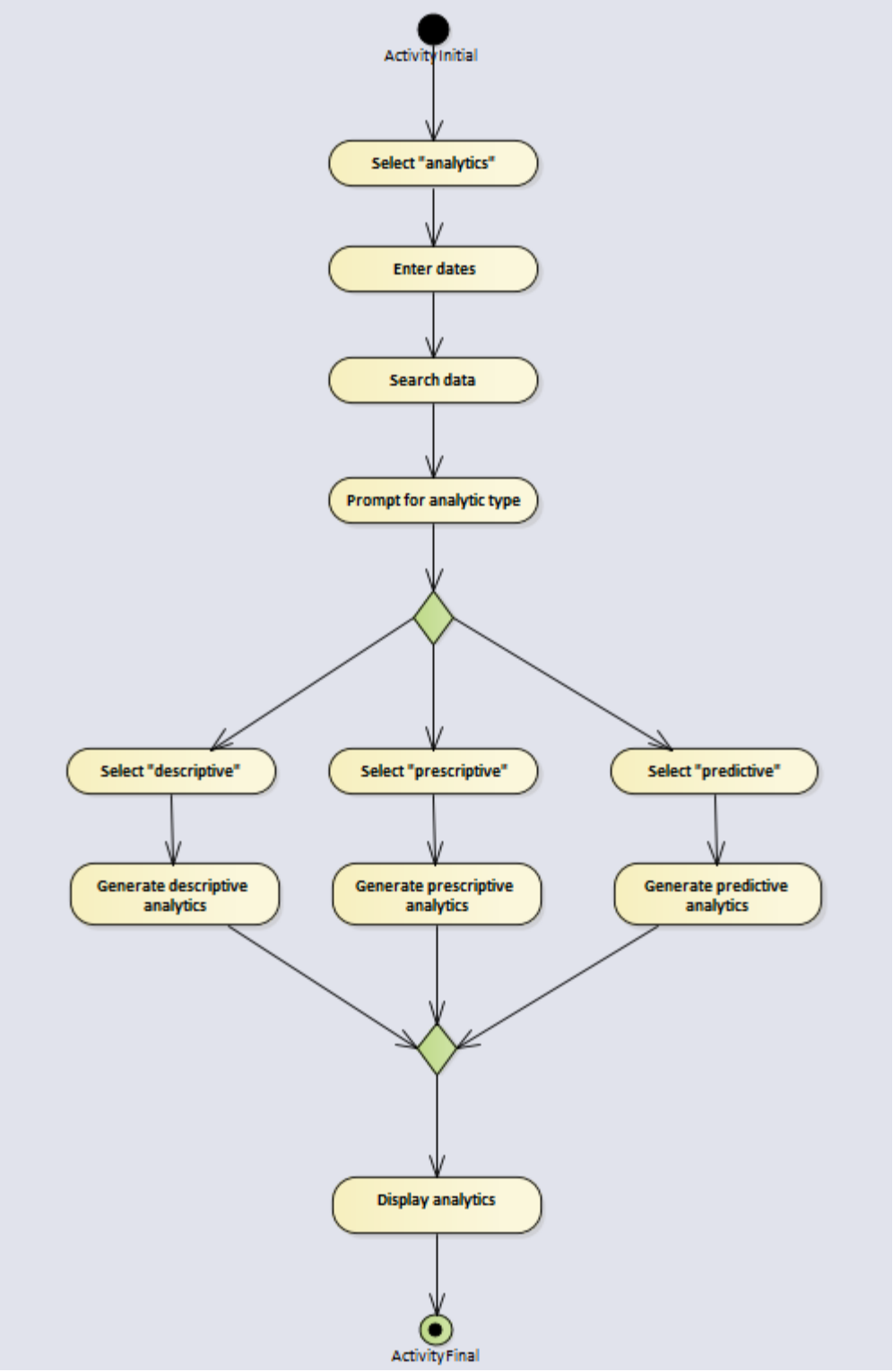

Administrator
:FieldDeviceManager
:EIS
getFieldDevices( )
displayFieldDevices( )
editFieldDevice( )
editFieldDevice( )
ModifyFieldDevices
Sequence Diagram

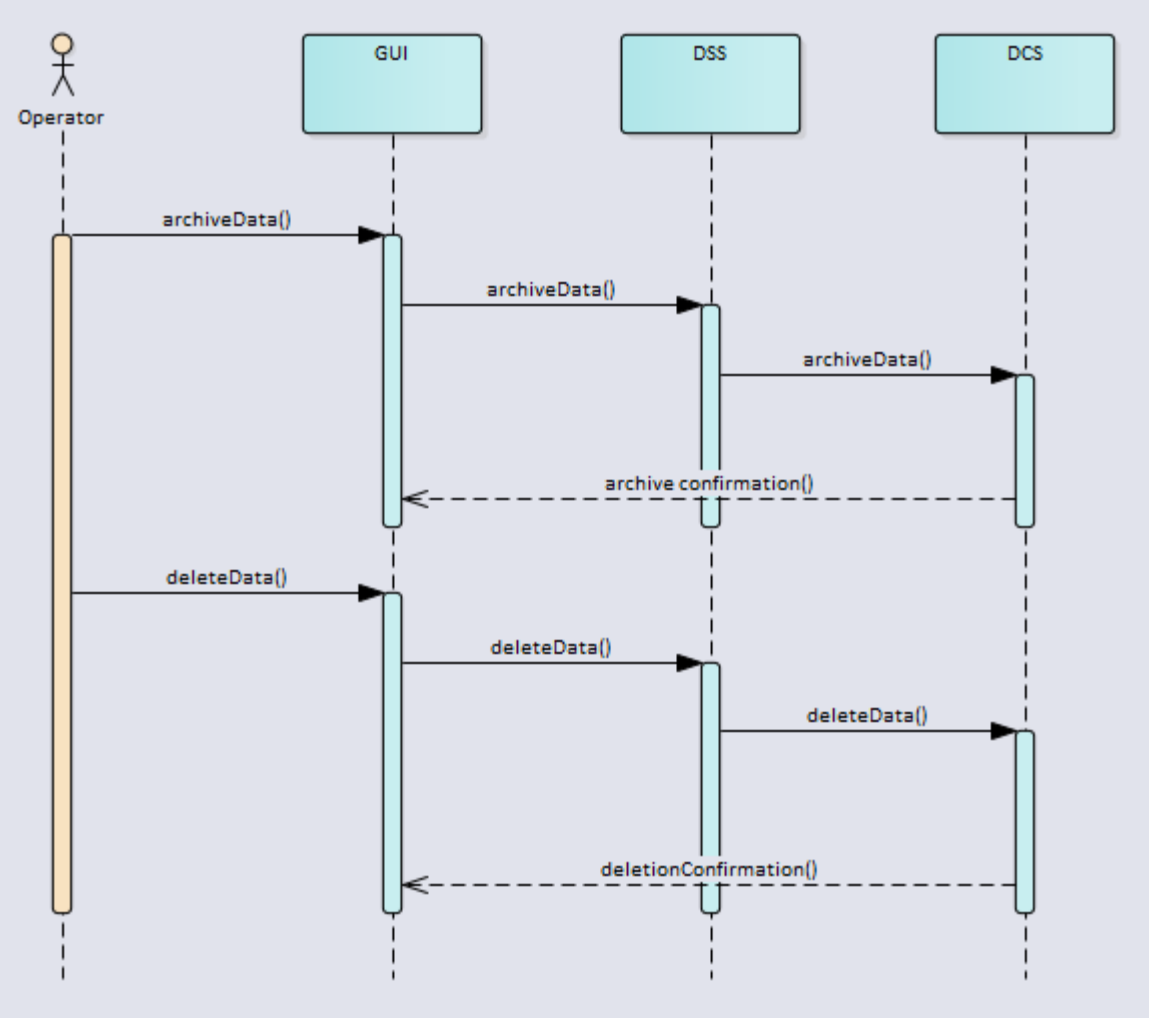

Administrator
:FieldDeviceManager
:IoT
checkUpdates()
checkUpdates()
updateFirmware()
updateFirmware()
UpdateFirmware
Sequence Diagram

DCS:

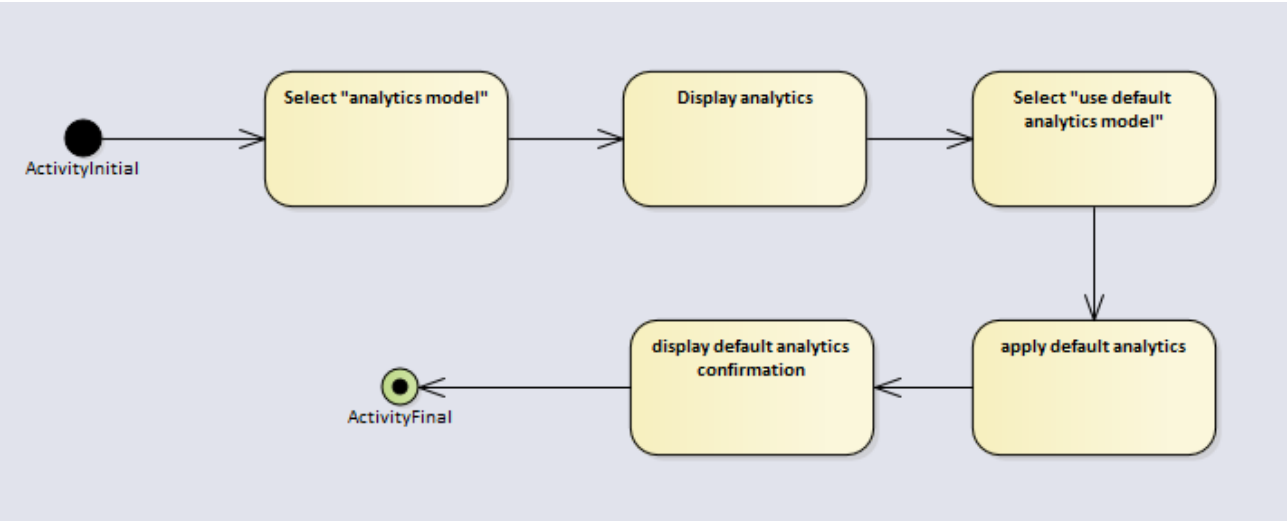

Operator
GUI
FDM
DCS
saveData()
getData()
saveData()
saveConfirmation()

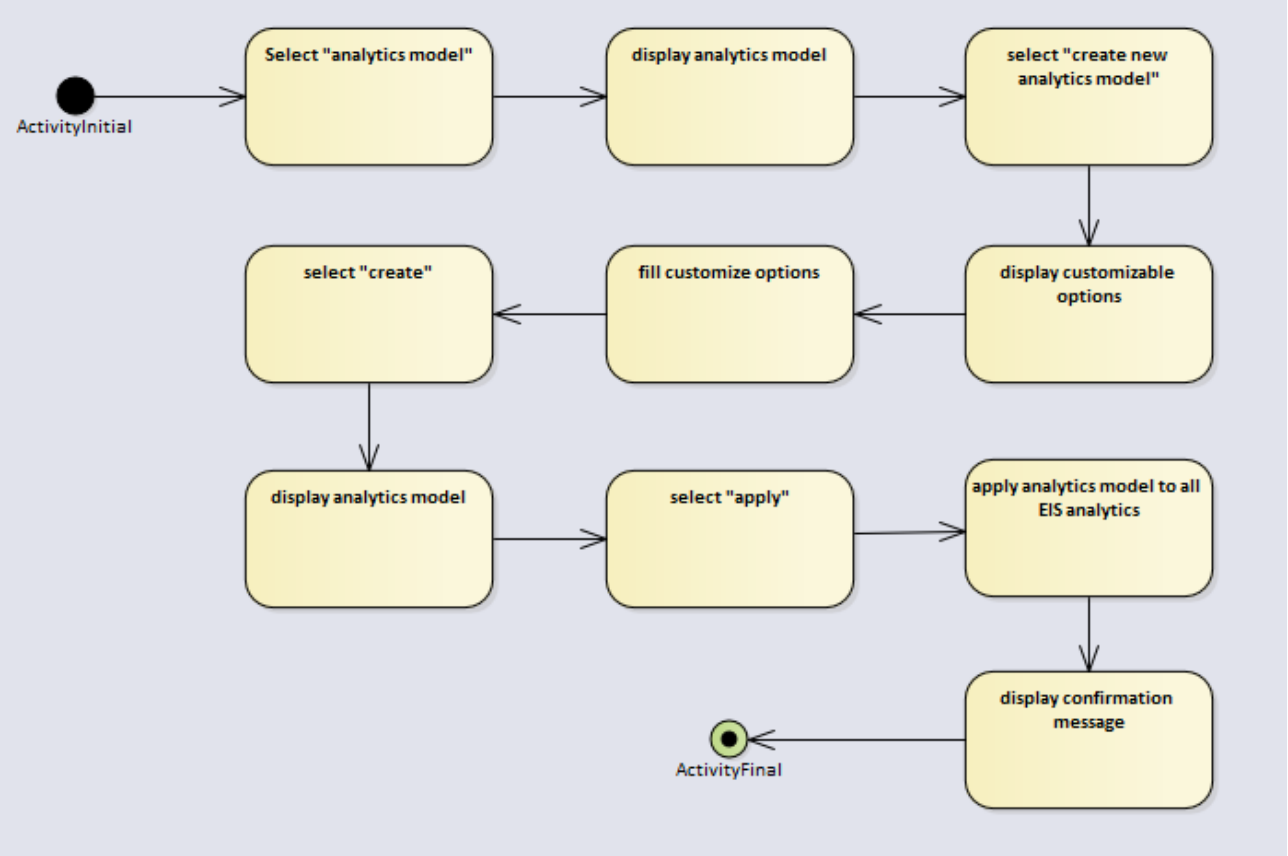

Operator
GUI
DSS
DCS
run()
queryData()
queryData()
returnData()

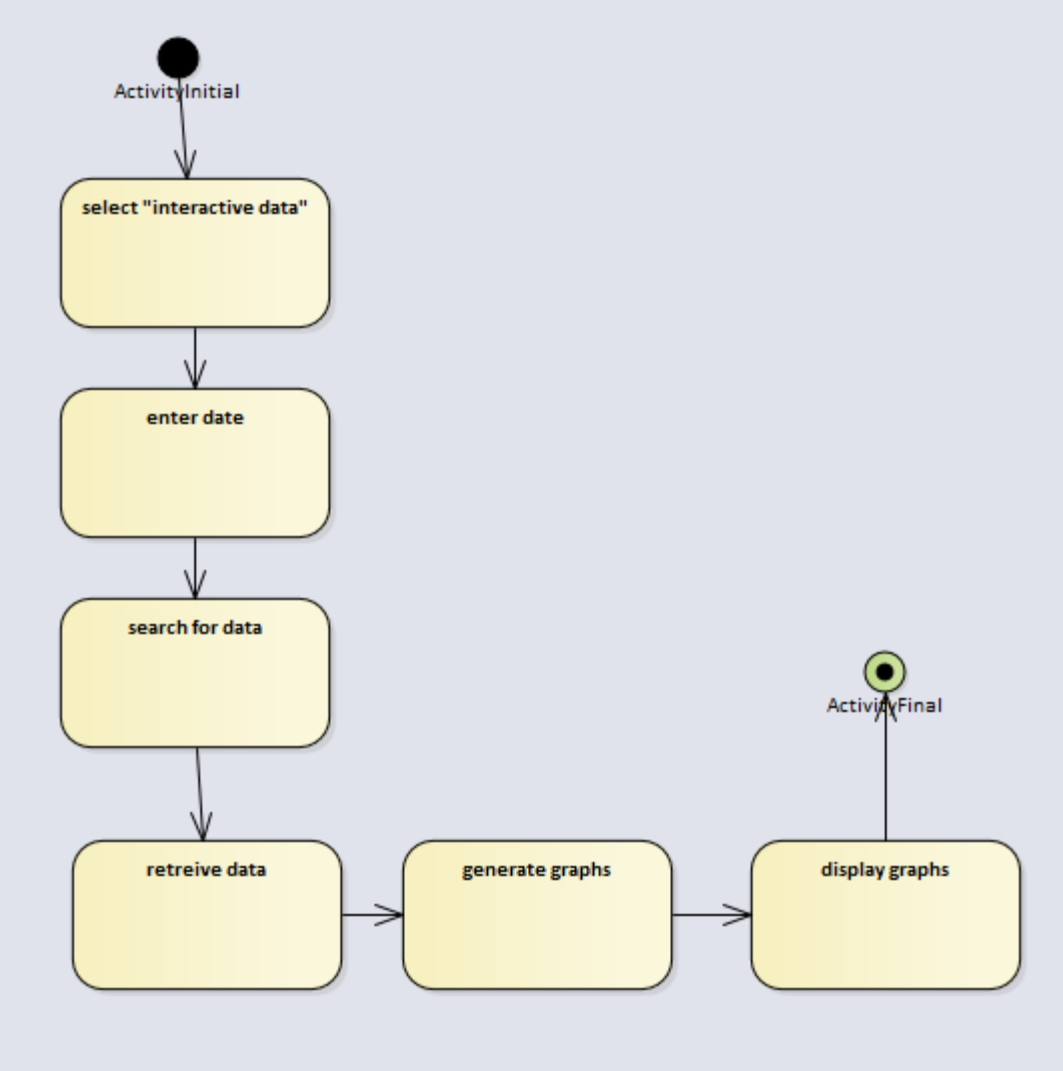

ActivityInitial
Select "analytics"
Enter dates
Search data
Prompt for analytic type
Select "descriptive"
Select "prescriptive"
Select "predictive"
Generate descriptive analytics
Generate prescriptive analytics
Generate predictive analytics
Display analytics
ActivityFinal

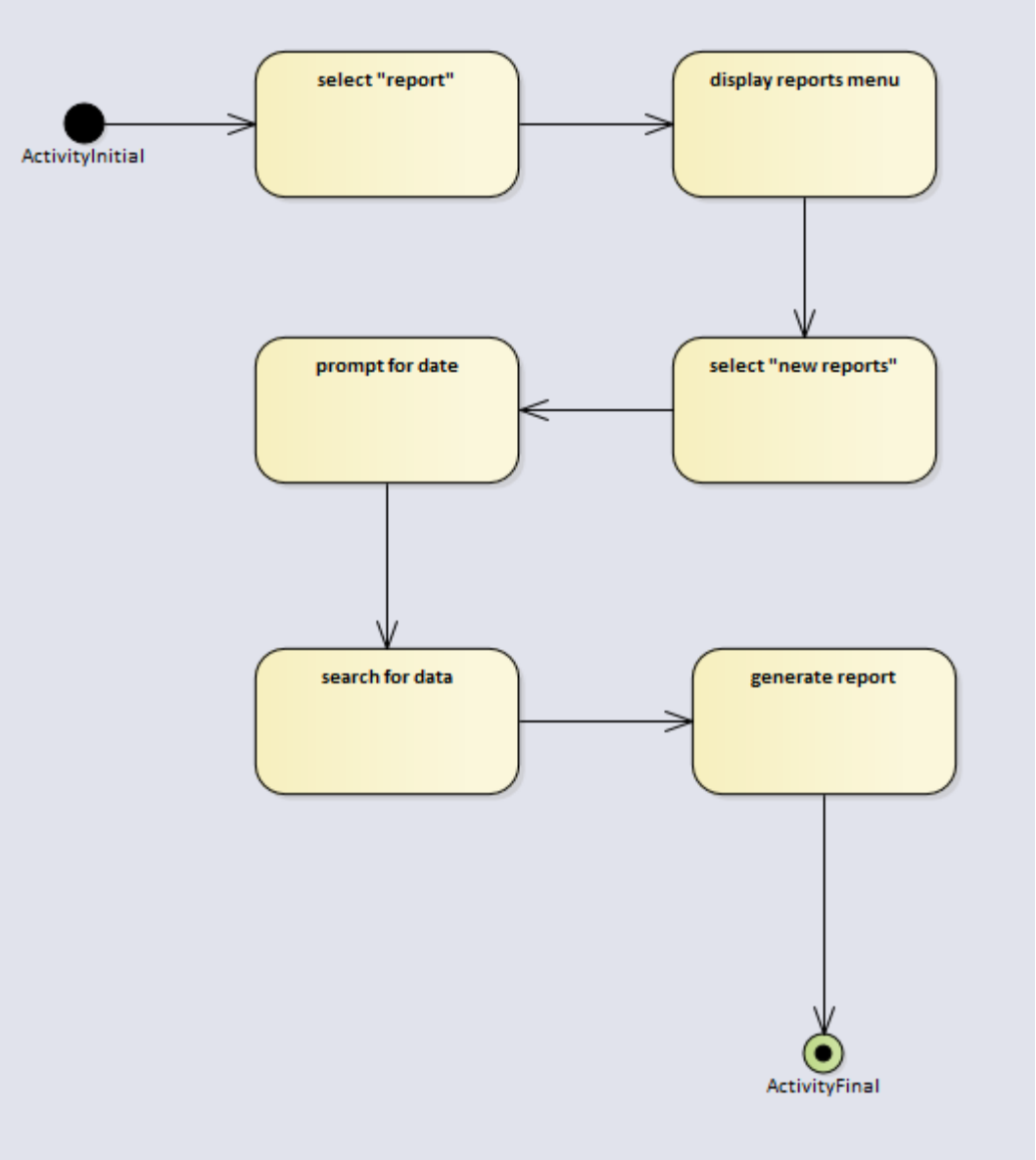

Operator
GUI
DSS
DCS
archiveData()
archiveData()
archiveData()
archive confirmation()
deleteData()
deleteData()
deleteData()
deletionConfirmation()

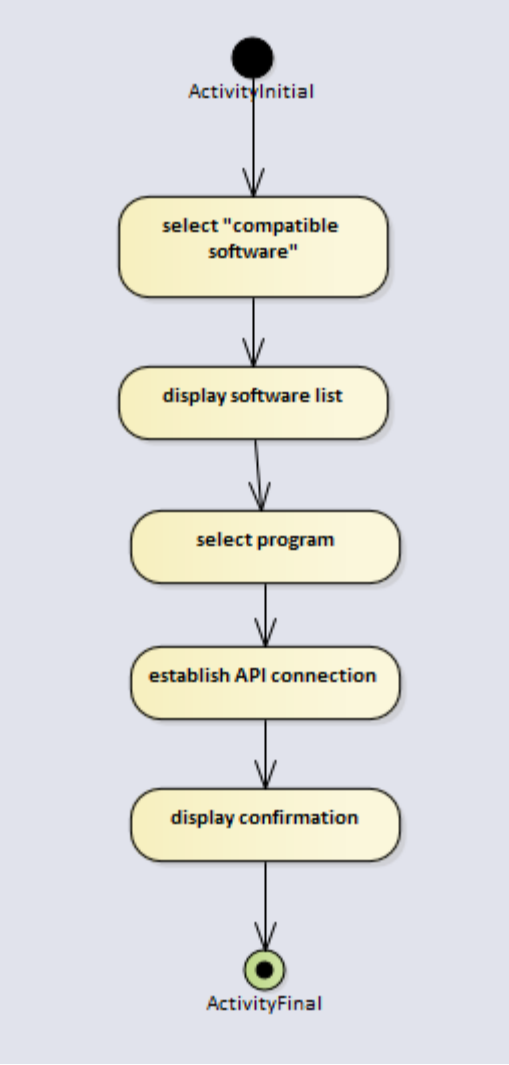
DSS:

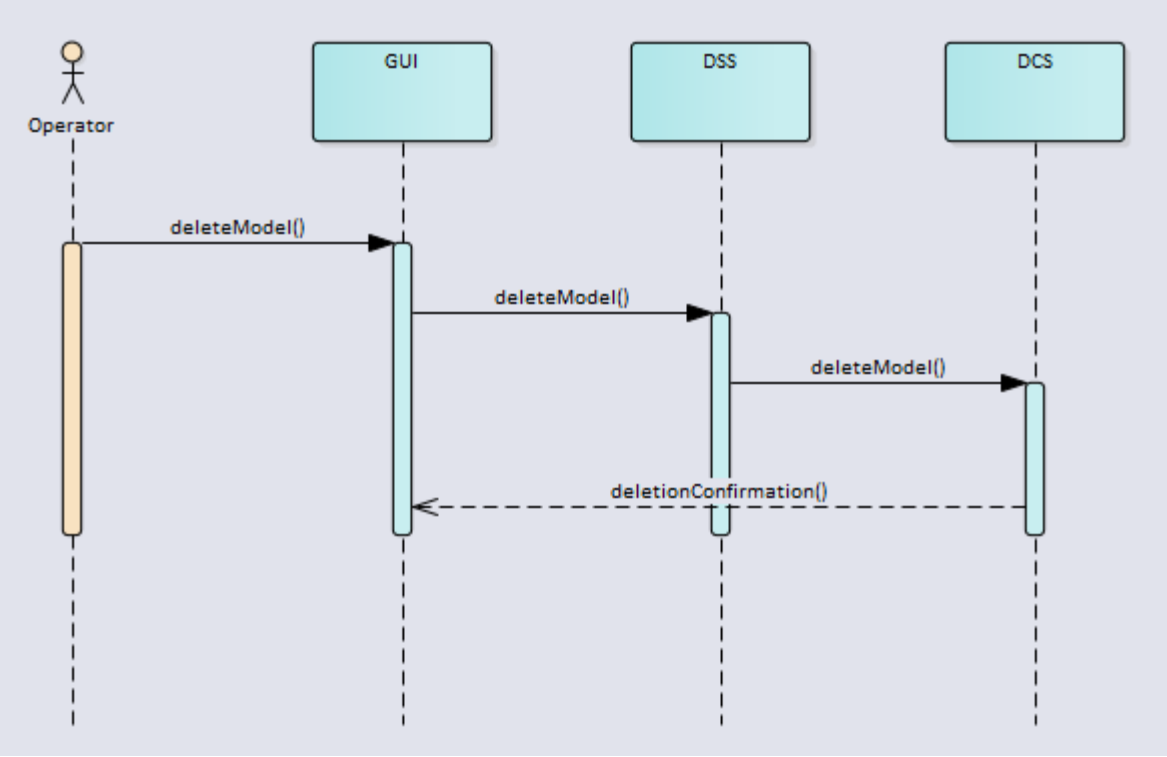

ActivityInitial
Select "analytics model"
Display analytics
Select "use default analytics model"
apply default analytics
display default analytics confirmation
ActivityFinal

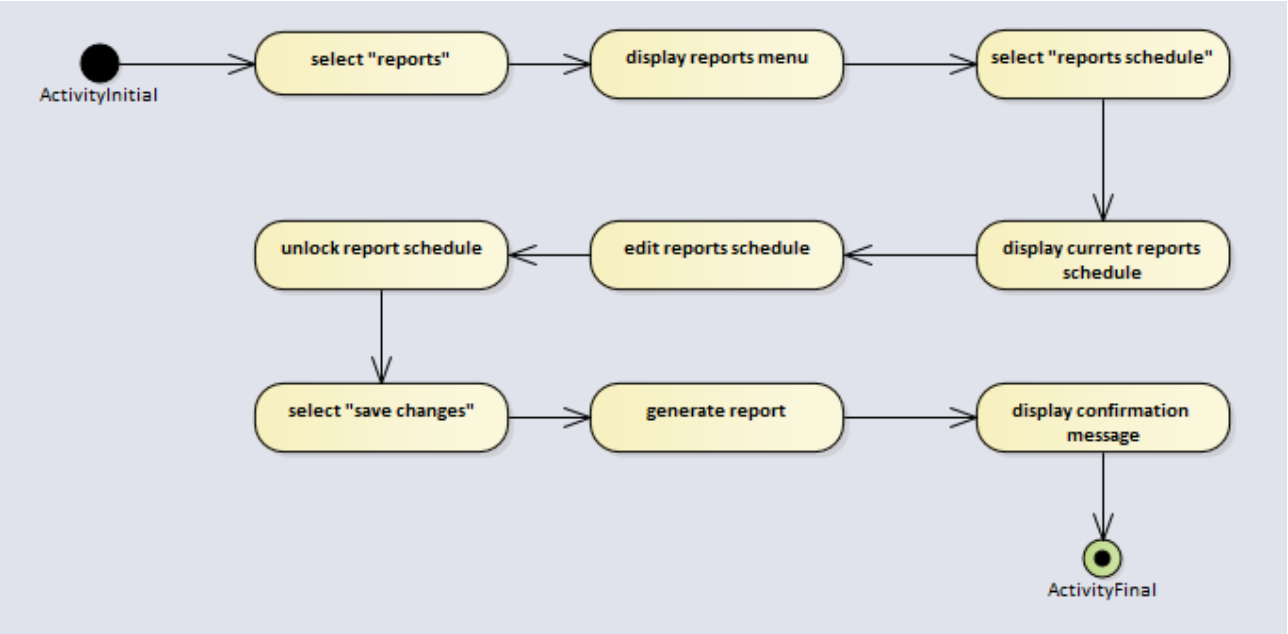

ActivityInitial
Select "analytics model"
display analytics model
select "create new analytics model"
display customizable options
fill customize options
select "create"
display analytics model
select "apply"
apply analytics model to all EIS analytics
display confirmation message
ActivityFinal


ActivityInitial
select "interactive data"
enter date
search for data
retreive data
generate graphs
display graphs
ActivityFinal


select "report"
display reports menu
ActivityInitial
prompt for date
select "new reports"
search for data
generate report
ActivityFinal

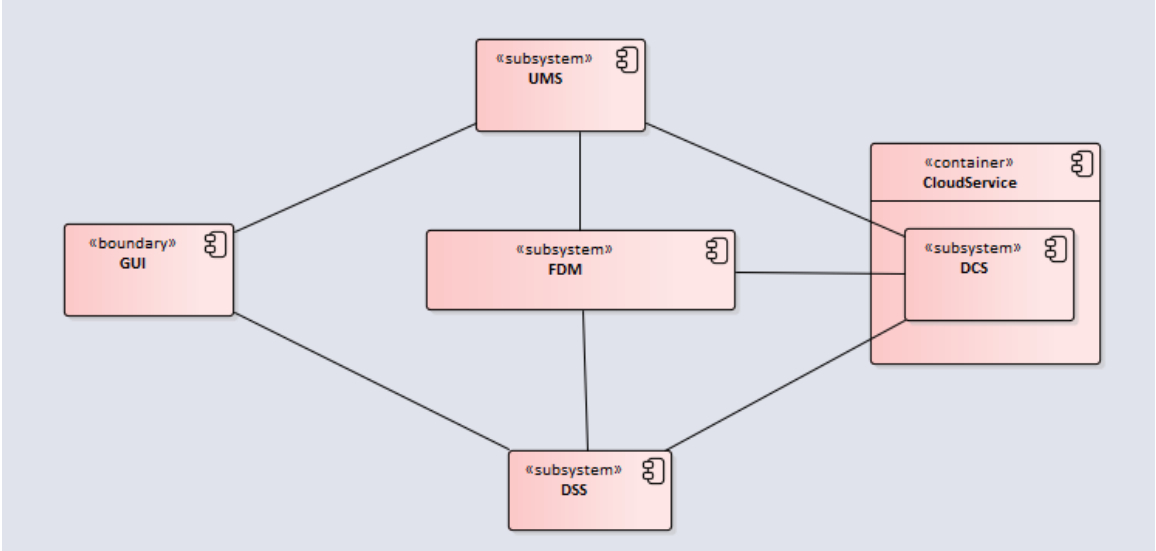

ActivityInitial
select "compatible software"
display software list
select program
establish API connection
display confirmation
ActivityFinal

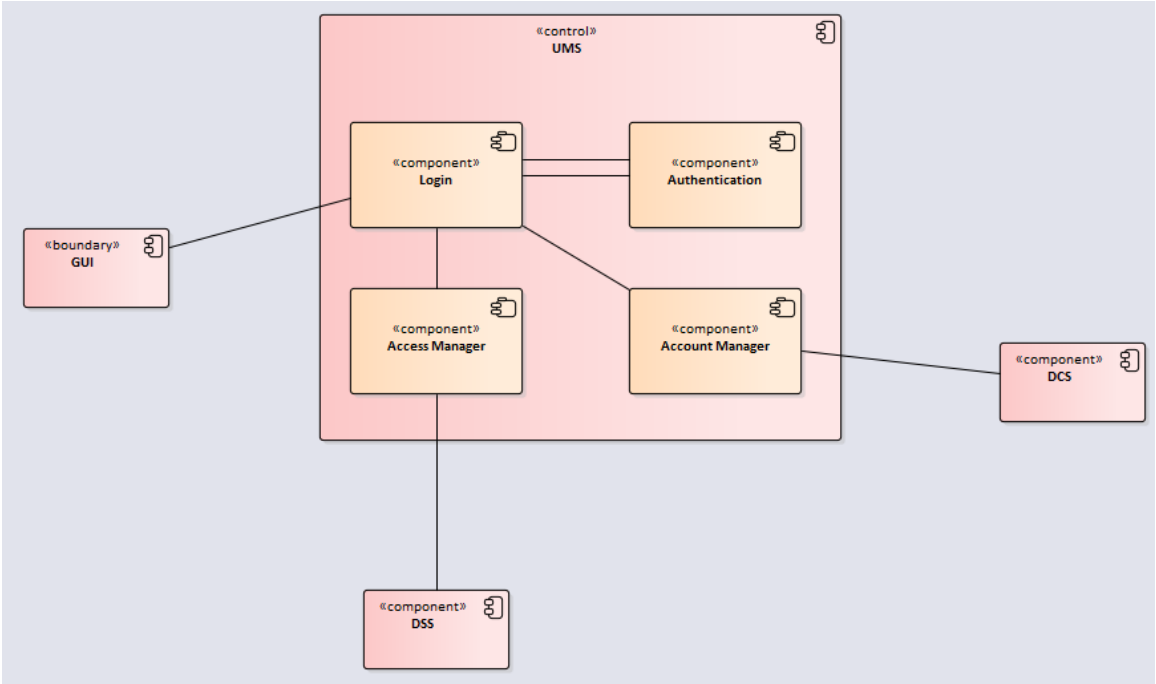

Operator
GUI
DSS
DCS
deleteModel()
deleteModel()
deleteModel()
deletionConfirmation()

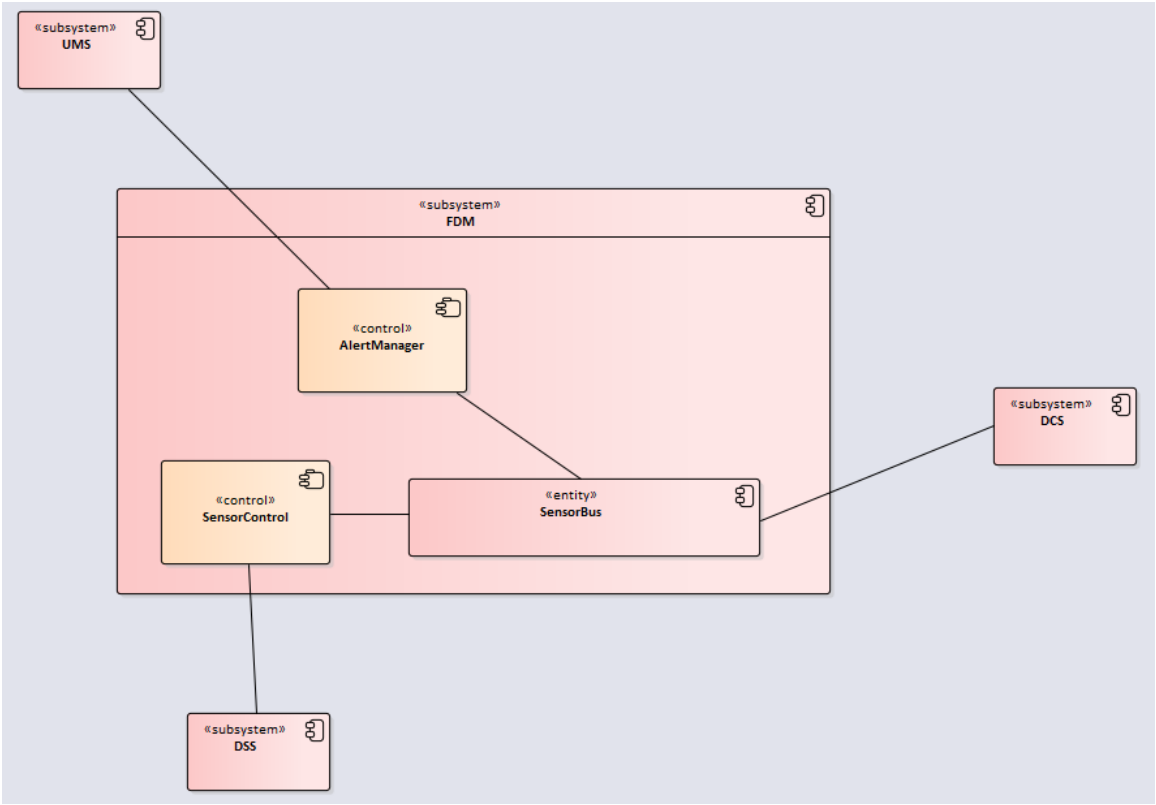

ActivityInitial
select "reports"
display reports menu
select "reports schedule"
display current reports schedule
edit reports schedule
unlock report schedule
select "save changes"
generate report
display confirmation message
ActivityFinal

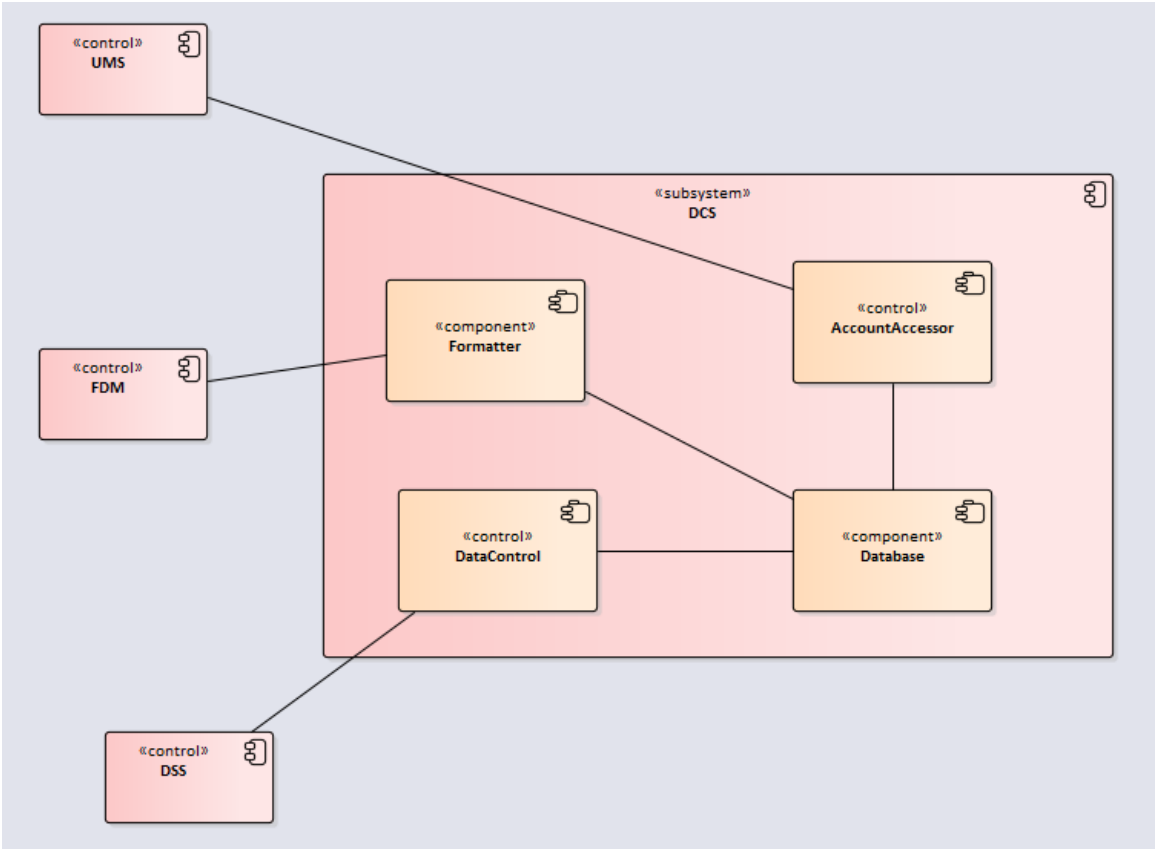
6. Design

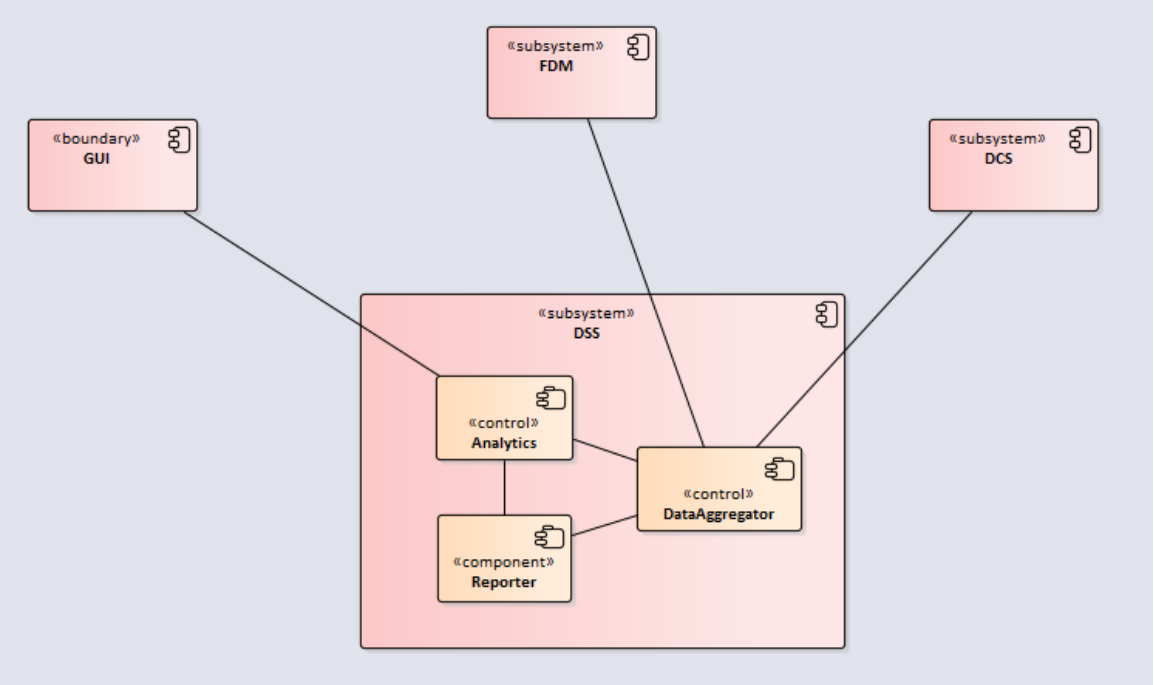
Component Diagrams





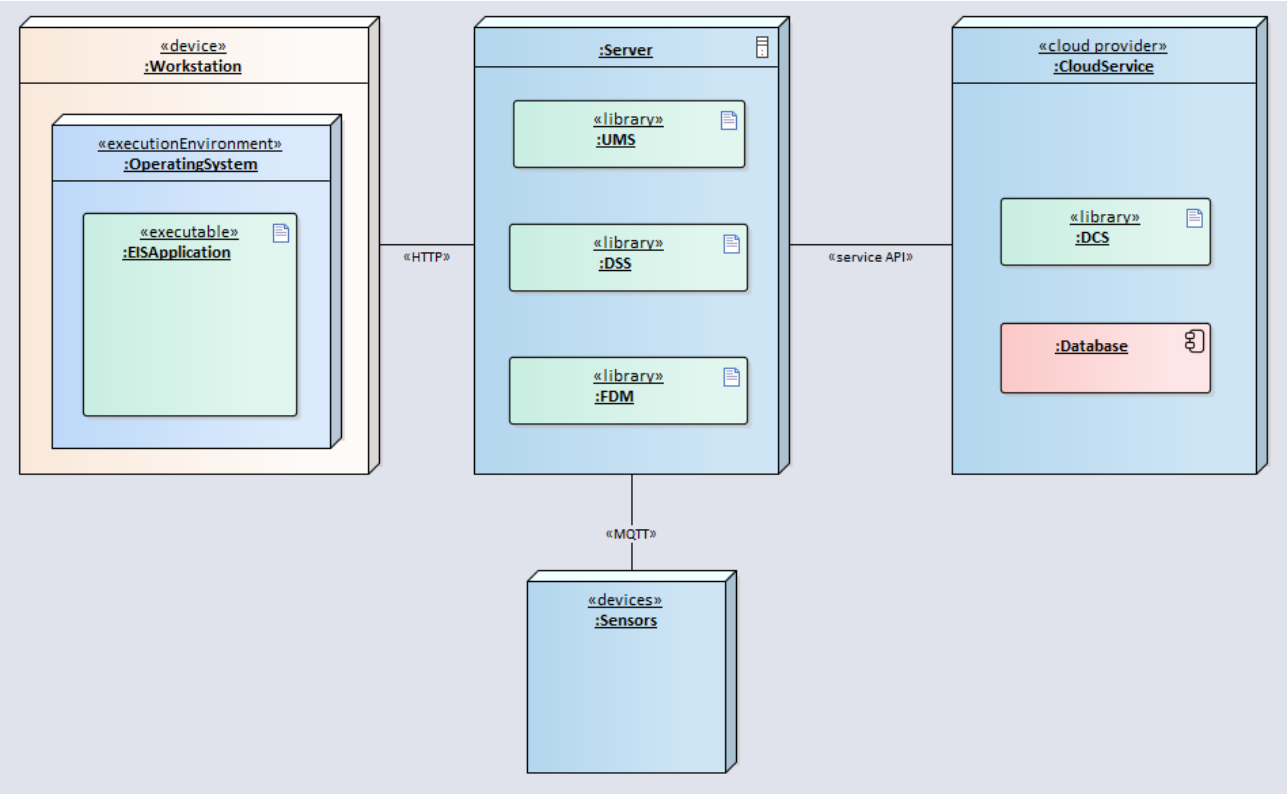

«subsystem»
UMS
«subsystem»
FDM
«control»
AlertManager
«subsystem»
DCS
«control»
SensorControl
«entity»
SensorBus
«subsystem»
DSS


«control»
UMS
«subsystem»
DCS
«component»
Formatter
«control»
AccountAccessor
«control»
FDM
«control»
DataControl
«component»
Database
«control»
DSS


«subsystem»
FDM
«boundary»
GUI
«subsystem»
DCS
«subsystem»
DSS
«control»
Analytics
«control»
DataAggregator
«component»
Reporter

7. Implementation

Deployment Model



Appendix A: Glossary

- Admin: Administrator.
- DCS: Data Collection System.
- DSS: Decision Support System.
- EIS: Environmental Information System.
- FDM: Field Device Management System.
- GUI: Guest User Interface.
- IoT: Internet of Things.
- SQL: Structured Query Language.
- UMS: User Management System.

Appendix B: Requirements and Use Case Traceability Matrix

Requirement ID	Requirement Statement	Use Case
4.1.1a	The system shall allow administrators to add, modify, or delete user accounts.	AddUserAccount, ModifyUserAccount, DeleteUserAccount.
4.1.1b	The system shall enforce strong password policies for user accounts.	EnforcePasswordPolicy
4.1.1c	The system shall provide a password reset mechanism for users.	ResetPassword
4.1.1d	The system shall log all user login attempts, including date, time, and IP address.	TrackLoginAttempts
4.1.1e	The system shall enforce role-based access control to limit user access to specific system features.	LimitUserAccess
4.1.2a	The system shall allow administrators to add, modify, or delete field devices.	AddFieldDevice, ModifyFieldDevice, DeleteFieldDevice
4.1.2b	The system shall automatically discover and add new field devices to the system.	DiscoverFieldDevices
4.1.2c	The system shall provide a mechanism for updating the firmware of field devices.	UpdateFirmware
4.1.2d	The system shall collect data from field devices at regular intervals based on user-defined schedules.	CollectData
4.1.2e	The system shall provide a mechanism for managing alerts related to field devices, such as low battery or connection failures.	ManageAlerts

4.1.2f	The system shall allow the user to define and edit the data collection schedule.	EditSchedule, SetSchedule
4.1.2g	The system shall allow the user to collect data on demand.	CollectData
4.1.3a	The system shall store data collected from field devices in a secure and scalable database.	StoreData
4.1.3b	The system shall allow users to query and retrieve historical data based on time range, device type, or other criteria.	QueryData
4.1.3c	The system shall provide a mechanism for real-time data streaming to support real-time analytics and visualization.	ProvideAnalytics
4.1.3d	The system shall automatically archive and delete data based on user-defined retention policies.	ArchiveData, DeleteData
4.1.4a	The system shall provide pre-built analytics models for data analysis, such as anomaly detection, trend analysis, and forecasting.	ProvideAnalyticsModel
4.1.4b	The system shall allow users to create custom analytics models using machine learning algorithms or other techniques.	CreateAnalyticsModel
4.1.4c	The system shall provide interactive data visualization capabilities to support data exploration and discovery.	ProvideInteractiveData
4.1.4d	The system shall allow users to create and schedule automated reports and alerts based on analytics results.	CreateReport, CreateAlert, ScheduleReport

4.1.4e	The system shall provide a mechanism for integrating with external data sources or third-party analytics tools.	IntegrateExternalSources
4.1.4f	The system shall allow users to modify and delete custom analytics models created by the user.	EditAnalyticsModel, DeleteAnalyticsModel
4.1.4g	The system shall allow users to modify the schedule for automated reports and alerts.	ModifyReportSchedule, ModifyAlert, DeleteAlert