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**Sri Lanka Institute of Information Technology**

**Power Grid Maintenance System – ElectroGrid**

**Project Report**

**Programming Applications and Frameworks – IT3030**

**Group ID – 146**

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**Submitted To:** Mr. Nalaka Dissanayake

**2022.04.24**

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[IT20237554 – Rathnaweera R.P.W.G 56](#_Toc101740502)

[IT20155520 - Amanullath M.U 59](#_Toc101740503)

# **Members details**

|  |  |  |
| --- | --- | --- |
| Member Name | IT Number | Contribution |
| Jayasooriya C. A | IT20250942 | Breakdown Information Service   * Add breakdown. * Read all breakdowns. * Read a sector’s breakdowns. * Update breakdown. * Delete breakdown.   Payment Management Service   * Insert payment. |
| Gavindya N.A.C | IT20409982 | User Management Service   * Add a user. * Read all users. * Update user. * Delete user.   Payment Management Service   * Delete payment. |
| Bandara T.M.Y.M | IT20492052 | Bill Management Service   * Add a bill. * Read all bills. * Update bill. * Delete bill.   Payment Management Service   * Update payment. |
| Rathnaweera R.P.W.G | IT20237554 | Inquiry Support Service   * Add an inquiry. * Read all inquiries. * Update inquiry. * Delete inquiry.   Payment Management Service   * Read all payments. |
| Amanullath M. U | IT20155520 | Power Consumption Service   * Add a reading. * Read all reading history. * Update reading. * Delete reading.   Payment Management Service   * Calculate due amount. |

# **Git Repository Details**

## Clickable Link to the Remote Repository

The following is the clickable link which prompts the remote GitHub repository that was created to maintain the collaborative work environment throughout the project’s duration.

<https://github.com/aseljayasooriya/ElectroGrid_PAF.git>

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Table

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# **Software Engineering Methodology**

AGILE methodology [1] is used in this project to achieve efficient software development. AGILE methodology is a practice that promotes continuous iteration of development and testing throughout the software development lifecycle of the project.

Both development and testing activities are concurrent unlike the Waterfall model.

First, Requirement gathering, and analysis is done. An agile software development process always starts by defining the users and documenting a vision statement on a scope of problems, opportunities, and values to be addressed.

Four major principles [2] for agile project are:

1. Individuals and interactions over processes and tools.
2. Working software over comprehensive documentation.
3. Customer collaboration over contract negotiation.
4. Responding to change over following a plan.

The typical iteration process flow of the AGILE methodology can be visualized as follows,

* Requirements – Define the requirements for the iteration based on the product backlog, sprint backlog, customer, and stakeholder feedback
* Development – Design and develop software based on defined requirements
* Testing – QA (Quality Assurance) testing, internal and external training, documentation development
* Delivery – Integrate and deliver the working iteration into production
* Feedback – Accept customer and stakeholder feedback and work it into the requirements of the next iteration

Using the AGILE methodology, helped the development of the system in the following ways:

1. Provided a disciplined project management process.
2. Centered around iterative development and testing throughout the development lifecycle.
3. Requirements and solutions evolve through collaboration between various teams
4. Allows for rapid development of high-quality software
5. Can find errors quickly resulting in decreased risk
6. It can respond to changes more quickly which makes it more flexible than other traditional approaches
7. Requires less planning and provides ability for more incremental changes

When considering the development of the system, restful architecture is used to design the overall architecture. REST web service is used for interaction among micro services and the MVC architecture is used to implement each of the micro services.

# **Time schedule (Gantt chart)**

**Chart, bar chart, waterfall chart

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# **Requirements Analysis**

## Stakeholder Analysis

Diagram

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## Functional Requirements

This defines the requirements which specifies what a system should do. It is the behavior of the system when different conditions are met [3]. Functional requirements are the functions that the Electro Grid system should perform. The following are the functional requirements that could be identified via thorough inter team discussions and research.

Registering a new user

* System admin can register a new user to the system. A user can be meter owner and meter reader

Breakdown management

* When a user experiences a technical failure, electricity breakdowns, he/she can inform the breakdown manager via a form.

Bill management

* Usage of a consumers electricity consumptions are detected by the meter reader and the bill of the customer is prepared accordingly.

Payment management

* A meter owner can pay the bill related to their consumptions as the bill manager has finalized.

Support and Inquiry management

* When there are complaints and feedbacks for the consumers, they can use the form and address the admin for clarifications.

Power Consumption management

* The system should have the ability to read the power consumption of the users.

## Non-functional Requirements

These are the requirements that are not directly concerned with specific functionality. These are also known as Quality attributes [4]. These requirements are more critical to a system than the functional requirements because without these requirements the system would be unusable.

Performance:

* in the web application performance must be considered heavily since both customers and the system administrators are using this web application to make their task easier so the application must be loaded to the users within a minimum time.
* Web application should support the main available web browsers that commonly used by the users
* There are more than 1000s of record since that when accessing data in the database it should be done with a minimum time.

Security:

* Security is one of the utmost importance in the application as a lot of data and personal information are handle via the application. All the necessary security measures are taken within the application, as it contains payments information, personal contact information.
* To ensure the security adding new users and updating or deleting existing users can be done only using the administrators end.

Availability:

* As this a web application runs via the online platform the application will be used by the users at any time throughout the day. Therefore, the application should be available to accessible at any time. (24\*7)

Safety:

* If a system failure occurs on any time the database of this web application should be backup immediately. Since many useful data are used in this application.

Maintainability:

* The application has been designed and implemented in a very functional and practical manner, where the maintenance of the application needs minimum effort. Proper coding standards and practices have enabled this feature.

Reliability:

* Reliability is very important aspect in a web application since web application must have the ability to perform the provided functions and tasks from the customers’ side and the system administrators’ side with a minimum failure rate.

## Technical Requirements [5]

Browser capability:

* This system should use a web browser like google chrome, Mozilla Firefox, opera, brave to access world wide web. but some older version web browsers like Microsoft edge might not support well for this web application.

Mobile responsive design:

* a website will be responsive if the layout of the web application adjusts to the screen of the viewers who visit this web application. We had developed this to display well across all the devices like mobile, tablet, laptop, and PC.

Operating Systems:

* Since many users are using this web application, we had developed this to support main operating system like Windows, Linux and MACOS. which most of the users use these days.

## Use Case Diagram (Requirements Modelling)

Diagram, schematic

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# **System’s overall design**

## System’s Overall Architecture

Diagram

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The RESTful architecture is used in the development of this project. A RESTful API, which is also referred to a RESTful web service [6] or REST API is based on Representational State Transfer (REST).

This architectural style and approach are commonly used for communications often used in web services development; This style allows systems to request access and manipulate web resources by using a uniform and predefined set of rules, hence it was chosen for this project with a common agreement among the team. [7]

This system basically consists of client who requests for the resources and server who consist of the requested resources and responds to those requests. In addition to accommodating direct requests, gateways can be used to invoke multiple back-end services and aggregate the results. Like almost all software, an API needs to reflect the needs of the humans who interact with it. An API is somewhat different from a GUI or other user interface because it interacts with the end user [8]. This API merely expose database functions CRUD operations of Create, Read, Update, delete by those services.

## Overall Database Design – Entity Relationship Diagram

Diagram

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## Class Diagram

Diagram

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# **Individual sections**

## Jayasooriya C.A - IT20250942

API description of the Breakdown Information Service.

**POST** -

• Resource: Breakdowns

• Request: POST BreakdownInformationService/BreakdownService/Breakdowns

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: breakdownSector, breakdownDate, startTime, endTime, breakdownType.

• Response: String Status message “Inserted Successfully”

**GET** -

• Resource: Breakdowns

• Request: GET BreakdownInformationService/BreakdownService/Breakdowns

• Response: HTML table with breakdownSector, breakdownDate, startTime, endTime, breakdownType columns.

**GET** -

Resource: Breakdowns

• Request: GET BreakdownInformationService/BreakdownService/Breakdowns/{breakdownSector}

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: breakdownSector.

• Response: HTML table with breakdownSector, breakdownDate, startTime, endTime, breakdownType columns.

**PUT** -

• Resource: Breakdowns

• Request: PUT BreakdownInformationService/BreakdownService/Breakdowns

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: breakdownID, breakdownSector, breakdownDate, startTime, endTime, breakdownType.

• Response: String Status message “Updated successfully.”

**DELETE**

• Resource: Breakdowns

• Request: DELETE BreakdownInformationService/BreakdownService/Breakdowns

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: breakdownID.

• Response: String Status message “Deleted Successfully”

API description of the Breakdown Payment Service.

**POST** -

• Resource: Payments

• Request: POST PaymentManagementService/PaymentService/Payments

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: accountNo, paymentAmount, paymentMethod, cardNo, email.

• Response: String Status message “Inserted Successfully”

* Please refer the Individual Work Appendix section for:

1. Individual Class diagrams.
2. Individual Activity diagrams.
3. Use case Scenario.
4. Tools used, including justifications for their selection.

* Please refer the Testing methodology Appendix section for:

1. Testing methodology and results

## Gavindya N.A.C - IT20409982

API description of the User Management Service.

**Post-**

* Resource: Users
* Request: POST UserManagementService/UserManagementService/Users
  + Media Type: Form Data- Application\_FORM\_URLENCODED
  + Data: userID, userNIC, userName, userAddress, userType, userSector
* Response: String Status message “Inserted Successfully”

**Get –**

* Resource: Users
* Request: Get UserManagementService/UserManagementService/Users
  + Data: userID, userNIC, userName, userAddress, userType, userSector
* Response: HTML table with userNIC, userName, userAddress, userType, userSector columns

**PUT-**

* Resource: Users
* Request: PUT UserManagementService/UserManagementService/Users
  + Media Type: Application\_JSON
  + Data: userID, userNIC, userName, userAddress, userType, userSector
* Response: String Status message “Updated Successfully”

**DELETE-**

* Resource: Users
* Request: DELETE UserManagementService/UserManagementService/Users
  + Media Type: Application\_XML
  + Data: userID
* Response: String Status message “Deleted Successfully”

API description of the Payment Service.

**POST** -

* Resource: Payments
* Request: DELETE PaymentManagementService/PaymentService/Payments
  + Media Type: Form Data- Application\_FORM\_URLENCODED
  + Data: paymentID
* Response: String Status message “Deleted Successfully”
* Please refer the Individual Work Appendix section for:

1. Individual Class diagrams.

2. Individual Activity diagrams.

3. Use case Scenario.

4. Tools used, including justifications for their selection.

* Please refer the Testing methodology Appendix section for:

1. Testing methodology and results

## Bandara T.M.Y.M - IT20492052

API description of the Bill management service.

**POST** -

• Resource: Bills

• Request: POST BillService/BillService/Bills

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: billCode, accountNo, billmonth, units, meterReader\_name

• Response: String Status message “Inserted Successfully”

**GET** -

• Resource: Bills

• Request: BillService/BillService/Bills

• Response: HTML table with billCode, accountNo, billmonth, units, billAmount, meterReader\_name columns.

**PUT** -

• Resource: Bills

• Request: PUT BillService/BillService/Bills

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: billID, billCode, accountNo, billmonth, units, meterReader\_name

• Response: String Status message “Updated successfully.”

**DELETE**

• Resource: Bills

• Request: DELETE BillService/BillService/Bills

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: billID.

• Response: String Status message “Deleted Successfully”

API description of the Breakdown Payment Service.

**PUT** -

• Resource: Payments

• Request: POST PaymentManagementService/PaymentService/Payments

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: paymentID, accountNo, paymentAmount, paymentMethod, cardNo, email.

• Response: String Status message “Updated Successfully”

* Please refer the Individual Work Appendix section for:

1. Individual Class diagrams.

2. Individual Activity diagrams.

3. Use case Scenario.

4. Tools used, including justifications for their selection.

* Please refer the Testing methodology Appendix section for:

1. Testing methodology and results

## Rathnaweera R.P.W.G - IT20237554

API description of the Support Inquiry Service

**POST-**

* Resource: Inquiry
* Request: POST SupportInquiryService/InquiryService/Inquiry

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: inquiryTitle,inquiryDesc,contactNum

* Response: String Status message “inserted successfully”

**GET-**

* Resource: Inquiry
* Request: GET SupportInquiryService/InquiryService/Inquiry
* Response: HTML table with Inquiry Title, Inquiry Description, Contact Number columns.

**PUT-**

* Resource: Inquiry
* Request: PUT SupportInquiryService/InquiryService/Inquiry

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: inquiryID,inquiryTitle,inquiryDesc,contactNum

* Response: String Status message “Update Sucessfully”

**DELETE-**

* Resource: Inquiry
* Request: DELETE SupportInquiryService/InquiryService/Inquiry

Media Type: Form Data- Application\_FORM\_URLENCODED

Data: inquiryID

* Response: String Status message “Deleted Sucessfully”

API description of the Breakdown Payment Service

**GET-**

* Resource: Payment
* Request: GET PaymentManagementService/PaymentService/Payment
* Response: JSON array with Account Number, Payment Amount, Payment Method, Card Number, email columns.
* Please refer the Individual Work Appendix section for:

1. Individual Class diagrams.

2. Individual Activity diagrams.

3. Use case Scenario.

4. Tools used, including justifications for their selection.

* Please refer the Testing methodology Appendix section for:

1. Testing methodology and results

## Amanullath M.U - IT20155520

API description of the Power Consumption Information Service.

**POST** -

• Resource: MeterReadings

• Request: POST PowerConsumptionService/readings

Media Type: JSON- Application\_Json

Data: meterReaderId, accountNo, year, month, reading.

• Response: JSON object {

"data": {

// inserted data

},

"message": "Meter Reading added successfully",

"status": "success"

}

**GET** -

• Resource: MeterReadings

• Request: GET PowerConsumptionService/readings

• Response: JSON array of meterRaeading objects.

**GET** -

Resource: MeterReadings

• Request: GET PowerConsumptionService/readings/account/:accountNo?year={year}&month={month}

Data: account number, year, month.

• Response: Meter Reading object as JSON which matches parameters.

**PUT** -

• Resource: MeterReadings

• Request: PUT PowerConsumptionService/readings/account/1?year=2022&month=10

Media Type: JSON – Application\_Json

Data: reading.

• Response: JSON with Status “success” and message “Meter Reading Updated successfully.”

**DELETE**

• Resource: MeterReadings

•Request:

DELETE PowerConsumptionService/readings/account/:accountNo?year={year}&month={month}

Data: accountNo, year, month.

• Response: String Status message “Deleted Successfully”

API description of the Breakdown Payment Service.

**POST** -

• Resource: Payments

•Request:

POST PaymentManagementService/PaymentService/Payments/account/:accountNo/due?asOfDate={date}

Data: accountNo, asOfDate (the date which the due amount must be calculated.

• Response: Double calculated due amount as at the given date

* Please refer the Individual Work Appendix section for:

1. Individual Class diagrams.

2. Individual Activity diagrams.

3. Use case Scenario.

4. Tools used, including justifications for their selection.

* Please refer the Testing methodology Appendix section for:

1. Testing methodology and results

# **System’s Integration Details**

System integration [9] (SI) is an IT or engineering process, or phase concerned with joining different subsystems or components as one large system. It ensures that each integrated subsystem functions as required.

SI is also used to add value to a system through new functionalities provided by connecting functions of different systems.

Integrating a set of web services [6] using an API gateway can be considered as a successful way.

An API conducts the process of organizing the requests which are processed by the microservices architecture to create simplified experience to the client. It takes all API calls from clients, then routes them to the appropriate microservice with request routing, composition, and protocol translation. It is a translator taking a client's many requests and turning them into just one, to reduce the number of round trips between the client and the application. Typically, it handles a request by invoking multiple microservices and aggregating the results, to determine the best path.

For most microservices‑based applications, it makes sense to implement an API gateway [10], because it acts as a single-entry point into the system. The API gateway is responsible for request routing, composition, and protocol translation, and can streamline the system. With an API gateway, each of the application’s clients gets a custom API. The API gateway handles some requests by simply routing them to the appropriate backend service and handles others by invoking multiple backend services and aggregating the results. If there are failures in the backend services, the API gateway can mask them by returning cached or default data.

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# **Appendix**

## Stakeholder Analysis

The Stakeholder Onion Diagram is often used to view the relationships of stakeholders to a project goal. To develop a Stakeholder Onion Diagram, we can identify the following categories of stakeholders:

* Layer 1: Stakeholders closely involved in the creation of the product, which could be a new system or a new process. Stakeholders may include the software developer, Tester etc.
* Layer 2: Stakeholders whose work changes when the solution is defined. For example, end users.
* Layer 3: Funders, Buyers, Viewers, and subject matter experts who interact closely with the system

According to this system, the onion diagram layers must be following:

1. Layer 1: Tester, Developer, Business Analyst
2. Layer 2: Sys Admin, Meter owner, Meter reader
3. Layer 3: Funders, Buyers, Viewers

## Individual Work

### Jayasooriya C.A - IT20250942

#### Table Description automatically generatedClass Diagram.

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#### Activity Diagram.

Diagram

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#### Use Case Scenario Diagram.

|  |  |  |
| --- | --- | --- |
| **Number** | **EG003** | |
| **Name** | Add breakdown announcement | |
| **Summary** | System Administrator can add a breakdown notice into the system. | |
| **Priority (0-5)** | 5 | |
| **Preconditions** | The user must be logged into the system | |
| **Postconditions** | The added breakdown should be displayed in the Breakdowns table. | |
| **Primary Actor(s)** | System Administrator | |
| **Trigger** | System administrator clicks the add breakdown button. | |
| **Main Scenario** | **Step** | **Action** |
| 1 | The Sys Admin is directed to the portal home page |
| 2 | The Sys Admin presses the “Add Breakdown” button |
| 3 | The system displays the form related to the adding a new breakdown |
| 4 | The Sys Admin enters the relevant details in the text fields |
| 5 | The Sys Admin presses the “Add button” |
| 6 | The system clears the entered details of the form |
| 7 | The system sends the filled data to the database |
| 8 | The system redirects the Sys Admin to the updated Breakdowns table |
| **Extensions** | **Step** | **Action** |
| 4a | System displays error message if the required fields are not filled. |
| 5a | System disables the “Add Breakdown” button unless the checkbox is checked. |

#### Tools Used in the Development Process and the Justifications for Using Them

1. Dependency management tools – Maven.

Maven has been selected and used as the dependency management tool in this project as Maven minimizes the need to study and declare the libraries that your own dependencies require by automatically adding transitive dependencies. It makes managing project dependencies a lot easier. It ensures that the same source code is used across several environments. Dependence Management combines all dependence information into a single POM file, making the references in the child POM file easier to understand. The section on dependency management provides a way for centralizing dependence data.

1. JAX-RS (Jersey) –

It makes creating a RESTful service that can be deployed to any Java application server much easier.

1. Testing tools – Postman.

Postman has been used as the testing tool for this project as Postman is the most suitable tool for testing since it supports a wide range of test types, including unit, functional, integration, regression, mock, and end-to-end tests, all of which can be automated. Creating test suites that will run repeatedly until the application is error-free is one way to automate testing. The advantage is that human errors are extremely unlikely, if not impossible, to occur.

1. Code quality checking tools - Eclipse Check style Plugin.

The project's integrated development environment is Eclipse. As a result, it would be better to use an Eclipse-compatible tool. The Eclipse Checkstyle Plugin inspects Java source code on a regular basis and alerts you if any deviations from standard coding practices are detected. These alarm signals are delivered to the developer via the Eclipse Problems View. This enables for speedier development and saves time.

1. Version Controlling System - Git

We require collaboration among our group members because this is a group project, so it's simple to work on the same shared folder and comprehend all that has been done to the project, hence Git was used to facilitate this.

Git is a free, open-source, cross-platform distributed version control system that allows non-linear development and can manage everything from small to huge projects swiftly and effectively. Local branching, convenient staging areas, and various workflows are just a few of Git's capabilities. It also includes a variety of tools to help us navigate through the history, and each instance of the source has the whole history tree, which is quite useful during development even if we don't have Internet connection.

### Gavindya N.A.C - IT20409982

#### Class Diagram.

Table

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#### Activity Diagram.

Diagram

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#### Use Case Scenario Diagram.

|  |  |  |
| --- | --- | --- |
| **Number** | **EG004** | |
| **Name** | Update an existing user | |
| **Summary** | System Administrator can update an existing user into the system. | |
| **Priority (0-5)** | 3 | |
| **Preconditions** | The user must be logged into the system | |
| **Postconditions** | The added user should be displayed in the user table. | |
| **Primary Actor(s)** | System Administrator | |
| **Trigger** | System administrator clicks the update button. | |
| **Main Scenario** | **Step** | **Action** |
| 1 | The Sys Admin is directed to the portal home page |
| 2 | The Sys Admin presses the “Update User” button |
| 3 | The system displays the form related to the updating a new user |
| 4 | The Sys Admin enters the relevant details in the text fields |
| 5 | The Sys Admin presses the “Update button” |
| 6 | The system clears the entered details of the form |
| 7 | The system sends the filled data to the database |
| 8 | The system redirects the Sys Admin to the updated User table |
| **Extensions** | **Step** | **Action** |
| 4a | System displays error message if the required fields are not filled. |
| 5a | System disables the “Update” button unless the checkbox is checked. |

#### Tools Used in the Development Process and the Justifications for Using Them

1. Dependency Management tools– Maven

Dependency Management pulls all the dependency information into a common POM file and there by simplifies the references in child POM file. Maven includes transitive dependencies automatically and thus it does not have the need to detect the libraries required. This happens by reading the project files of the dependencies from the remote repositories.

Dependency Management is basically centralizing dependency information. Maven allows the projects to have simpler references in the child POM, for those that share a common parent and a common POM. Further, dependency management defines a standard version of an artifact to use across multiple projects.

1. Version Controlling tools– Git

Git is a free, cross-platform, and open-source distributed version control solution that supports non-linear development and can handle everything from tiny to extremely large projects quickly and efficiently. Git has a number of useful features, like local branching, easy staging spaces, and different workflows. It also provides a number of tools to assist us in navigating around the history, and each instance of the source contains the whole history tree, which is quite useful during development even if we don't have access to the Internet.

1. Testing tools – Postman

Postman is the greatest tool for testing since it supports a wide range of test types, including unit, functional, integration, regression, mock, and end-to-end tests, all of which can be automated. Creating test suites that will run repeatedly until the application is error-free is one way to automate testing. The advantage is that human errors are extremely unlikely, if not impossible, to occur.

### Bandara T.M.Y.M - IT20492052

#### Class Diagram.

Table

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#### Activity Diagram.

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#### Use Case Scenario Diagram.

|  |  |  |
| --- | --- | --- |
| **Number** | **EG004** | |
| **Name** | Add bill | |
| **Summary** | Users can register a new item to the system | |
| **Priority (0-5)** | 5 | |
| **Preconditions** | The user must be logged into the system | |
| **Postconditions** | The added bill should be in the added bill list | |
| **Primary Actor(s)** | Meter reader | |
| **Trigger** | Meter reader clicks the add bill option | |
| **Main Scenario** | **Step** | **Action** |
| 1 | User logs into the system using staff credentials |
| 2 | The system redirects to the bill management portal |
| 3 | The user presses the “Add bill” button |
| 4 | The system displays the form related to the adding a new bill |
| 5 | The user enters the relevant details in the text fields |
| 6 | The user presses the “Add button” |
| 7 | The system clears the entered details of the form. |
| 8 | The system sends the filled data to the database and shows them in the added bill list |
| **Extensions** | **Step** | **Action** |
| 1a | The system displays an error message |
| 6a | The system displays alert messages |
| 6b | The user presses the ok button |
| 6c | The user enters correct data to the fields |

#### Tools Used in the Development Process and the Justifications for Using Them

1. Dependency management tools – Maven.

By introducing transitive dependencies automatically, Maven reduces the need to investigate and specify the libraries that your own dependencies require. It makes project dependencies easier to manage. It ensures that the same source code is used in different settings. Dependence Management is used to consolidate all dependency information into a single POM file, simplifying the child POM file's references. The section on dependency management is a way for centralizing dependence data.

1. Testing tools – Postman.

Postman is the greatest tool for testing since it supports a wide range of test types, including unit, functional, integration, regression, mock, and end-to-end tests, all of which can be automated. Creating test suites that will run repeatedly until the application is error-free is one way to automate testing. The advantage is that human errors are extremely unlikely, if not impossible, to occur.

1. Code quality checking tools - Eclipse Check style Plugin.

Eclipse is the project's integrated development environment. As a result, choosing a tool that supports Eclipse would be preferable. The Eclipse Checkstyle Plugin inspects Java source code on a regular basis and notifies you if there are any deviations from the conventional coding norms. The Eclipse Problems View is used to deliver these alert signals to the developer. This saves time and allows for faster development.

### Rathnaweera R.P.W.G - IT20237554

#### Class Diagram.

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#### Activity Diagram.

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#### Use Case Scenario Diagram.

|  |  |  |
| --- | --- | --- |
| **Number** | **EG004** | |
| **Name** | Make inquiry | |
| **Summary** | Meter owner(user) makes inquiry through the system | |
| **Priority (0-5)** | 5 | |
| **Preconditions** | The meter owner must be logged into the system | |
| **Postconditions** | Submitted inquiry should be posted on the inquiry table | |
| **Primary Actor(s)** | Meter owner | |
| **Trigger** | Meter owner clicks “Inquiry’ button to add an inquiry | |
| **Main Scenario** | **Step** | **Action** |
| 1 | The meter owner will be directed to the portal home page |
| 2 | The Meter owner clicks on the “Add Inquiry” button |
| 3 | The system will display all the related form details to the meter owner to add an inquiry. |
| 4 | The Meter owner add all the details to the relevant fields shown. |
| 5 | The Meter owner press the “Submit Inquiry” button |
| 6 | The system will clear details in the form. |
| 7 | The system sends the data which was filled by the Meter owner to the database |
| 8 | The system redirects the Meter owner back to the home page |
| **Extensions** | **Step** | **Action** |
| 4a | System displays error message if the Meter owner feed wrong details in the form. |
| 5a | System will disable the “Submit Inquiry” button unless the check box is ticked |

#### Tools Used in the Development Process and the justification for using them

1. Dependency management tools- Maven

The reason to use dependency management tool like maven is to its easy to manage project dependencies. Maven eliminates the need to explore and specify the libraries that your own dependencies need by adding transitive dependencies automatically. The dependency management section is a mechanism for centralizing dependency information, and it had ensured that the same source code will the used across all the environments and using this dependency management we are getting all the dependencies and collection them into a common POM file and simplifying the references in the child POM.

1. Testing Tools – Postman

Reason for selecting postman as a testing tool is that the tests can be done automated by developing test suites where the can-do tests repeatedly. such as unit tests, functional tests, integration tests, end-to-end tests, regression tests, mock tests, and other sorts of testing can all be automated with Postman. By using this automated testing method, it will lead us to reduces the risk of the human mistake and streamlines the testing process.

1. JAX-RS (Jersey) Framework

By using this jersey framework, it makes easy to create a RESTful service that can be deployed to any Java application server

1. Checking code quality- Checkstyle plug-in

To implement this project, we had used JAVA as the programming language and Eclipse as the IDE, so when using a plugin which can be used in the same coding environment is effective since that I had chosen the checkstyle plugin. The Checkstyle Plugin (eclipse-cs) integrates the well-known source code analyzer Checkstyle into the Eclipse IDE. Checkstyle is a development tool to help our ensure that your Java code adheres to a set of coding standards.

1. Version Control System – Git

Reason to use git as our version control system is that when we are developing we may come across to several type of errors since that it’s easy to use a version control system to undo the changes which we had used to develop the project and restore to the previous versions, Since this a group project we need a collaboration among our group members so it’s easy to work on the same shared folder which is easy to understand all the things that which have been done to the project.

### Amanullath M.U - IT20155520

#### Class Diagram.

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#### Activity Diagram.

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#### Use Case Scenario Diagram.

|  |  |  |
| --- | --- | --- |
| **Number** | **EG005** | |
| **Name** | Add power consumption. | |
| **Summary** | Meter reader adds consumed units into the system. | |
| **Priority (0-5)** | 5 | |
| **Preconditions** | The user must be logged into the system | |
| **Postconditions** |  | |
| **Primary Actor(s)** | Meter reader | |
| **Trigger** | Meter reader wanting to add a reading. | |
| **Main Scenario** | **Step** | **Action** |
| 1 | The Meter reader is directed to the portal home page |
| 2 | The Meter reader presses the “Add Reading” button |
| 3 | The system displays add account number form. |
| 4 | The Meter reader enters the account no. |
| 5 | The system displays add year and date form. |
| 6 | The Meter reader enters the year and date. |
| 7 | The system displays add used units form. |
| 8 | The Meter reader enters the used units no. and submits the form. |
| 9 | System enters the power consumption details to the database. |
| **Extensions** | **Step** | **Action** |
| 3a | System displays proper error message if fields are not filled. |
| 8a | System displays error message if the required fields are not filled. |

#### Tools Used in the Development Process and the justification for using them

1. Dependency management tools – Maven.

Maven eliminates the need to research and define the libraries that your own dependencies require by automatically creating transitive dependencies. It facilitates the management of project dependencies. It ensures that the same source code is used across several environments. Dependence Management consolidates all dependence information into a single POM file, making the references in the child POM file easier to understand. The dependency management section is a method of centralizing dependency information.

1. Testing tools – Postman.

Postman is the best testing tool since it can automate a wide variety of test types, including unit, functional, integration, regression, mock, and end-to-end tests. One method for automating testing is to create test suites that will run until the application is error-free. Human errors are highly rare, if not impossible, to occur.

1. Code quality checking tools - Eclipse Check style Plugin.

The project's integrated development environment is Eclipse. As a result, it would be preferable to use an Eclipse-compatible tool. The Eclipse Checkstyle Plugin inspects Java source code on a regular basis and alerts you if any deviations from standard coding practices are detected. These alert signals are delivered to the developer via the Eclipse Problems View. This enables for speedier development and saves time.

## Testing Methodology and Results

### IT20250942 - Jayasooriya C. A

Testing – Breakdown Information Service and Payment Management Service (Create Payment function)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test ID | Test Description | Test Inputs | Expected Outputs | Actual Outputs | Pass / Fail |
| T1001 | Insert a breakdown | breakdownSector = “F”  breakdownDate = “2022-04-22”  startTime = “11:00:00”  endTime = “17:00:00”  breakdownType = “Repair and cut” | Display message as “Inserted successfully” | Display message as “Inserted successfully” | Pass |
| T1002 | Read sector breakdowns | breakdownSector = “A” | Display all breakdowns of sector A | Display all breakdowns of sector A | Pass |
| T1003 | Update a breakdown | breakdownID = “8”  breakdownSector = “F”  breakdownDate = “2022-04-25”  startTime = “11:00:00”  endTime = “17:00:00”  breakdownType = “Power cut canceled” | Display message as “Updated successfully” | Display message as “Updated successfully” | Pass |
| T1004 | Delete a breakdown | breakdownID = “8” | Display message as “Deleted successfully” | Display message as “Deleted successfully” | Pass |
| T1005 | Insert a payment | accountNo = “EG1122”  paymentAmount = “1220.00”  paymentMethod = “VISA”  cardNo = “111-222-231-332”  email= “aseljay@gmail.com” | Display message as “Inserted successfully” | Display message as “Inserted successfully” | Pass |

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### IT20409982 - Gavindya N.A.C

Testing – User Management Service and Payment Management Service (Delete Payment function)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test ID | Test Description | Test Inputs | Expected Outputs | Actual Outputs | Pass / Fail |
| T2001 | Insert a User | userID = “6”  userNIC = “678v”  userName = “wishwa”  userAddress = “kurunagala”  userType = “O”  userSector = “R” | Display message as “Inserted successfully” | Display message as “Inserted successfully” | Pass |
| T2002 | Read Users |  | Display all users | Display all users | Pass |
| T2003 | Update a user | userID = “6”  userNIC = “999v”  userName = “kamal”  userAddress = “galle”  userType = “O”  userSector = “F” | Display message as “Updated successfully” | Display message as “Updated successfully” | Pass |
| T2004 | Delete a user | userID = “6” | Display message as “Deleted successfully” | Display message as “Deleted successfully” | Pass |
| T2005 | Delete a payment | paymentID = “3” | Display message as “Deleted successfully” | Display message as “Deleted successfully” | Pass |

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### IT20492052 - Bandara T.M.Y.M

Testing – Bill Service and Payment Management Service (Update Payment function)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test ID | Test Description | Test Inputs | Expected Outputs | Actual Outputs | Pass / Fail |
| TST1001 | Insert a bill | billCode = “B020”  accountNo = “B700001”  billMonth = “Apr”  units = 5  meterReader\_name = “Saman” | Display message as “Inserted successfully” | Display message as “Inserted successfully” | Pass |
| TST1002 | Insert a bill | billCode = “B030”  accountNo = “B700002”  billMonth = “Mar”  units = 7  meterReader\_name = “Jagath” | Display message as “Inserted successfully” | Display message as “Inserted successfully” | Pass |
| TST1003 | Update a bill | billID = 8  billCode = “B021”  accountNo= “B700003”  billMonth = “Jun”  units = 10  meterReader\_name = “Jane” | Display message as “Updated successfully” | Display message as “Updated successfully” | Pass |
| TST1004 | Delete a bill | billID = 9 | Display message as “Deleted successfully” | Display message as “Deleted successfully” | Pass |
| TST1005 | Update a payment | paymentID = 2  accountNo = “EG2233”  paymentAmount = “12000.00”  paymentMethod = “VISA”  cardNo = “456-978-963-214”  email= “abs@gmail.com” | Display message as “Inserted successfully” | Display message as “Inserted successfully” | Pass |

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### IT20237554 – Rathnaweera R.P.W.G

Testing – Support Inquiry Service and Payment Management Service (Read Payment function) –

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test ID | Test Description | Test Inputs | Expected Outputs | Actual Outputs | Pass / Fail |
| T1010 | Insert an inquiry | inquiryTitle=”Refund”  inquiryDesc=”Need a payment refund for the bill”  contactNum=”0767990025” | Display message as “Inserted successfully” | Display message as “Inserted successfully” | Pass |
| T1011 | Update an inquiry | inquiryID=”12”  inquiryTitle=”Refund update”  inquiryDesc=”Updated Description”  contactNum=”0711812925” | Display message as “Update successfully” | Display message as “Update successfully” | Pass |
| T1012 | Delete an Inquiry | inquiryID=”12” | Display message as “Deleted successfully” | Display message as “Deleted successfully” | Pass |
| T1013 | Delete an Inquiry without passing inquiryID | inquiryTitle=”Refund update”  inquiryDesc=”Updated Description”  contactNum=”0711812925” | Display message as “Error while deleting the inquiry” | Display message as “Error while deleting the inquiry” | Pass |

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### IT20155520 - Amanullath M.U

Testing – Power Consumption Information Service and Payment Management Service (Calculate Due Amount function) – IT20155520 Amanullath M. U

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test ID | Test Description | Test Inputs | Expected Outputs | Actual Outputs | Pass / Fail |
| T1001 | Insert a meter reading | "meterReaderId": 2,  "accountNo": "1",  "year": 2022,  "month": 12,  "reading": 20000 | Display message as “Meter Reading added successfully” with inserted data | Display message as “Meter Reading added successfully” with inserted data | Pass |
| T1002 | Get all meter readings by account no | accountNo = “1” | Display all meter reading of account number 1 | Display all meter reading of account number 1 | Pass |
| T1003 | Update a meter reading | Reading=10000  accountNo=”1”  month=12  year=2022 | Display message as “Updated successfully” | Display message as “Updated successfully” | Pass |
| T1004 | Delete a meter reading | accountNo=”1”  month=12  year=2022 | Display message as “Deleted successfully” | Display message as “Deleted successfully” | Pass |
| T1005 | Calculate due amount | accountNo=”1”  month=12  year=2022 | Display message as display the due amount as of 2022 december | Display message as display the due amount as of 2022 december | Pass |

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