Sri Lanka Institute of Information Technology

ElectroGrid (EG) System

Project Report
Programming Applications and Frameworks Project 2022

Project ID: Y3.S1.WD.IT.02.02

Submitted by:

1. IT20212018 – R.R.W.G.B.P.P.M.Hulangamuwa
2. IT20068400 – Bihash. A
3. IT20110734 – O.G.K.G.Perera
4. IT20253158 – U.R.S.N.Udapolawatta

Submitted to:

……………………………..

Mr. Nalaka Dissanayake

2022.04.26

Table of Contents

1.Member Details & Workload Distribution

Student ID	IT20212018
Student Name	R.R.W.G.B.P.P.M.Hulangamuwa
Workload Distribution	Payment Microservice

Student ID	IT20068400
Student Name	Bihash.A
Workload Distribution	Units & Bill Microservices

Student ID	IT20110734
Student Name	O.G.K.G.Perera
Workload Distribution	Admin Microservice

Student ID	IT20253158
Student Name	U.R.S.N.Udapolawatta
Workload Distribution	User Microservice

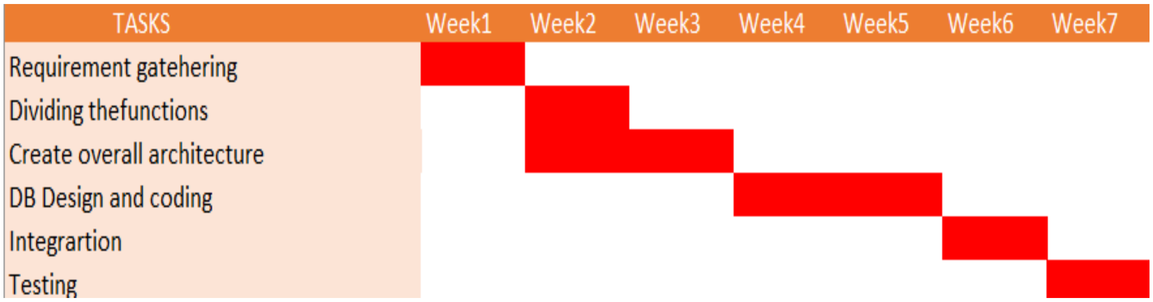
2. VCS Repository Link: https://github.com/PiyumaliHulangamwa/PAF_2022

3. SE Methodology/ Methods

Incremental Development Model is a Software Engineering Methodology where the main requirements are broken down in to multiple modules. Incremental development is done in steps from analysis design, implementation, testing/verification, maintenance. Each module goes through the requirements, design, coding and testing phases.

For this project we have used incremental development model since all the requirements are clearly understood and the development team is fairly new microservice are developed separately to minimize errors and fix the easily. So for our project, incremental development method is the best software engineering methodology.

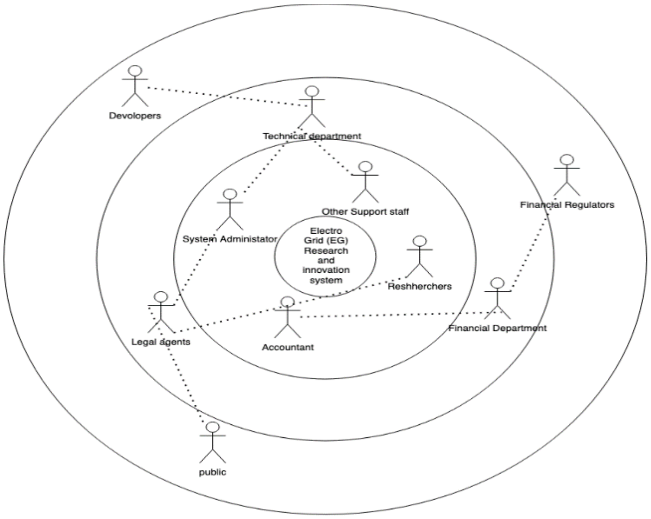
4. Time Schedule (Gantt Chart)



TASKS	Week1	Week2	Week3	Week4	Week5	Week6	Week7
Requirement gatehering	🟥						
Dividing thefunctions		🟥					
Create overall architecture		🟥	🟥				
DB Design and coding				🟥	🟥		
Integrartion						🟥	
Testing							🟥

5.Requirements

5.1. Stakeholder analysis (onion diagram)



5.2. Requirements Analysis (Functional, Non-functional, Technical requirements)

5.1.1 Functional Requirements

- **User Microservice**

  By the admin user can enter to the system. User enter profile details and user has a chance to sign in and edit his/her profile. User can delete his paid bills if they not needed.

- **Admin Microservice**

  Admin can manage (add, edit, delete) users by login to the system. Admin can search the payment history by user id.

- **Units & Bill Microservices**

  Here the admin can enter the particular costs per unit and update the cost. Admin search cost by unit or admin can delete the units. Bill is generated according to the units he/she earned.

- **Payment Microservice**
  Admin can enter payment information or update payment information. He/she can search payment receipt by user id and if dues are exceeded the bill amount can delete the payment receipt.

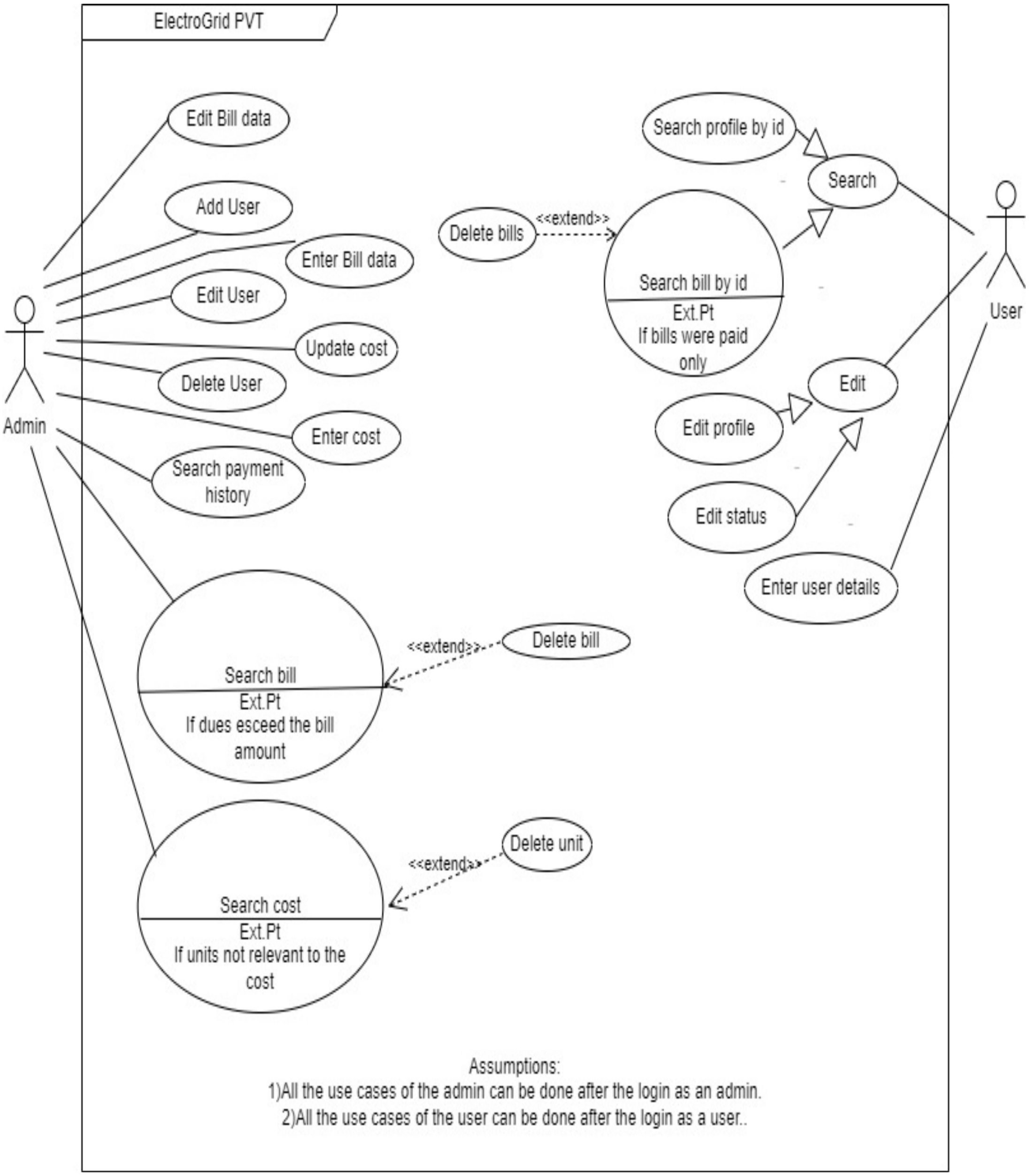
5.1.2.Non Functional Requirements

5.1.1.1 Performance – Response time, throughput, utilization
5.1.1.2 Security – All the Users end points are protected using a token
5.1.1.3 Reliability
5.1.1.4 Scalability
5.1.1.5 Maintainability

5.1.3.Technical Requirements

New browser like Google Chrome, Mozilla Firefox and Opera will support a lot better than the old browsers. (E.g : Internet Explorer)

5.3. Requirements modelling (Use case diagram)



Individual Sections

Student No :	IT20212018
Student Name :	R.R.W.G.B.P.P.M.Hulangamuwa
Microservice:	Payment Microservice

Service Design

1. API Design Rationale

The Payment microservice is an important section in this ElectroGrid (EG) power grid system.

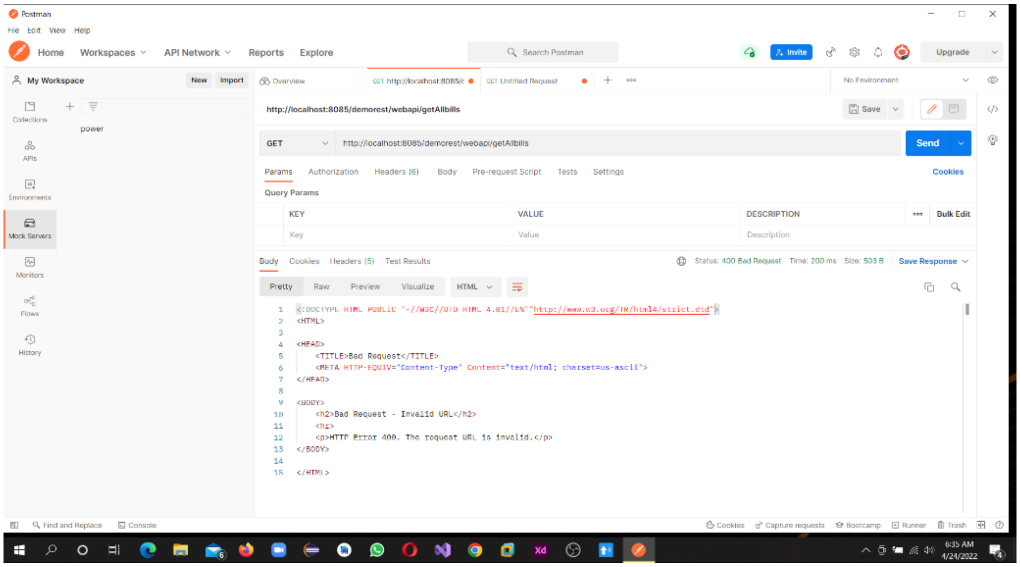
In this Service,

- Admin can add payment information.
- Admin can update the payment information.
- Admin can view the payment receipt by user id.
- Admin can delete the payment receipt if it exceed the dues over bill amount.
- If need, Admin can retrieve all the payment Details.

2. API Of The Service

2.1. API for view Payment Details -GET Request

URL : http://localhost:8083/demorest /webapi/getAllbills



http://localhost:8085/demorest/webapi/getAllbills

GET http://localhost:8085/demorest/webapi/getAllbills

Query Params

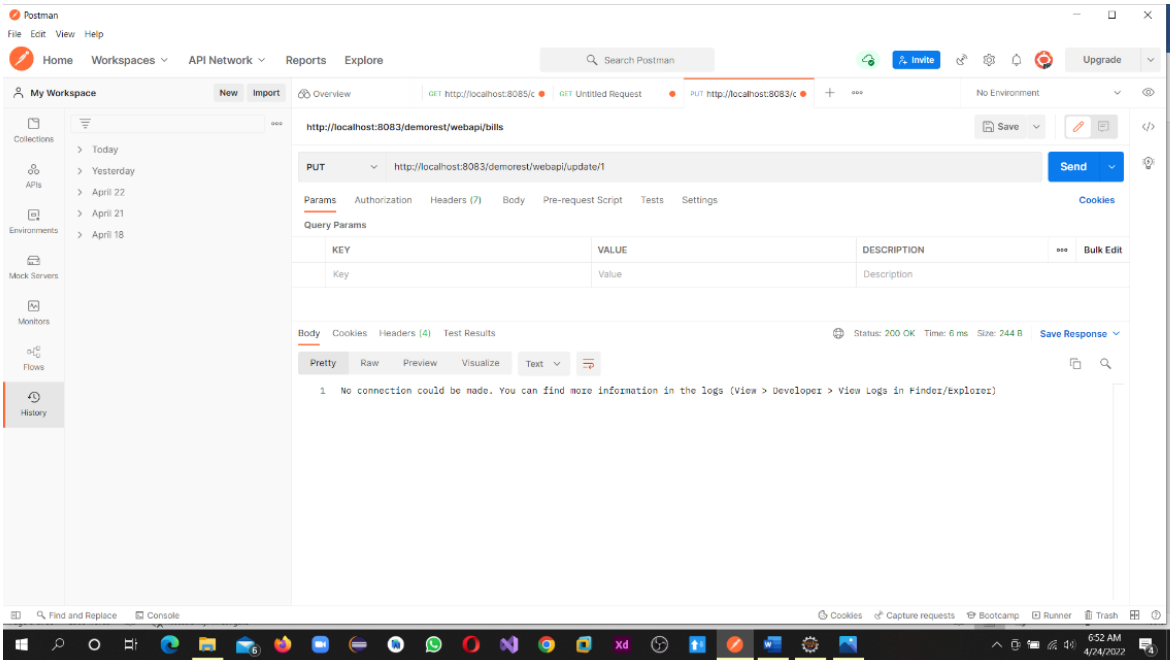
KEY	VALUE	DESCRIPTION
Key	Value	Description

Status: 400 Bad Request Time: 200 ms Size: 503 B

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN""http://www.w3.org/TR/html4/strict.dtd">
<HTML>

<HEAD>
    <TITLE>Bad Request</TITLE>
    <META HTTP-EQUIV="Content-Type" Content="text/html; charset=us-ascii">
</HEAD>

<BODY>
    <h2>Bad Request - Invalid URL</h2>
    <hr>
    <p>HTTP Error 400. The request URL is invalid.</p>
</BODY>

</HTML>
```

2.1. API for update Payment details -PUT Request

URL : http://localhost:8083/demorest /webapi/update /1



http://localhost:8083/demorest/webapi/bills

PUT http://localhost:8083/demorest/webapi/update/1

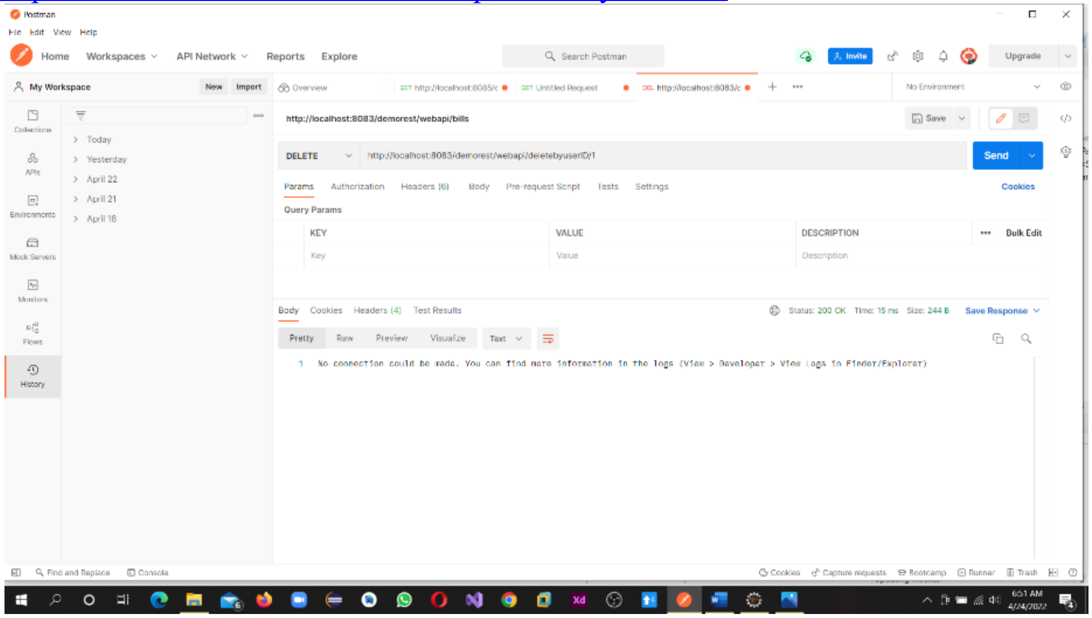
KEY	VALUE	DESCRIPTION
Key	Value	Description

Status: 200 OK Time: 6 ms Size: 244 B

```
1 No connection could be made. You can find more information in the logs (View > Developer > View Logs in Finder/Explorer)
```

2.2. API for Delete Payment receipt -DELETE Request

URL : http://localhost:8083/demorest /webapi/deletebyuserID/1



http://localhost:8083/demorest/webapi/bills

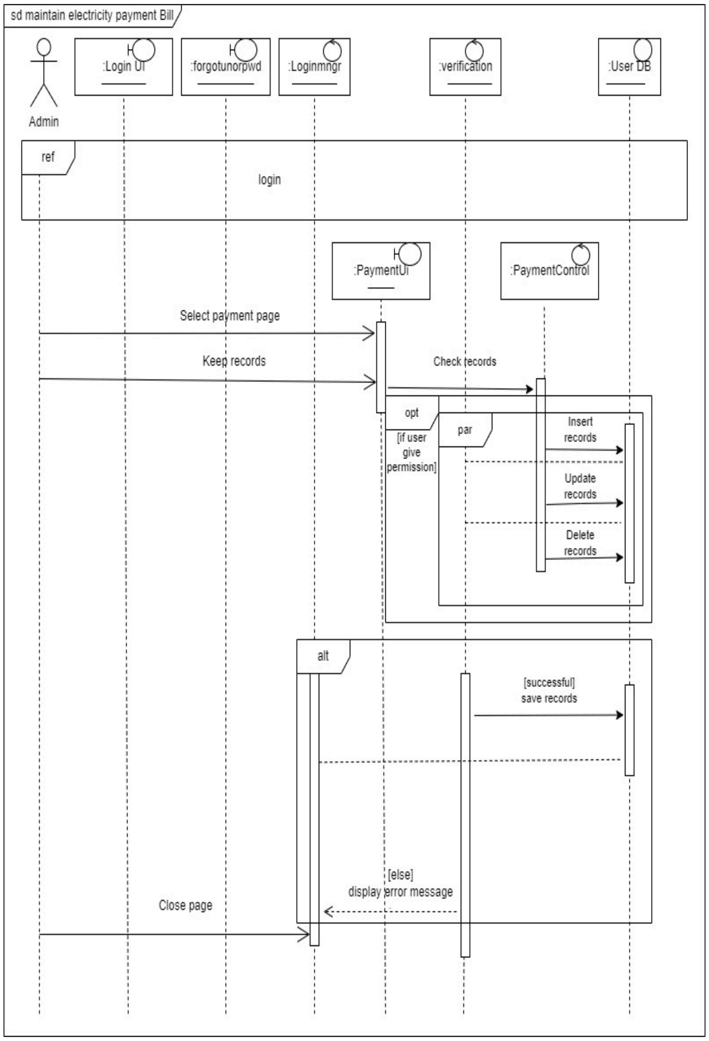
DELETE http://localhost:8083/demorest/webapi/deletebyuserID/1

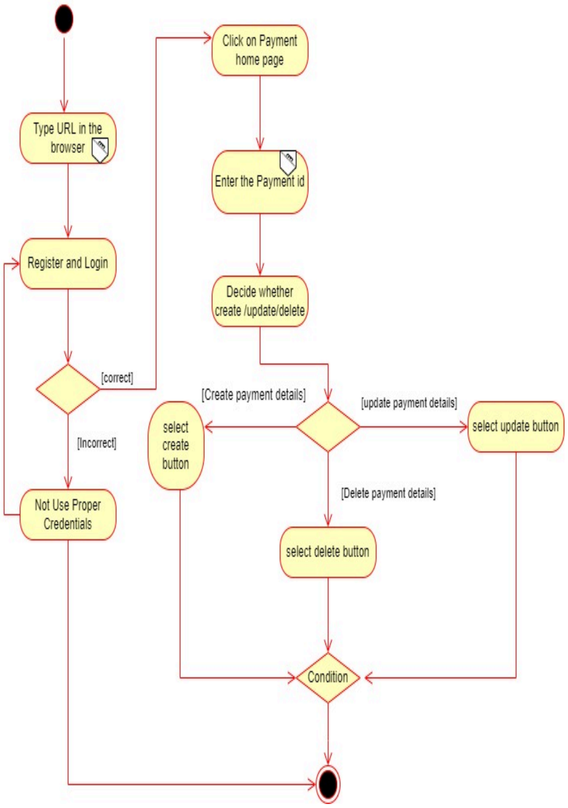
KEY	VALUE	DESCRIPTION
Key	Value	Description

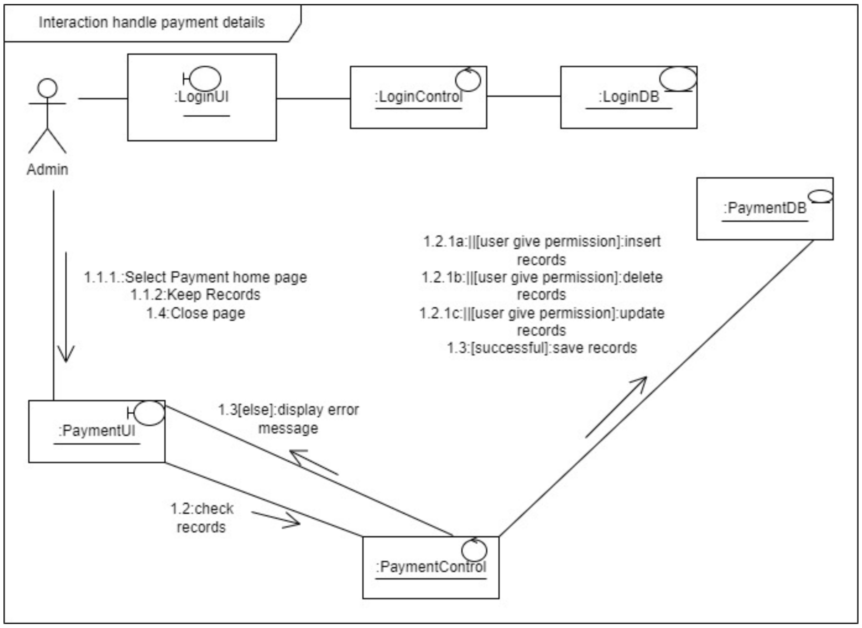
Status: 200 OK Time: 15 ms Size: 244 B

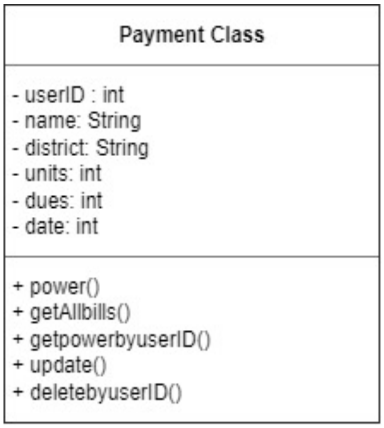
```
1 No connection could be made. You can find more information in the logs (View > Developer > View Logs in Finder/Explorer)
```

2.4. Internal Logic/ Database Design Diagrams of Payment Microservice






Interaction handle payment details
Admin
:LoginUI
:LoginControl
:LoginDB
:PaymentDB
1.1.1.:Select Payment home page
1.1.2:Keep Records
1.4:Close page
1.2.1a:||[user give permission]:insert records
1.2.1b:||[user give permission]:delete records
1.2.1c:||[user give permission]:update records
1.3:[successful]:save records
1.3[else]:display error message
1.2:check records
:PaymentUI
:PaymentControl



3.1. Service Development

3.2. Tools Used

- Technologies Used : Java - JAX-RS (Jersey) on Tomcat

  Reason: -Familiarity with the language, easy server configuration
- IDE : Eclipse 4.18

  Reason: -User friendly IDE
- Database : MySQL

  Reason: - Less complex to implement the DB connection
  - Testing : POSTMAN

3.3. Testing Methodology and Results

Test Id	01
Test Description	Insert payment details
Test Input(s)	userID=5,name=sunil,district=kandy,units=200,dues=2000,date=2012-09-08
Expected output(s)	Inserted successfully
Actual output(s)	Bad Request
Result(PASS/FAIL)	FAIL

Test Id	02
Test Description	Retrieve payment details
Test Input(s)	userID=5
Expected output(s)	userID=5,name=sunil,district=kandy,units=200,dues=2000,date=2012-09-08
Actual output(s)	No Connection
Result(PASS/FAIL)	FAIL

Test Id	03
Test Description	Update payment details
Test Input(s)	userID=5,name=sunil,district=kandy,units=200,dues=2000,date=2012-09-08
Expected output(s)	userID=5,name=Ann,district=Colombo,units=200,dues=2000,date=2012-09-08
Actual output(s)	No Connection
Result(PASS/FAIL)	FAIL

Test Id	04
Test Description	Delete payment receipt which exceeded the dues over the bill amount
Test Input(s)	Payment id=2
Expected output(s)	Deleted successfully
Actual output(s)	No Connection
Result(PASS/FAIL)	FAIL

Student No :	IT20068400
Student Name :	Bihash.A
Microservice :	Units & Bill Microservices

Service Design

1. API Design Rationale

Units Service-

API Design Rationale the Unit Part is an important section in this PowerGrid innovative project Electricity system. User have to login first and then go to the unit system. Then they can do this kind of functions. That functions are below in the section,

- Admin can insert new Unit Details.
- Admin can update unit details.
- Admin can view their Unit details with User ID.
- Admin can delete their Units.

Billing Service-

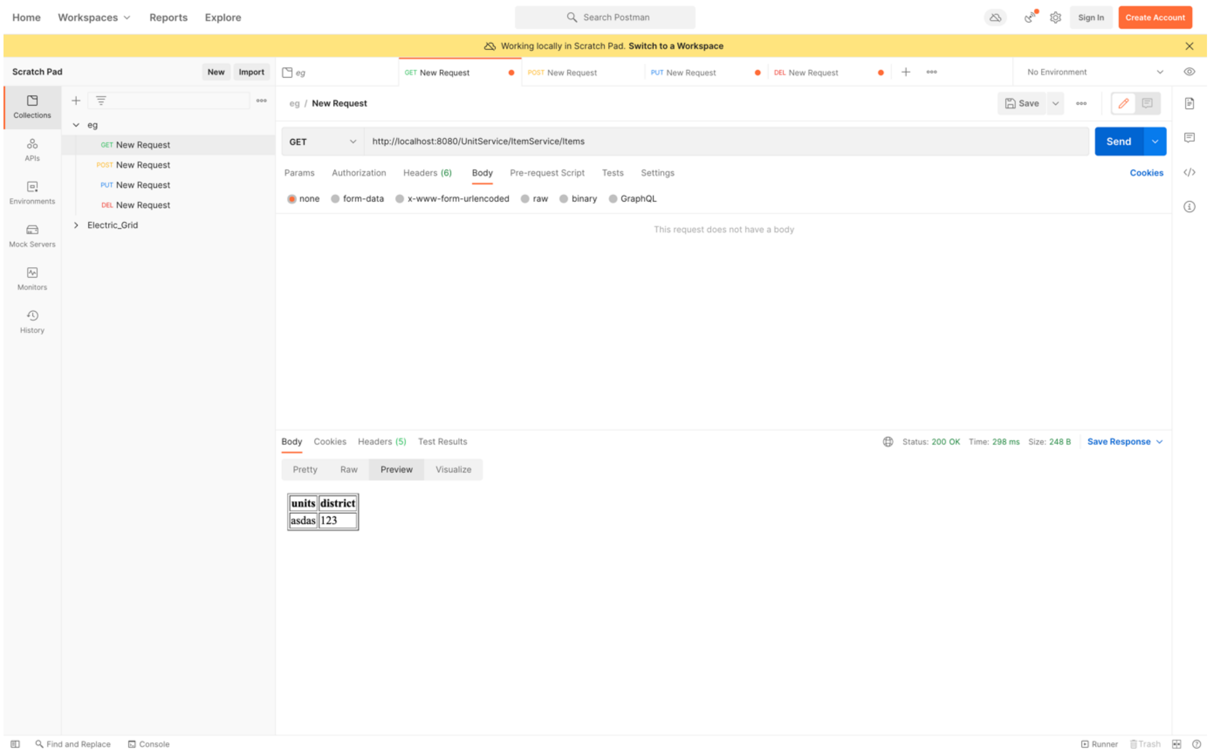
API Design Rationale the billing Part is also an important section in this PowerGrid innovative project Electricity system. User have to login first and then go to the billing system. Then they can do this kind of functions. That functions are below in the section,

- Admin can insert new Bill Details.
- Admin can update Bill details.
- Admin can view their bill details with User ID.
- Admin can delete their Bills

2. API Of The Service

2.1. API for view unit details (GET Request)

URL : http://localhost:8080/UnitService/UnitService/Unit



GET http://localhost:8080/UnitService/ItemService/Items

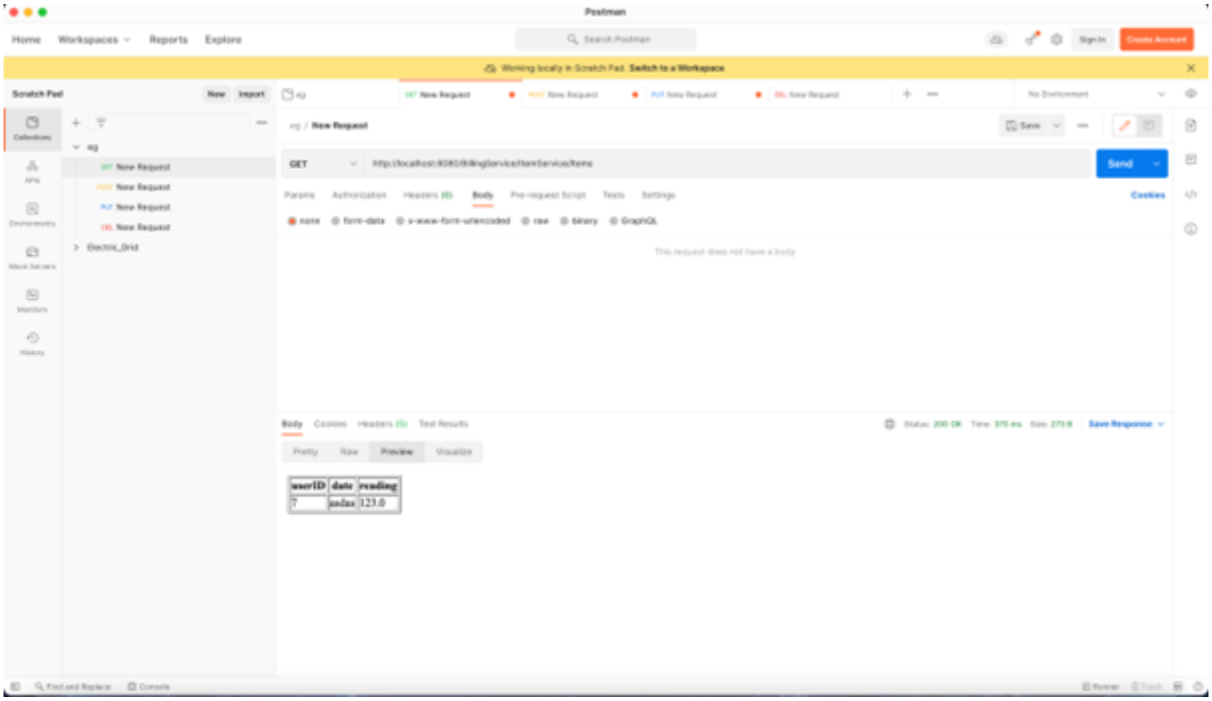
This request does not have a body

Status: 200 OK Time: 298 ms Size: 248 B

units	district
asdas	123

2.2.API for view billing details (GET Request)

url: http://localhost:8080/BillingService/BillService/Bill



eg / New Request

GET http://localhost:8080/BillingService/ItemService/Items

Body: ● none ○ form-data ○ x-www-form-urlencoded ○ raw ○ binary ○ GraphQL

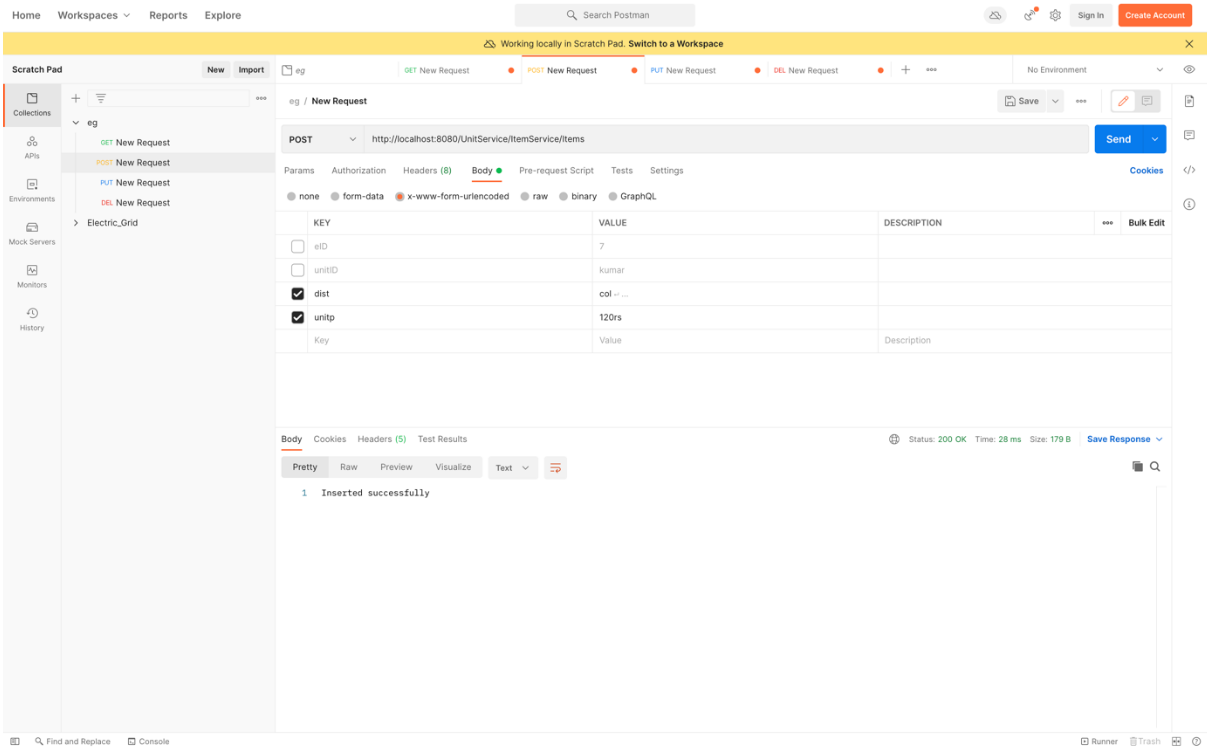
This request does not have a body

Body Cookies Headers (5) Test Results Status: 200 OK Time: 370 ms Size: 273 B

userID	date	reading
7	asdas	123.0

2.2. API for add unit details (POST Request)

URL : http://localhost:8080/UnitService/UnitService/Unit



eg / New Request

POST http://localhost:8080/UnitService/ItemService/Items

○ none ○ form-data ● x-www-form-urlencoded ○ raw ○ binary ○ GraphQL

	KEY	VALUE	DESCRIPTION
□	eID	7	
□	unitID	kumar	
☑	dist	col ↵ ...	
☑	unitp	120rs	
	Key	Value	Description

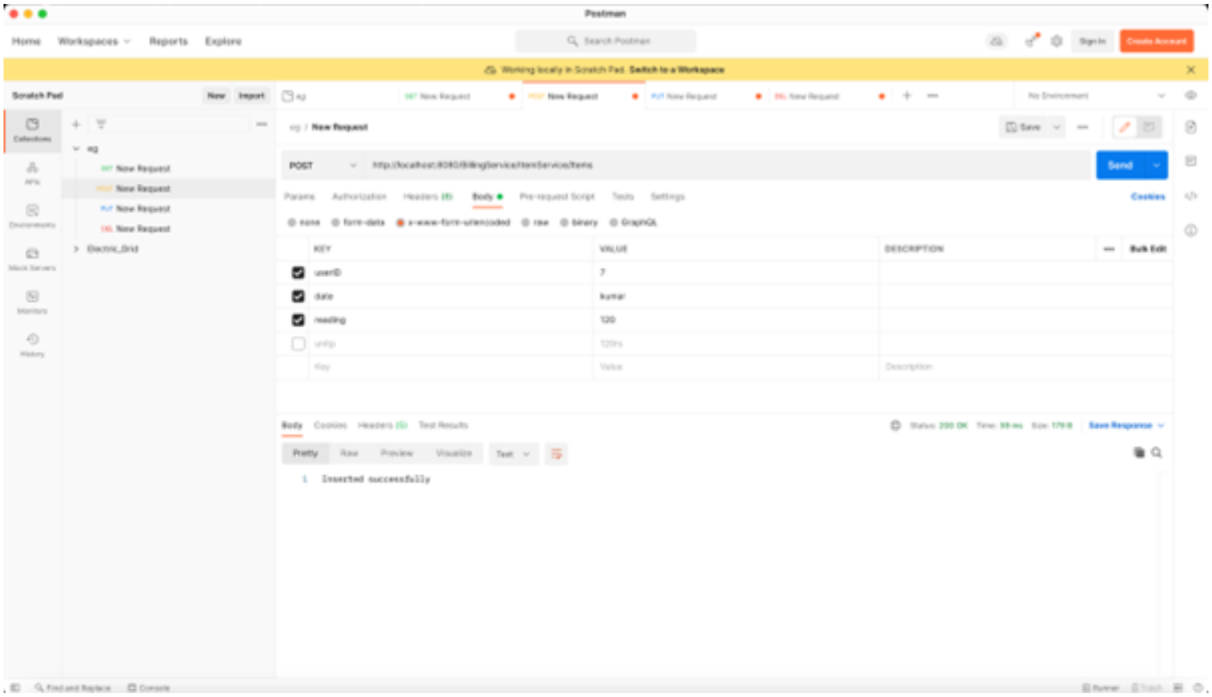
Body

Status: 200 OK Time: 28 ms Size: 179 B

```
Inserted successfully
```

2.4.API for add billing details (POST Request)

url: http://localhost:8080/BillingService/BillService/Bill



POST http://localhost:8080/BillingService/ItemService/Items

Body: x-www-form-urlencoded

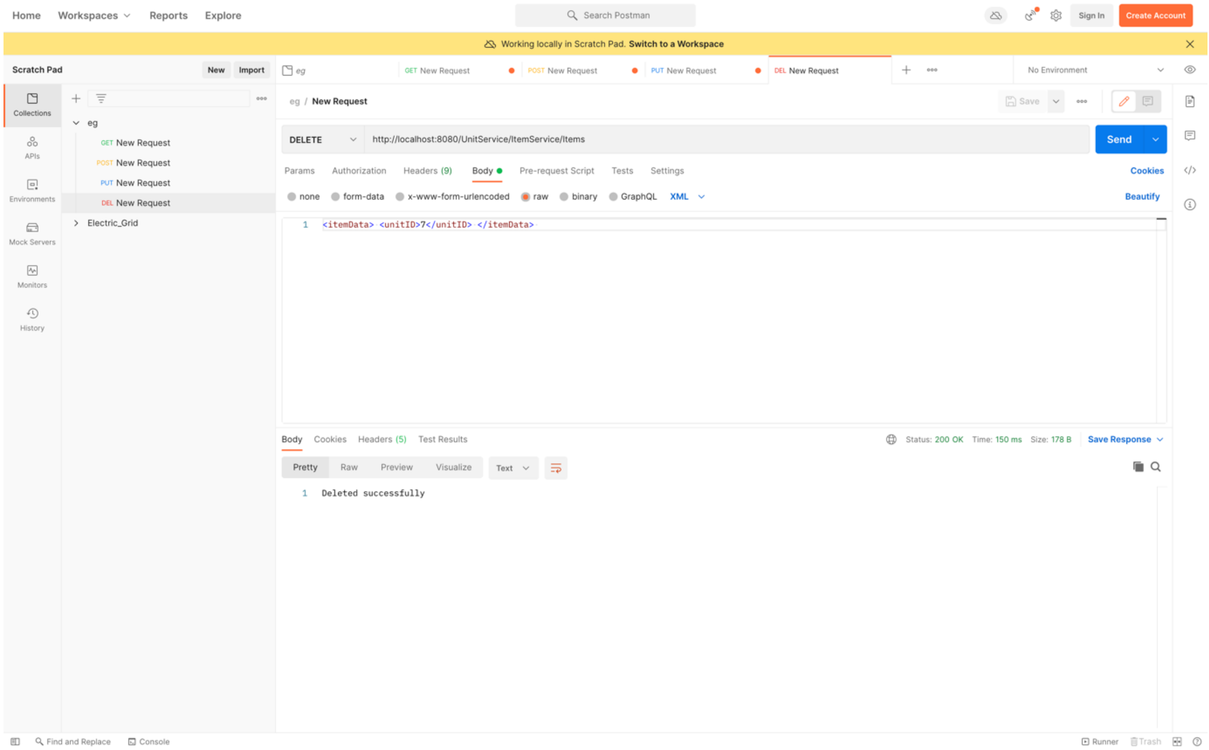
	KEY	VALUE	DESCRIPTION
☑	userID	7	
☑	date	kumar	
☑	reading	120	
□	unitp	120rs	
	Key	Value	Description

Status: 200 OK

```
Inserted successfully
```

2.5.API for remove unit details (DELETE Request)

URL : http://localhost:8080/UnitService/UnitService/Unit



DELETE http://localhost:8080/UnitService/ItemService/Items

Body: raw XML

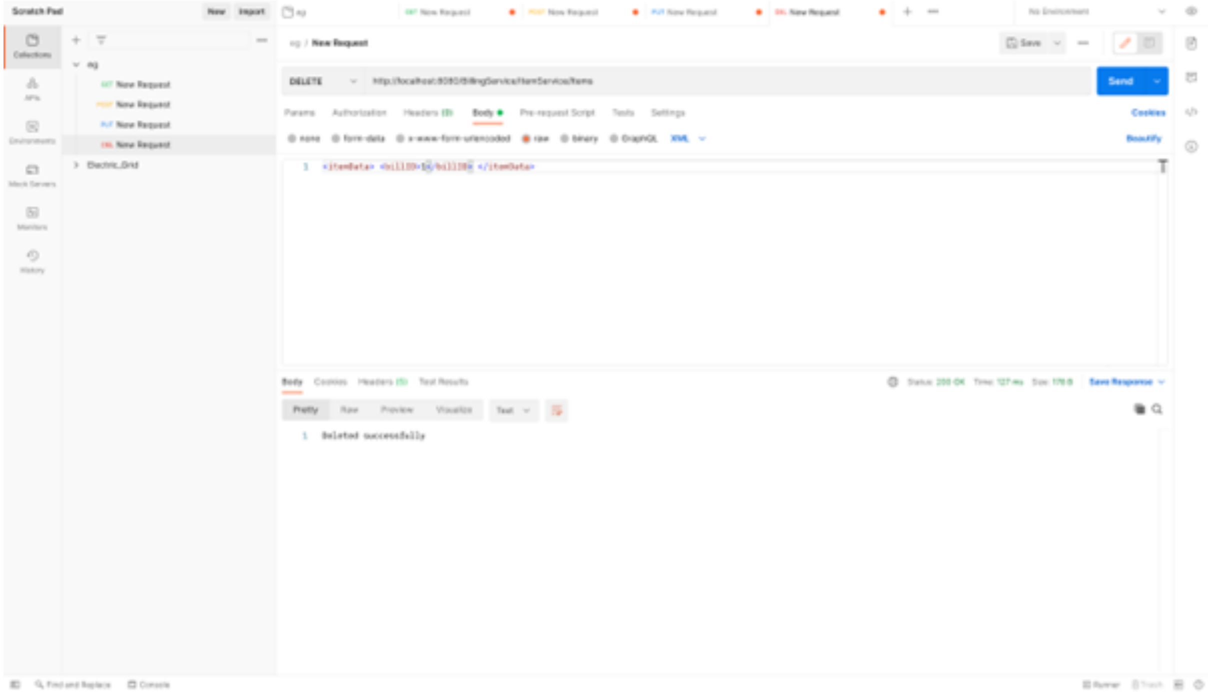
```
<itemData> <unitID>7</unitID> </itemData>
```

Status: 200 OK Time: 150 ms Size: 178 B

```
Deleted successfully
```

2.6.API for remove billing details (DELETE Request)

url: http://localhost:8080/BillingService/BillService/Bill



DELETE http://localhost:8080/BillingService/ItemService/Items

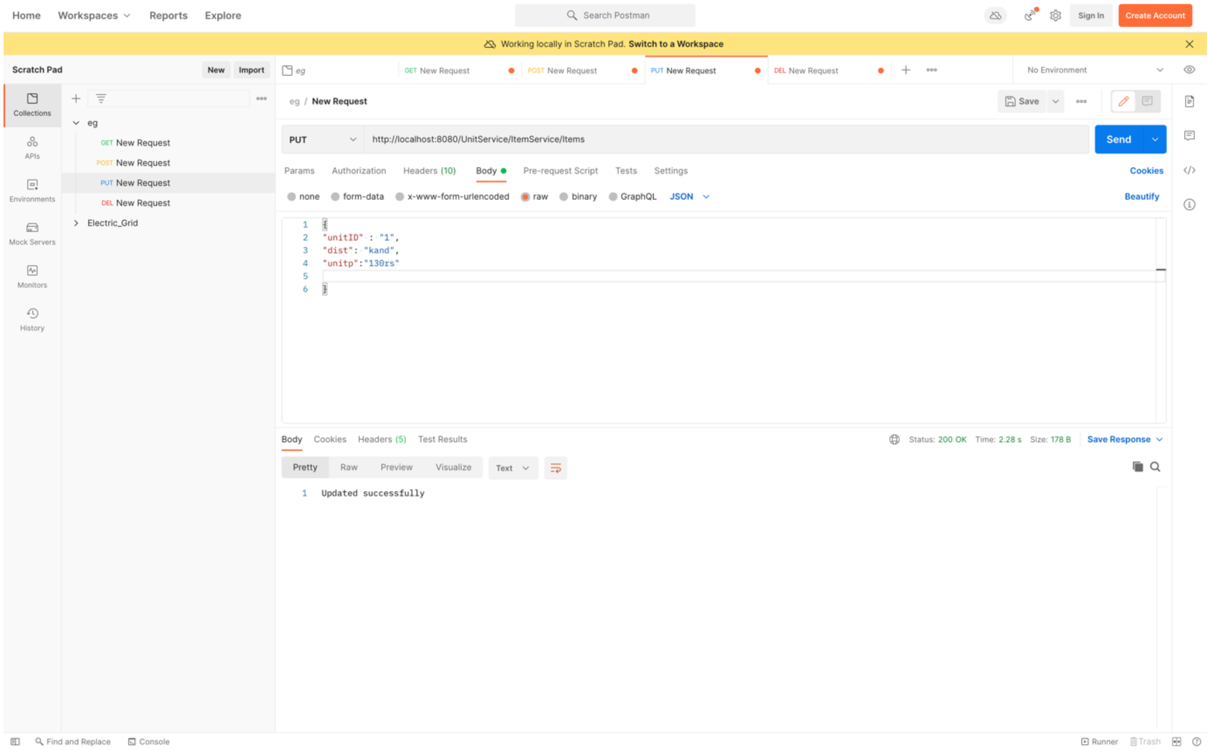
```
<itemData> <billID>1</billID> </itemData>
```

Status: 200 OK Time: 127 ms Size: 176 B

```
Deleted successfully
```

2.7.API for update unit details (PUT Request)

URL : http://localhost:8080/UnitService/UnitService/Unit



PUT http://localhost:8080/UnitService/ItemService/Items

Send

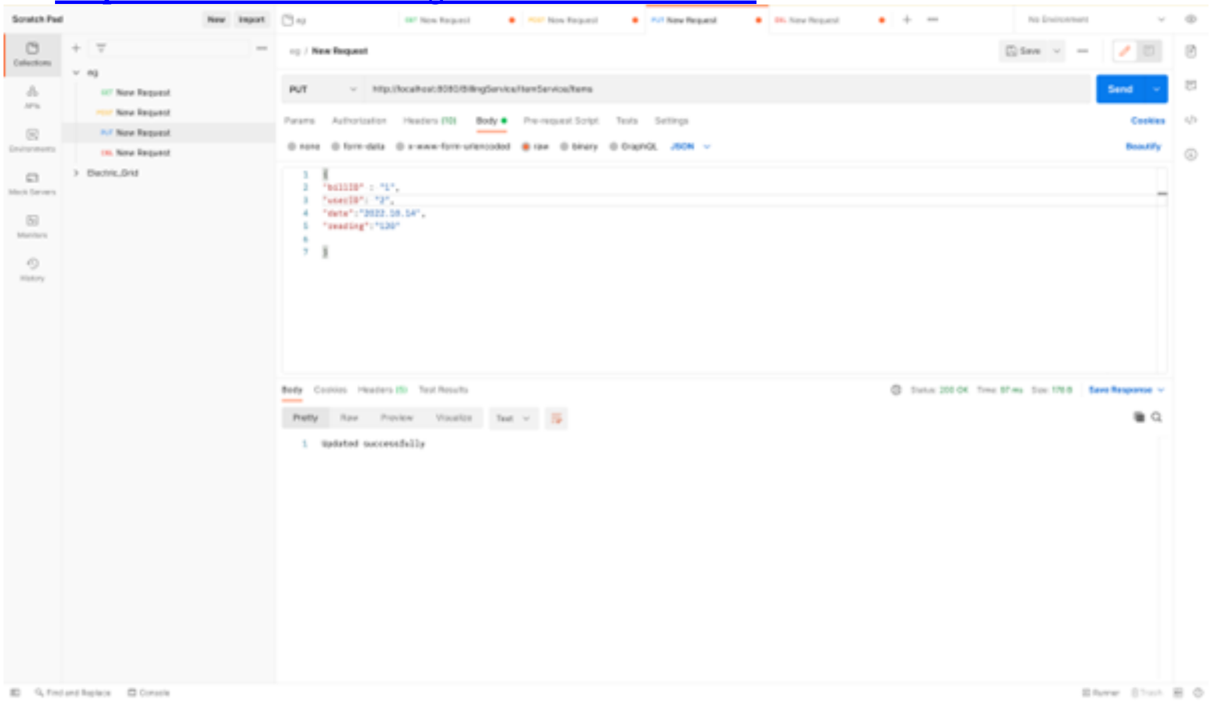
```
{
"unitID" : "1",
"dist": "kand",
"unitp":"130rs"

}
```

Status: 200 OK Time: 2.28 s Size: 178 B

```
Updated successfully
```

2.8.API for update billing details (PUT Request)

url: http://localhost:8080/BillingService/BillService/Bill



eg / New Request

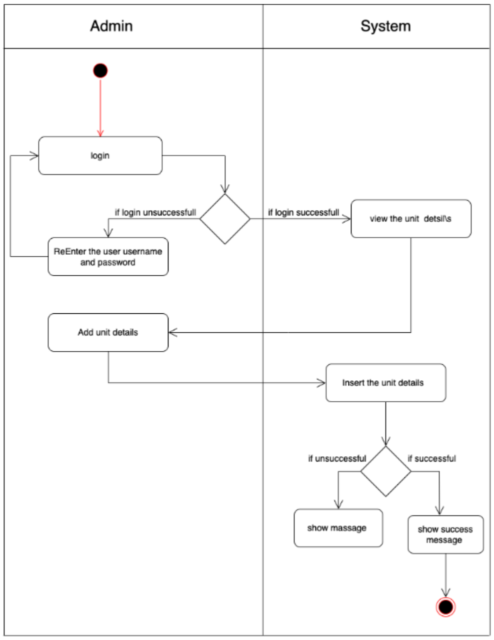
PUT http://localhost:8080/BillingService/ItemService/Items

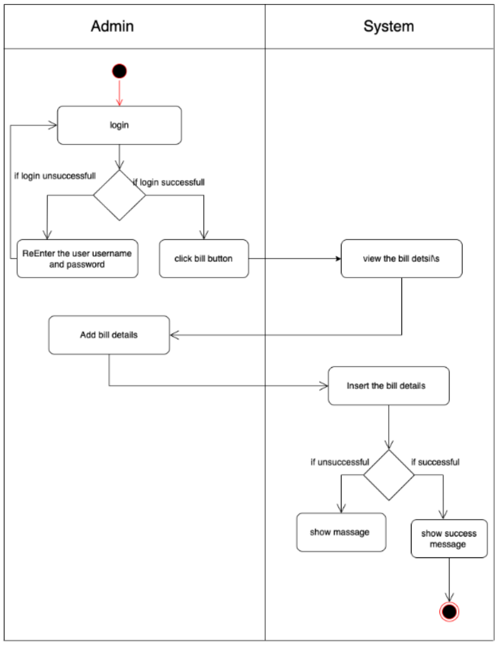
```
{
"billID" : "1",
"userID": "2",
"date":"2022.10.14",
"reading":"120"

}
```

Status: 200 OK Time: 97 ms Size: 170 B

```
Updated successfully
```

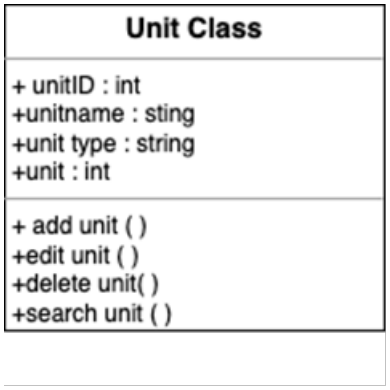
2.1. Internal Logic/ Database Design Diagrams of Units & Bill Microservice

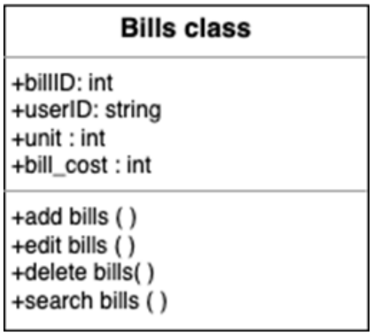




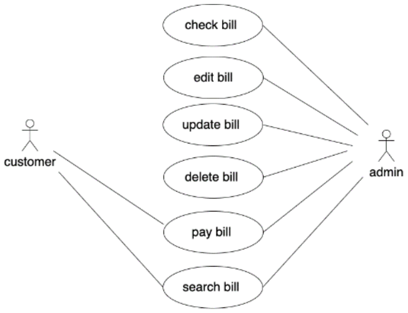
Activity diagram-Insert Unit Details

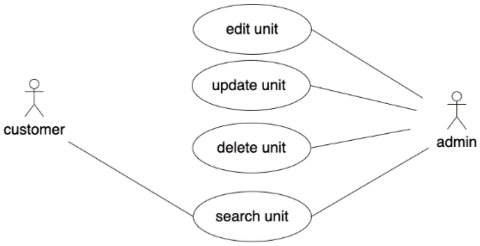
Activity diagram-Insert Bill Details



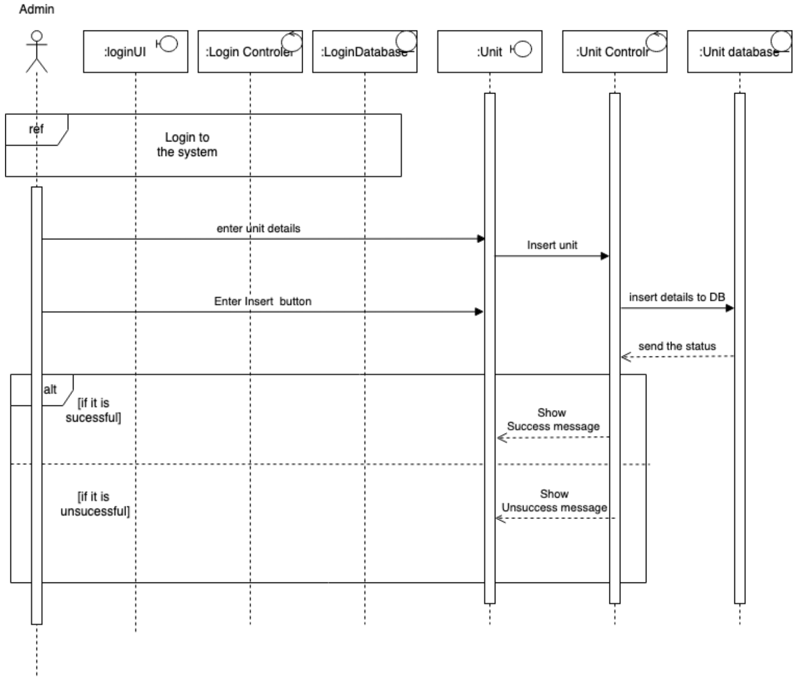


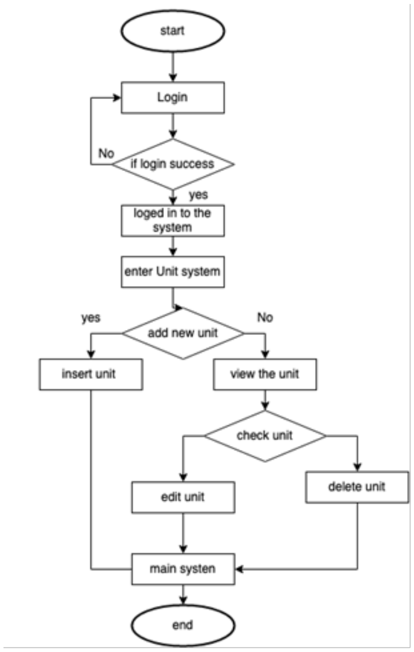
Insert Bill Details





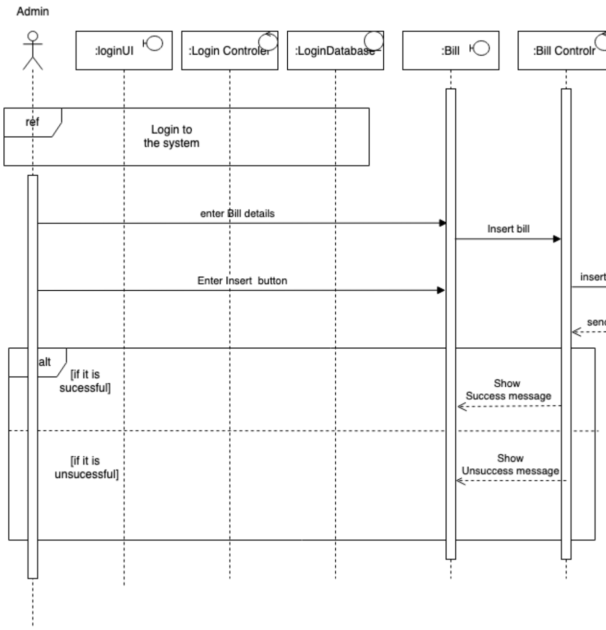
Insert Unit Details

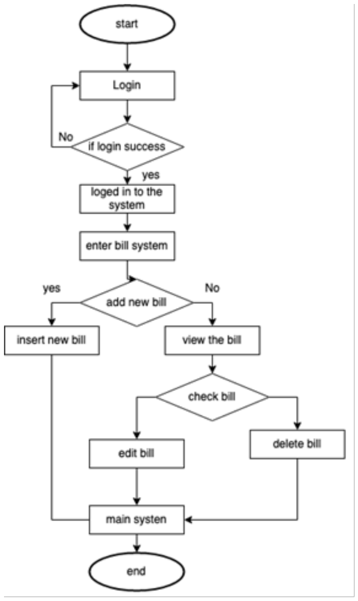




Sequence Diagram-Unit Service

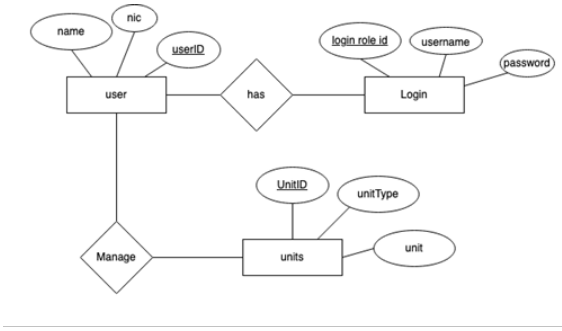
Flow chart-Unit Service

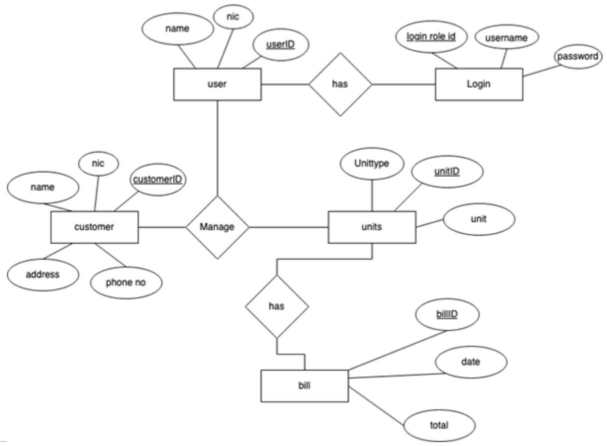




Sequence Diagram- Billing Service

Flow chart- Billing Service





ER Diagram- Unit Service

ER Diagram- Billing Service

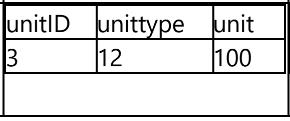
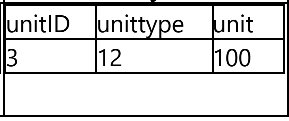
3. Service Development And Testing

3.1. Tools Used

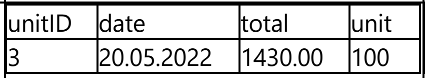
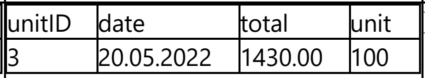
- Technologies Used : Java - JAX-RS (Jersey) on Tomcat
- IDE : Eclipse 21.12
- Database : MySQL
- Testing : POSTMAN

3.2 Testing Methodology and Results

Unit Service

Test ID	Test description	Test input	Expected output	Actual output	Result
01	Adding a new Unit details in to the DB (testing postman)	{ "unittype": "12", "unit": "120" }	{ "unittype": "12", "unit": "120" }	{ "unittype": "12", "unit": "120" }	Pass
02	Update the unit details it show the success message.	{ "unittype": "12", "unit": "100" }	{ "unittype": "12", "unit": "100" }	{ "unittype": "12", "unit": "100" }	Pass
03	Delete the account using the particular Unitid	<unitId>1</unitId>	Show Message as " Deleted Successfully"	Unit Details was Deleted Message : " Deleted Successfully"	Pass
04	Display the details from the entering the UnitID.	{ "unittype": "12", "unit": "100" }	 unitID unittype unit 3 12 100	 unitID unittype unit 3 12 100	Pass

Billing Service

est ID	Test descr T iption	Test input	Expected output	Actual output	Result
01	Adding a new Bill details in to the DB (testing postman)	{ "date": "12.05.2022", "total": "1430.00""unit": "120" }	{ "date": "12.05.2022", "total": "1430.00""unit": "120" }	{ "date": "12.05.2022", "total": "1430.00""unit": "120" }	Pass
02	Update the Bill details it show the success message. (change the date)	{ "date": "20.05.2022", "total": "1430.00""unit": "120" }	{ "date": "20.05.2022", "total": "1430.00""unit": "120" }	{ "date": "20.05.2022", "total": "1430.00""unit": "120" }	Pass
03	Delete the account using the particular Billid.	<billId>1</billId>	Show Message as " Deleted Successfully"	Unit Details was Deleted Message : " Deleted Successfully"	Pass
04	Display the details from the entering the Billid.	{ "date": "20.05.2022", "total": "1430.00""unit": "120" }	 unitID date total unit 3 20.05.2022 1430.00 100	 unitID date total unit 3 20.05.2022 1430.00 100	Pass

Student No :	IT20110734
Student Name :	O.G.K.G Perera
Microservice:	Admin Microservice

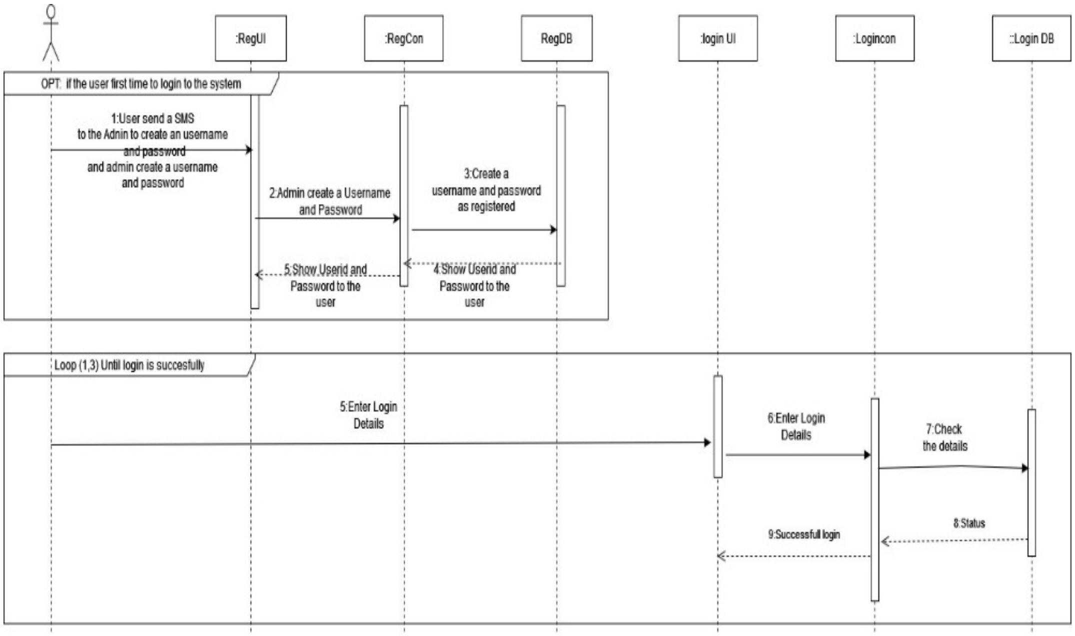
Service Design

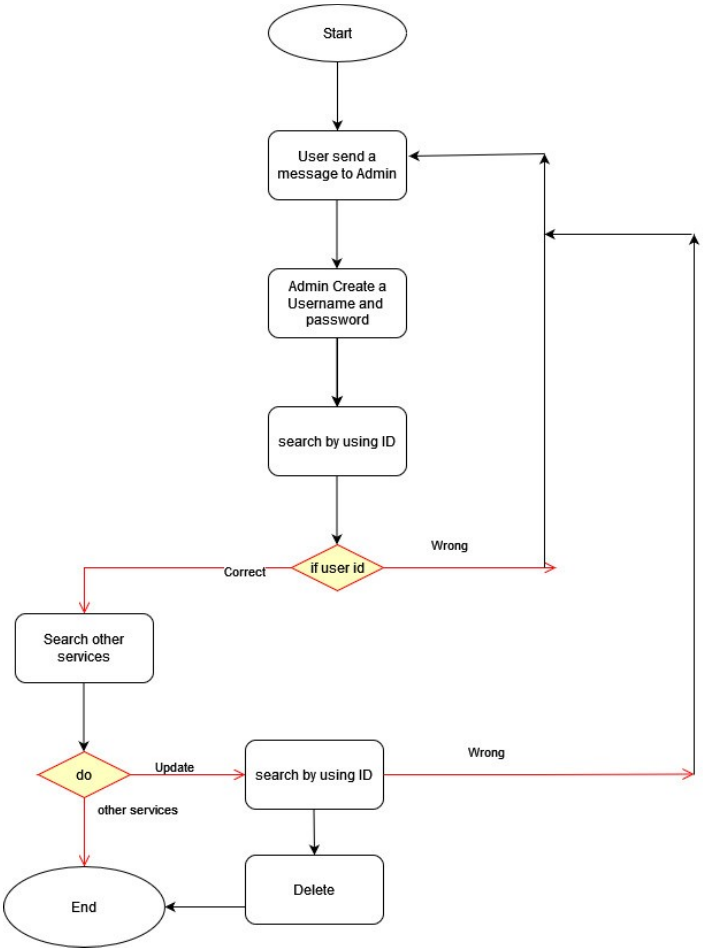
1.API Design Rationale

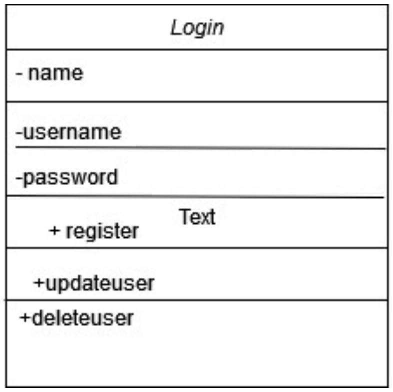
Rationale The Funding body is an important section in this PoweGrid innovative project Electricity system. User can register using login if the user is new to the system they can signup and made an account.

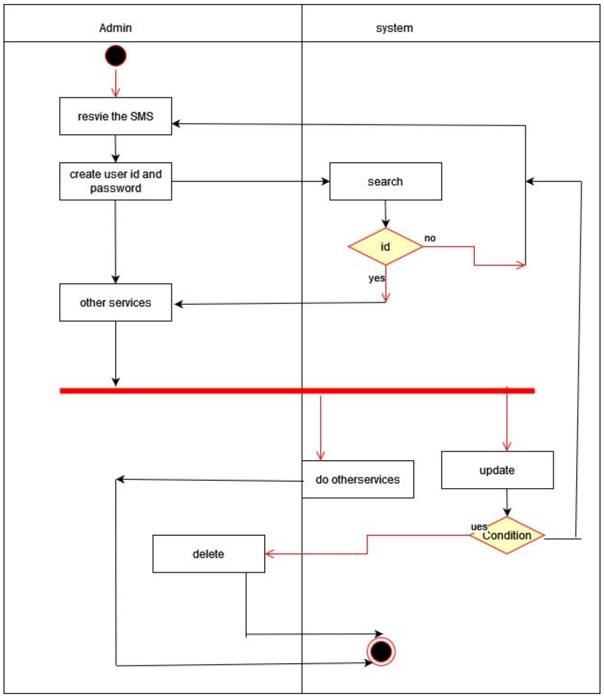
- Users can register using login id user is the new for the system they can sign up from the system.
- Admin can update their profile details.
- Admin can view their profile details using user ID.
- Admin can delete their user.

2.Internal logic of Admin Microservice


:RegUI
:RegCon
RegDB
:login UI
:Logincon
::Login DB
OPT: if the user first time to login to the system
1:User send a SMS to the Adnin to create an username and password and admin create a username and password
2:Admin create a Username and Password
3:Create a username and password as registered
4:Show Userid and Password to the user
5:Show Userid and Password to the user
Loop (1,3) Until login is succesfully
5:Enter Login Details
6:Enter Login Details
7:Check the details
8:Status
9:Successfull login


Start
User send a message to Admin
Admin Create a Username and password
search by using ID
if user id
Wrong
Correct
Search other services
do
Update
search by using ID
Wrong
other services
Delete
End


Login
- name
-username
-password
+ register
Text
+updateuser
+deleteuser


Admin
system
resvie the SMS
create user id and password
search
id
no
yes
other services
do otherservices
update
ues
Condition
delete

3.Service Development And Testing

3.1.Tools Used

- Technologies Used : Java - JAX-RS (Jersey) on Tomcat
- IDE : Eclipse 21.12
- Database : MySQL
- Testing : POSTMAN

4.Testing Methodology and Results

Test ID	Test description	Test input	Expected output	Actual output	Result
01	Adding a new user name and password (Register) to the Database	{ "userName": "Mahendra Costa", "password": "mahi#123", }	{ "password": "mahi#123", "regiteredAt": "A few seconds ago", "id": 8 "userName": "Mahendra Costa", , "updatedAt": null }	{ "password": "mahi#123", "regiteredAt": "A few seconds ago", "id": 8 "userName": "Mahendra Costa", , "updatedAt": null }	Pass
02	Update the user name or a password it show the successful popup message.	{ "userName": "Mahendra Munasinghe", "password": "mahendra@1343" }	{ "password": "mahendra@1343", "regiteredAt": null, "id": 8, "userName": "Mahendra Munasinghe", , "updatedAt": "A few seconds ago" }	{ "password": "mahendra@1343", "regiteredAt": null, "id": 8, "userName": "Mahendra Munasinghe", , "updatedAt": "A few seconds ago" }	Pass
03	Delete the account using the particular user id	User Id {4}	Show Message as "User Account Deleted Successfully"	User Details are Deleted Message : "Funding Body Account Deleted Successfully"	Pass
04	Display the details from the entering the Username.	{"UserName":"Mahendra Munasinghe"}	{ "password": "67hb435gf", "regiteredAt": "2021-04-24 00:29:36", "id": 1, "FullName": "Amila Sandaruwan", "email": "amila@gmail.com", "updatedAt": null },	{ "password": "67hb435gf", "regiteredAt": "2021-04-24 00:29:36", "id": 1, "Full Name": "Amila Sandaruwan", "email": "amila@gmail.com", "updatedAt": null },	Pass
05	View of the all users	View of all users	{"password": "67hb435gf", "regiteredAt": "2021-04-	{"password": "67hb435gf", "regiteredAt": "2021-04-	Pass

			24 00:29:36", "id": 1, "Full Name": "Amila Sandaruwan", "email": "amila@gmail.com", "updatedAt": null }, { "password": "mahendra@1343", "regiteredAt": "2021-04-25 16:40:43", "id": 8, "Full Name": "Mahendra Munasinghe", "email": "mahendra@gmail.com", "updatedAt": null } Etc …	24 00:29:36", "id": 1, "Full Name": "Amila Sandaruwan", "email": "amila@gmail.com", "updatedAt": null }, { "password": "mahendra@1343", "regiteredAt": "2021-04-25 16:40:43", "id": 8, "Full Name": "Mahendra Munasinghe", "email": "mahendra@gmail.com", "updatedAt": null } Etc …	

Student No:	IT20253158
Student Name:	U.R.S.N.Udapolawatta
Microservice:	User Microservice

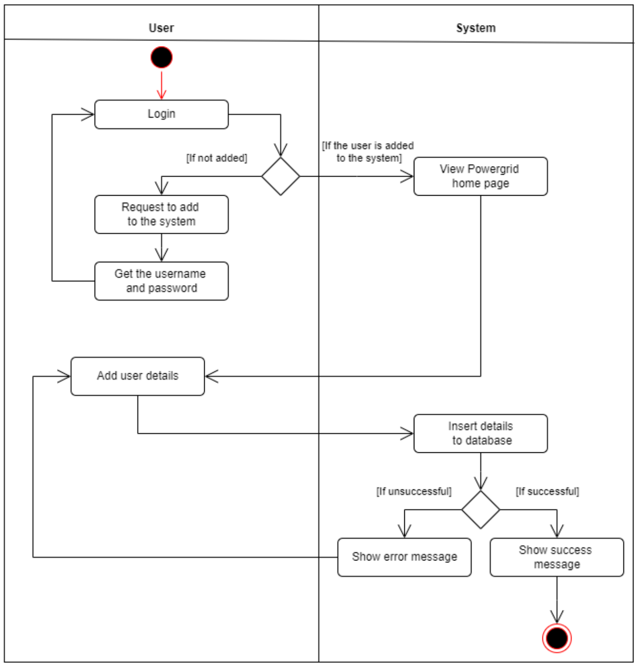
Service Design

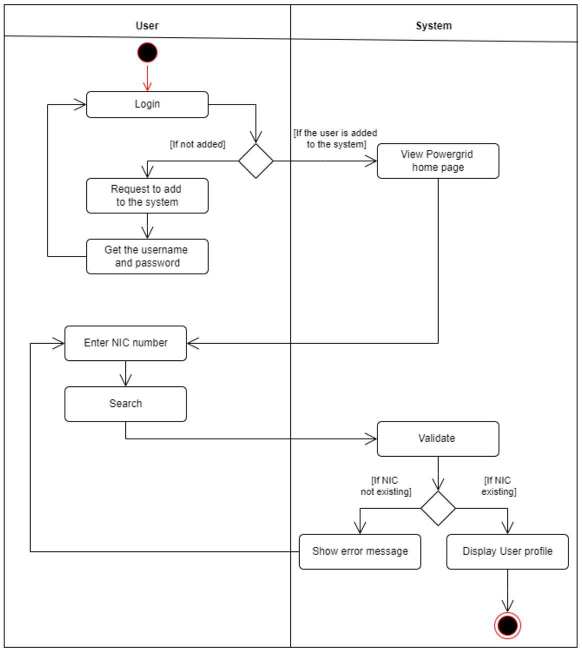
1. API Design Rationale

In this Service,

- Users can login to the system entering the username and password created by the admin.
- Users can also add and update their profile.
- Users can view their profile after they search it by id.
- Also, users can view the paid bills when search by bill id.
- Users can delete the paid bills.

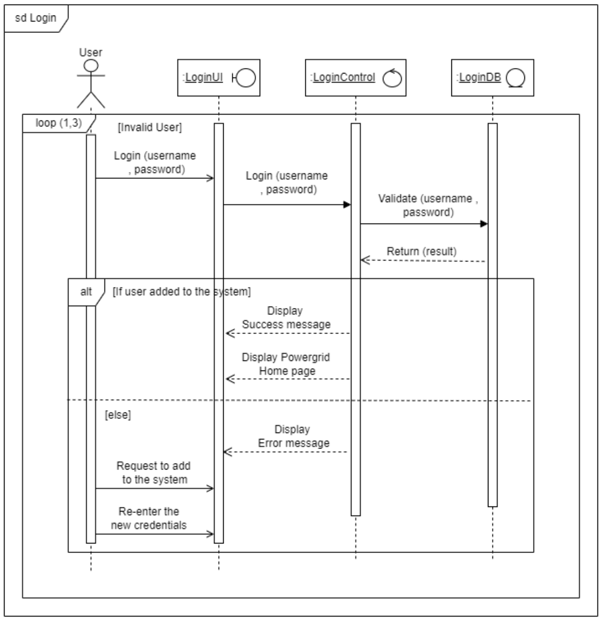
2.Internal Logic/ Database Design Diagrams of User Microservice

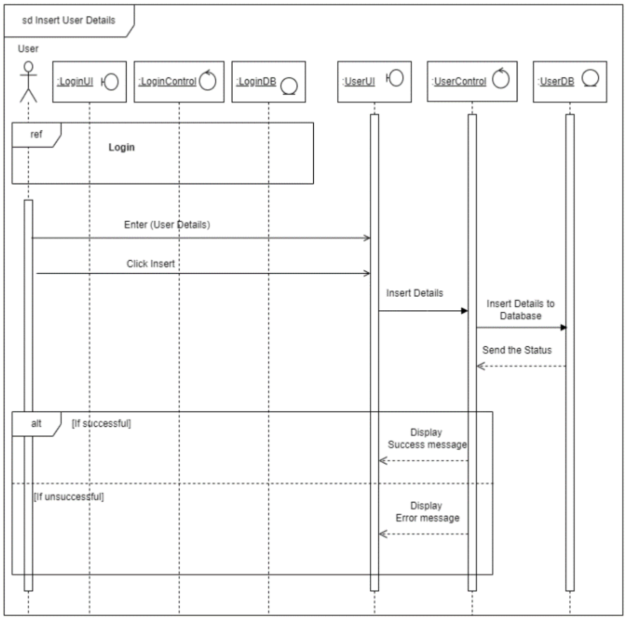




Activity Diagram - Insert User Details

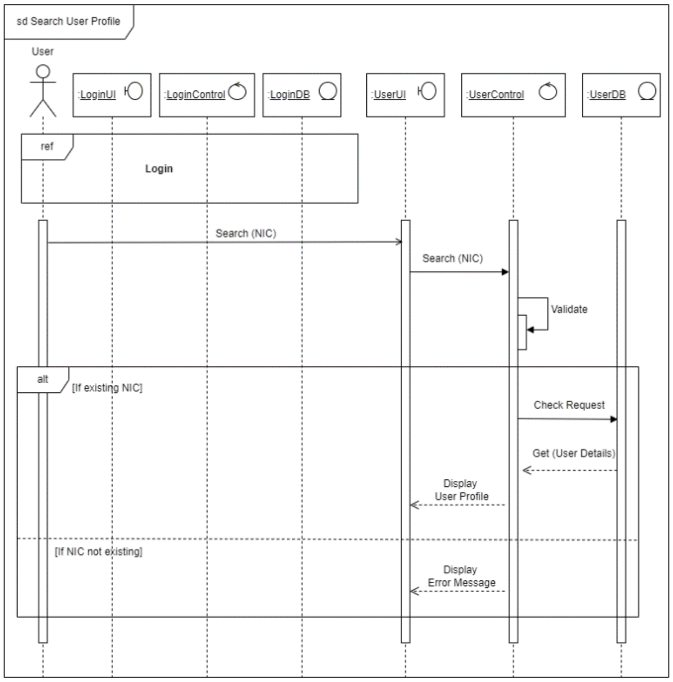
Activity Diagram – Search profile by Id


sd Login
User
:LoginUI
:LoginControl
:LoginDB
loop (1,3)
[Invalid User]
Login (username , password)
Login (username , password)
Validate (username , password)
Return (result)
alt
[If user added to the system]
Display Success message
Display Powergrid Home page
[else]
Display Error message
Request to add to the system
Re-enter the new credentials

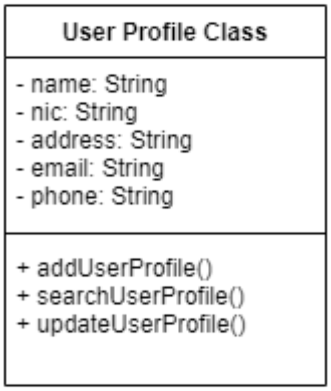


Sequence Diagram – **Login**

Sequence Diagram **-Insert User Details**



Sequence Diagram – Search User Profile



3.Service Development And Testing

3.1.Tools Used

- Technologies Used : Java - JAX-RS (Jersey) on Tomcat
- IDE : Eclipse 21.12
- Database : MySQL
- Testing : POSTMAN

3.2.Testing Methodology and Results

Test ID	U01
Description	Add user details to a new profile

Test Inputs	{
	"name": “Nimal Amarasena”,
	"nic": “8526351456V”,
	"address": "No 822/A, Mahawa Road, Kurunegala",
	"email": “nimalamara@gmail.com”,
	"phone": “0775684522”
	}

Expected Output	User details are added to the database and display result
	{
	"name": “Nimal Amarasena”,
	"nic": “8526351456V”,
	"address": "No 822/A, Mahawa Road, Kurunegala",
	"email": “nimalamara@gmail.com”,
	"phone": “0775684522”
	}

Actual Output	User details are added to the database and display result
	{
	"name": “Nimal Amarasena”,
	"nic": “8526351456V”,
	"address": "No 822/A, Mahawa Road, Kurunegala",
	"email": “nimalamara@gmail.com”,
	"phone": “0775684522”
	}

Result (Pass/Fail)	Pass

Test ID	U02
Description	Update user profile details

Test Inputs	{
	"name": “Nimal Sanju Amarasena”,
	"address": "No 822/A, Uduyaya Road, Kurunegala",
	"phone": “0714550023”
	}

Expected Output	User details are updated in the database and display result
	{
	"name": “Nimal Sanju Amarasena”,
	"nic": “8526351456V”,
	"address": "No 822/A, Uduyaya Road, Kurunegala",
	"email": “nimalamara@gmail.com”,
	"phone": “0714550023”
	}

Actual Output	User details are updated in the database and display result
	
	{
	"name": “Nimal Sanju Amarasena”,
	"nic": “8526351456V”,
	"address": "No 822/A, Uduyaya Road, Kurunegala",
	"email": “nimalamara@gmail.com”,
	"phone": “0714550023”
	}

Result (Pass/Fail)	Pass

Test ID	U03
Description	Search user profile by Id

Test Inputs	{
	“nic”:”6623884801V”
	}

Expected Output	User details are retrieved from the database and display result
	
	{
	"name": “Rasika Ranathunga”,
	“nic”:”6623884801V”,
	"address": "No 27/A, Temple Road, Dehiwala",
	"email": “rasikarr@gmail.com”,
	"phone": “0715521131”
	}

Actual Output	User details are retrieved from the database and display result
	
	{
	"name": “Rasika Ranathunga”,
	“nic”:”6623884801V”,
	"address": "No 27/A, Temple Road, Dehiwala",
	"email": “rasikarr@gmail.com”,
	"phone": “0715521131”
	}

Result (Pass/Fail)	Pass
Test ID	U04
Description	Delete paid bills

Test Inputs	{
	“bill id “:4
	}

Expected Output	Paid bill is deleted and show result as "Successfully Deleted the Bill"
Actual Output	Paid bill is deleted and show result as "Successfully Deleted the Bill"
Result (Pass/Fail)	pass