**CAPSTONE PROJECT**

**Electricity Payment Application**

**Functional Requirements:**

1. Consumers should be able to login.
2. Consumers should be able to change the password.
3. Consumers should be able to check the electricity unit’s consumption for all their properties.
4. Consumers should be able to download the bill.
5. Consumers should be able to add or remove properties.
6. Consumers should be able to edit property address
7. Consumers should be able to edit their personal info.
8. Consumers should be able to raise a support ticket.
9. DO should be able to register Consumers.
10. DO should be able to create monthly bill for all consumer groups.
11. DO should be able to access and edit all consumer’s profile.
12. Admin should be able to register new DO’s.
13. Admin should be able to access and edit all the DOs and Consumers profile.
14. Admin should be able to access all the functionalities.
15. Application should send automated notification for abnormal usage to all the consumers
16. Application should send notification for upcoming due dates to consumers.
17. Application should send automated reminder for bill payment to all the consumers.
18. Application should send notification for successful payment to the consumer once payment is done.

**Non-functional Requirements:**

1. The system should be highly available
2. The system should be modular and highly scalable
3. The data must be consistent
4. The system should be highly reliable

**Components:**

1. Authentication and Authorization
   1. Login
   2. Register
   3. Logout
   4. Forgot Password
   5. Role and Permission
2. Dashboard
   1. User Profile
      1. User details
      2. Properties associated
   2. Consumption activity
      1. Historical usage data
      2. Usage analysis
   3. Bill activity
      1. Bill generation
      2. Bill viewing and Downloading
3. Payment
   1. Payment options
   2. Payment Gateway
4. Customer Support
   1. Ticket creation
   2. Ticket assignment
   3. Ticket status updating

**Modules:**

1. User Authentication and Authorization:

* Authentication Module: Responsible for user registration, login, and authentication processes.
* Authorization Module: Handles user roles and permissions, restricting access to specific features based on user privileges.
* Password Management Module: Deals with securely storing passwords using encryption techniques.

1. User Profile Management:

* Profile Management Module: Manages user profiles, including viewing and updating personal information.
* Property Management Module: Handles the management of user properties, allowing users to add and associate multiple properties with their profile.

1. Electricity Usage Monitoring:

* Real-time Monitoring Module: Integrates with smart meters or provides manual entry options for users to monitor their electricity usage in real-time.
* Usage Data Storage Module: Stores historical usage data for analysis and reporting purposes.
* Notification Module: Sends notifications to users for abnormal usage patterns or high consumption.

1. Bill Generation and Payment:

* Bill Generation Module: Generates bills based on user's electricity usage data and tariff rates.
* Bill Management Module: Handles the storage, retrieval, and viewing of bills, including the option to download them in PDF format.
* Payment Processing Module: Integrates with payment gateways to securely process transactions for bill payments.

1. Bill Reminders and Notifications:

* Reminder Module: Sends notifications to users for upcoming bill due dates and pending payments.
* Notification Module: Sends notifications for successful payments and bill confirmations.

1. Customer Support:

* Customer Support Module: Provides a feature for users to raise queries or report issues.
* Ticketing System Module: Manages support tickets, assigns them to relevant staff, and tracks their resolution.
* Notification Module: Sends updates to users regarding the status of their queries.

**System API’s:**

1. User Authentication and Authorization:

* Register User: (POST) /api/users
* User Login: (POST) /api/login
* Define User Roles and Permissions: (POST) /api/roles
* Check User Access: (GET) /api/access

1. User Profile Management:

* Get User Profile: (GET) /api/profile/{userId}
* Update User Profile: (PUT) /api/profile/{userId}
* Add Property to User Profile: (POST) /api/profile/{userId}/properties

1. Electricity Usage Monitoring:

* Get Real-time Usage: (GET) /api/usage/{userId}/real-time
* Submit Manual Usage Entry: (POST) /api/usage/{userId}/manual-entry
* Get Historical Usage Data: (GET) /api/usage/{userId}/history

1. Bill Generation and Payment:

* Generate Bill: (POST) /api/bills
* View Bill: (GET) /api/bills/{billId}
* Download Bill (PDF): (GET) /api/bills/{billId}/pdf
* Make Payment: (POST) /api/payments
* Get Payment Options: (GET) /api/payments/options

1. Bill Reminders and Notifications:

* Send Bill Due Date Notification: (POST) /api/notifications/bill-due
* Send Payment Reminder Notification: (POST) /api/notifications/payment-reminder
* Send Payment Confirmation Notification: (POST) /api/notifications/payment-confirmation

1. Customer Support:

* Raise Support Query: (POST) /api/support/queries
* Assign Support Ticket: (POST) /api/support/tickets/{ticketId}/assign
* Get Query Status: (GET) /api/support/queries/{queryId}/status

**Design Considerations:**

1. SQL Database – Consistent Hashing across distributed servers
2. Load Balancing – Regional Load Balancer
3. IoT Platform for handling the Incoming data from Smart Meter, Analytics and storing in DB