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1. **Python Programming Language**: Python is a high-level, interpreted programming language known for its readability and simplicity. It supports multiple programming paradigms, including procedural, object-oriented, and functional programming. Python is widely used for web development, data analysis, artificial intelligence, scientific computing, and more.
2. **Django Framework**: Django is a high-level Python web framework that encourages rapid development and clean, pragmatic design. It follows the Model-View-Controller (MVC) architectural pattern and provides an ORM for database interactions, a templating engine for rendering views, and a robust set of tools for managing web applications.

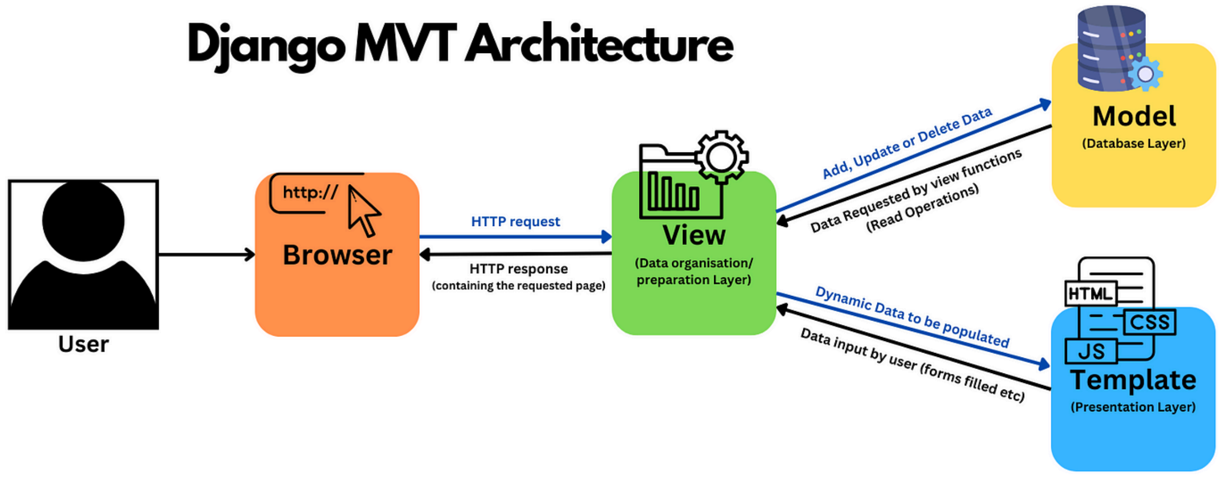

Django MVT Architecture
User
http://
Browser
HTTP request
HTTP response
(containing the requested page)
View
(Data organisation/ preparation Layer)
Add, Update or Delete Data
Data Requested by view functions (Read Operations)
Model
(Database Layer)
Dynamic Data to be populated
Data input by user (forms filled etc)
HTML
CSS
JS
Template
(Presentation Layer)

Fig: Django Framework Flow

3. **JWT Authentication (Simple JWT Library in Python)**: JSON Web Token (JWT) is an open standard for securely transmitting information between parties as a JSON object. Simple JWT is a Python library that provides a JSON Web Token authentication backend

for Django. It allows for stateless, token-based authentication, making it suitable for RESTful APIs.

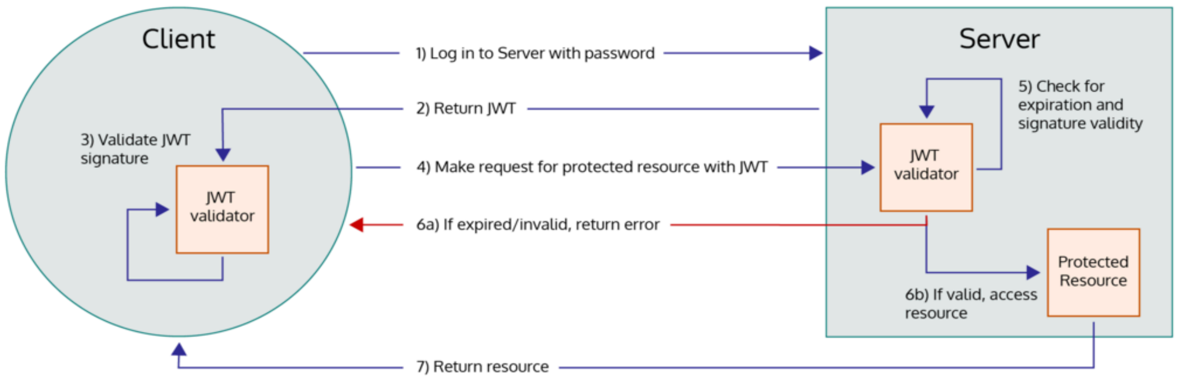

Client
Server
1) Log in to Server with password
2) Return JWT
3) Validate JWT signature
JWT validator
4) Make request for protected resource with JWT
5) Check for expiration and signature validity
JWT validator
6a) If expired/invalid, return error
6b) If valid, access resource
Protected Resource
7) Return resource

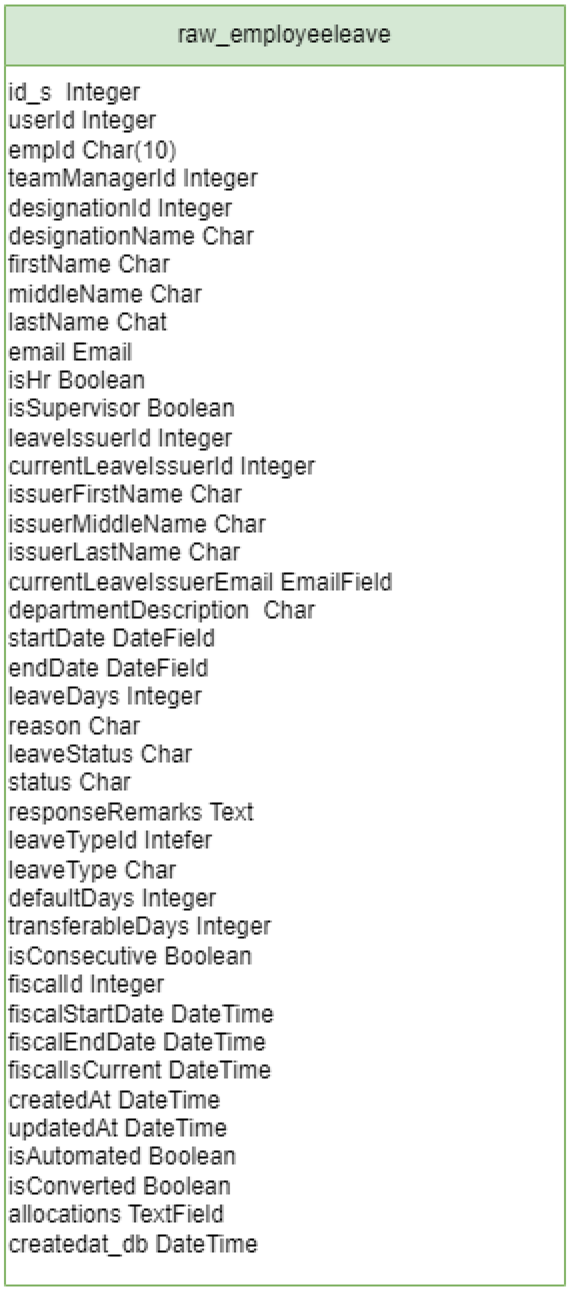
Fig: JWT Authentication

4. **Draw.io**: Draw.io is a web-based diagramming tool that allows users to create flowcharts, network diagrams, UML diagrams, and other types of visual representations. It offers a wide range of shapes, icons, and templates, and supports real-time collaboration.
5. **Google Sheet**: Google Sheets is a web-based spreadsheet application provided by Google. It allows users to create, edit, and collaborate on spreadsheets online. It supports functions, formulas, charts, and various data visualization tools, and can be integrated with other Google services and APIs.
6. **Google Docs**: Google Docs is a web-based word processing application provided by Google. It allows users to create, edit, and collaborate on documents online. Google Docs supports real-time collaboration, rich text formatting, and integration with other Google services and third-party applications.
7. **JavaScript for Visualization (Chart.js and D3.js)**:
    - **Chart.js**: Chart.js is a simple, yet flexible JavaScript charting library. It provides easy-to-use options for creating various types of charts, such as bar, line, pie, and doughnut charts. Chart.js is known for its simplicity and ease of integration with web applications.
    - **D3.js**: D3.js (Data-Driven Documents) is a powerful JavaScript library for creating dynamic and interactive data visualizations in web browsers. It uses web standards such as SVG, HTML, and CSS to bring data to life. D3.js is highly customizable and allows developers to create complex visualizations with precision.
8. **PostgreSQL(Database)**

PostgreSQL is a powerful, open-source object-relational database system known for its reliability, feature robustness, and performance. It is used in this project to handle data storage, complex queries. The project leverages PostgreSQL for its relational database needs, ensuring efficient and scalable data management.

Raw Table

In the below raw table the data from API or the bulk upload is fetched and stored as it is.


raw_employeeleave

id_s Integer
userId Integer
empId Char(10)
teamManagerId Integer
designationId Integer
designationName Char
firstName Char
middleName Char
lastName Chat
email Email
isHr Boolean
isSupervisor Boolean
leaveIssuerId Integer
currentLeaveIssuerId Integer
issuerFirstName Char
issuerMiddleName Char
issuerLastName Char
currentLeaveIssuerEmail EmailField
departmentDescription Char
startDate DateField
endDate DateField
leaveDays Integer
reason Char
leaveStatus Char
status Char
responseRemarks Text
leaveTypeId Intefer
leaveType Char
defaultDays Integer
transferableDays Integer
isConsecutive Boolean
fiscalId Integer
fiscalStartDate DateTime
fiscalEndDate DateTime
fiscalIsCurrent DateTime
createdAt DateTime
updatedAt DateTime
isAutomated Boolean
isConverted Boolean
allocations TextField
createdat_db DateTime

Fig:Raw table

The above raw table is created from the Django Model.

```
Class EmployeeLeave(models.Model):
    id_s = models.IntegerField(null=True)
    userId = models.IntegerField(null=True)
    empId = models.CharField(max_length=10, null=True)
    teamManagerId = models.IntegerField(null=True)
    designationId = models.IntegerField(null=True)
    designationName = models.CharField(max_length=100, null=True)
    firstName = models.CharField(max_length=100, null=True)
    middleName = models.CharField(max_length=100, null=True)
    lastName = models.CharField(max_length=100, null=True)
    email = models.EmailField(null=True)
    isHr = models.BooleanField(null=True)
    isSupervisor = models.BooleanField(null=True)
    leaveIssuerId = models.IntegerField(null=True)
    currentLeaveIssuerId = models.IntegerField(null=True)
    issuerFirstName = models.CharField(max_length=100, null=True)
    issuerMiddleName = models.CharField(max_length=100, null=True)
    issuerLastName = models.CharField(max_length=100, null=True)
    currentLeaveIssuerEmail = models.EmailField(null=True)
    departmentDescription = models.TextField(null=True)
    startDate = models.DateField(null=True)
    endDate = models.DateField(null=True)
    leaveDays = models.IntegerField(null=True)
    reason = models.TextField(null=True)
    leaveStatus = models.CharField(max_length=20, null=True)
    status = models.CharField(max_length=20, null=True)
    responseRemarks = models.TextField(null=True)
    leaveTypeId = models.IntegerField(null=True)
    leaveType = models.CharField(max_length=50, null=True)
    defaultDays = models.IntegerField(null=True)
    transferableDays = models.IntegerField(null=True)
    isConsecutive = models.BooleanField(null=True)
    fiscalId = models.IntegerField(null=True)
    fiscalStartDate = models.DateTimeField(null=True)
    fiscalEndDate = models.DateTimeField(null=True)
    fiscalIsCurrent = models.BooleanField(null=True)
    createdAt = models.DateTimeField(null=True)
    updatedAt = models.DateTimeField(null=True)
    isAutomated = models.BooleanField(null=True)
    isConverted = models.BooleanField(null=True)
    allocations = models.TextField(null=True)
    createdat_db = models.DateTimeField(null=True)
    def __str__(self):
        return f"{self.firstName} {self.lastName} - {self.leaveType}"
```

Processed Table ER diagram

In the below processed ER diagram , the data from above raw table is normalized and merged inserted into the below tables

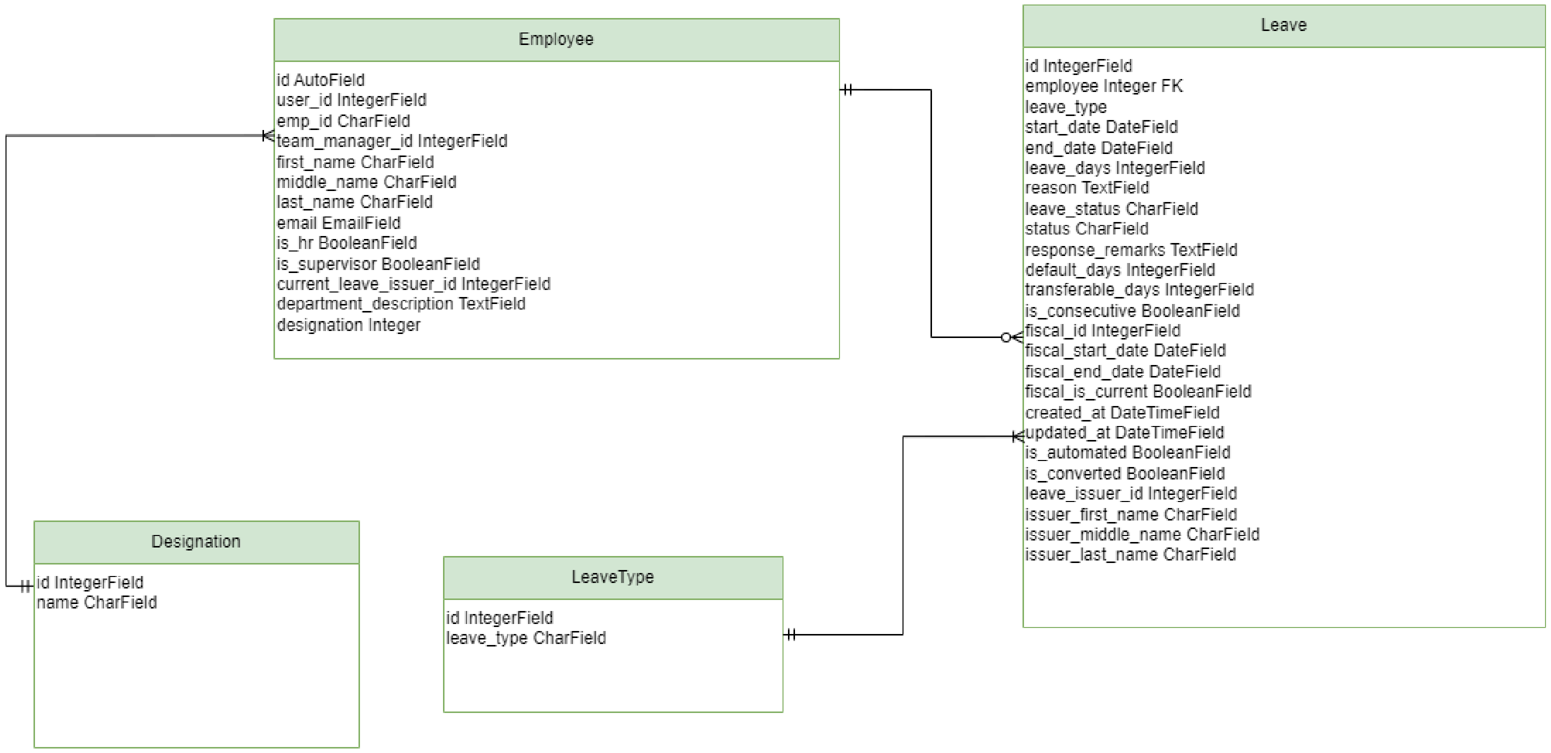


Fig: Entity Relationship Diagram

The above tables in the postgreSQL is created from the Django model.The list of django model for the above tables are:

```
class Designation(models.Model):
    id = models.IntegerField(primary_key=True)
    name = models.CharField(max_length=100)

    def __str__(self):
        return self.name

class LeaveType(models.Model):
    id = models.IntegerField(primary_key=True)
    leave_type = models.CharField(max_length=100)

    def __str__(self):
        return self.name
```

```python
class Employee(models.Model):
    id = models.AutoField(primary_key=True)
    user_id = models.IntegerField()
    emp_id = models.CharField(max_length=20, blank=True,unique=True)
    team_manager_id = models.IntegerField(blank=True,default=None)
    first_name = models.CharField(max_length=100, blank=True)
    middle_name = models.CharField(max_length=100, null=True, blank=True)
    last_name = models.CharField(max_length=100, blank=True)
    email = models.EmailField(unique=True, blank=True)
    is_hr = models.BooleanField(blank=True)
    is_supervisor = models.BooleanField(blank=True)
    current_leave_issuer_id = models.IntegerField(default=None,null=True,blank=True)
    current_leave_issuer_email = models.EmailField(default='unknown@unknown.com')  # Provide a
           default value here
    department_description = models.TextField(default=None)
    designation = models.ForeignKey(Designation, on_delete=models.CASCADE)

    def __str__(self):
        return f'{self.first_name} {self.last_name}'

class Leave(models.Model):
    id = models.IntegerField(primary_key=True)
    employee = models.ForeignKey(Employee,to_field='emp_id', on_delete=models.CASCADE)
    leave_type= models.ForeignKey(LeaveType, on_delete=models.CASCADE)
    start_date = models.DateField()
    end_date = models.DateField()
    leave_days = models.IntegerField()
    reason = models.TextField()
    leave_status = models.CharField(max_length=50)
    status = models.CharField(max_length=50)
    response_remarks = models.TextField(null=True, blank=True)
    default_days = models.IntegerField()
    transferable_days = models.IntegerField()
    is_consecutive = models.BooleanField()
    fiscal_id = models.IntegerField()
    fiscal_start_date = models.DateField()
    fiscal_end_date = models.DateField()
    fiscal_is_current = models.BooleanField()
    created_at = models.DateTimeField()
    updated_at = models.DateTimeField()
    is_automated = models.BooleanField()
    is_converted = models.BooleanField()
    leave_issuer_id = models.IntegerField(blank=True)
    issuer_first_name = models.CharField(max_length=100,blank=True)
    issuer_middle_name = models.CharField(max_length=100, null=True, blank=True)
    issuer_last_name = models.CharField(max_length=100,blank=True)

    def __str__(self):
        return f'{self.leave_type} ({self.start_date} to {self.end_date})'
```

API data upload

The data is fetched from the given API passed through the .env variable . The data is fetched asynchronously making use of the python library `asyncio` and defining the function as async and using await to wait for all the data from the API.
The given API
`API_URL=https://dev.vyaguta.lftechnology.com.np/api/leave/leaves?fetchType=all&startDate=2024-04-23&endDate=2024-07-30&size=10000000&roleType=issuer
`
is broken down in several API by dividing the startDate and endDate in a three month gap and making the API request asynchronously .

After the data is fetched from the API , it is bulk inserted into the `raw_employeeleave` table along with the date of insertion.
After that data is successfully inserted in the raw table , then it runs the script from the application to normalize the data. Basically , it first filters the data from the date of insertion (i.e don't make any operation to older data) and then merges insert into the other normalized table.

Scripts 1:

```
    -- Insert filtered results from source_table to destination_table
    INSERT INTO apidataupload_designation(id, name)
    SELECT DISTINCT "designationId", "designationName"
    FROM apidataupload_employeeleave a
    WHERE a."designationId" NOT IN
    (
        SELECT DISTINCT "designationId" FROM apidataupload_designation
    );
```

Script 2:

```
-- Insert filtered results from source_table to destination_table
MERGE INTO apidataupload_employee AS employee
USING (SELECT DISTINCT "userid",
                       "empid",
                       "teammanagerid",
                       "designationid",
                       "firstname",
                       "middlename",
                       "lastname",
                       "email",
                       "ishr",
                       "issupervisor",
                       "currentleaveissuerid",
                       "currentleaveissueremail",
                       "departmentdescription"
       FROM   apidataupload_employeeleave el
       WHERE  el."createdat_db" >= %s) a
ON employee."user_id" = a."userId"
WHEN NOT matched THEN
  INSERT (user_id,
          emp_id,
          team_manager_id,
          designation_id,
          first_name,
          middle_name,
          last_name,
          email,
          is_hr,
          is_supervisor,
          current_leave_issuer_id,
          current_leave_issuer_email,
          department_description)
  VALUES ("userid",
          "empid",
          "teammanagerid",
          "designationid",
          "firstname",
          "middlename",
          "lastname",
          "email",
          "ishr",
          "issupervisor",
          "currentleaveissuerid",
          "currentleaveissueremail",
          "departmentdescription")
WHEN matched THEN
  UPDATE SET team_manager_id = a."teamManagerId",
             designation_id = a."designationId",
             first_name = a."firstName",
             middle_name = a."middleName",
             last_name = a."lastName",
             email = a."email",
             is_hr = a."isHr",
             is_supervisor = a."isSupervisor",
             current_leave_issuer_id = a."currentLeaveIssuerId",
             current_leave_issuer_email = a."currentLeaveIssuerEmail",
             department_description = a."departmentDescription";
```

Script 3:

```
-- Insert filtered results from source_table to destination_table
MERGE INTO apidataupload_leave AS l
USING (SELECT DISTINCT "id_s",
                       "empid",
                       "leaveissuerid",
                       "issuerfirstname",
                       "issuermiddlename",
                       "issuerlastname",
                       "startdate",
                       "enddate",
                       "leavedays",
                       "reason",
                       "leavestatus",
                       "status",
                       "responseremarks",
                       "leavetypeid",
                       "defaultdays",
                       "transferabledays",
                       "isconsecutive",
                       "fiscalid",
                       "fiscalstartdate",
                       "fiscalenddate",
                       "fiscaliscurrent",
                       "createdat",
                       "updatedat",
                       "isautomated",
                       "isconverted"
       FROM   apidataupload_employeeleave el
       WHERE  el."createdat_db" >= %s) a
```

```
ON l."id" = a."id_s"
WHEN NOT matched THEN
  INSERT ( "id",
           "employee_id",
           "leave_issuer_id",
           "issuer_first_name",
           "issuer_middle_name",
           "issuer_last_name",
           "start_date",
           "end_date",
           "leave_days",
           "reason",
           "leave_status",
           "status",
           "response_remarks",
           "leave_type_id",
           "default_days",
           "transferable_days",
           "is_consecutive",
           "fiscal_id",
           "fiscal_start_date",
           "fiscal_end_date",
           "fiscal_is_current",
           "created_at",
           "updated_at",
           "is_automated",
           "is_converted" )
  VALUES ( "id_s",
           "empid",
           "leaveissuerid",
           "issuerfirstname",
           "issuermiddlename",
           "issuerlastname",
           "startdate",
           "enddate",
           "leavedays",
           "reason",
           "leavestatus",
           "status",
           "responseremarks",
           "leavetypeid",
           "defaultdays",
           "transferabledays",
           "isconsecutive",
           "fiscalid",
           "fiscalstartdate",
           "fiscalenddate",
           "fiscaliscurrent",
           "createdat",
           "updatedat",
           "isautomated",
           "isconverted" )
WHEN matched THEN
  UPDATE SET "id" = a."id_s",
             "employee_id" = a."empId",
             "leave_issuer_id" = a."leaveIssuerId",
             "issuer_first_name" = a."issuerFirstName",
             "issuer_middle_name" = a."issuerMiddleName",
             "issuer_last_name" = a."issuerLastName",
             "start_date" = a."startDate",
             "end_date" = a."endDate",
             "leave_days" = a."leaveDays",
             "reason" = a."reason",
             "leave_status" = a."leaveStatus",
             "status" = a."status",
             "response_remarks" = a."responseRemarks",
             "leave_type_id" = a."leaveTypeId",
             "default_days" = a."defaultDays",
             "transferable_days" = a."transferableDays",
             "is_consecutive" = a."isConsecutive",
             "fiscal_id" = a."fiscalId",
             "fiscal_start_date" = a."fiscalStartDate",
             "fiscal_end_date" = a."fiscalEndDate",
             "fiscal_is_current" = a."fiscalIsCurrent",
             "created_at" = a."createdAt",
             "updated_at" = a."updatedAt",
             "is_automated" = a."isAutomated",
             "is_converted" = a."isConverted";
```

Script 4:

```
-- Insert filtered results from source_table to destination_table
merge INTO apidataupload_leavetype AS lt
USING (SELECT DISTINCT "leavetypeid",
                       "leavetype"
       FROM   apidataupload_employeeleave el
       WHERE  el."createdat_db" >= %s) a
ON lt."id" = a."leaveTypeId"
WHEN NOT matched THEN
  INSERT ( "id",
           "leave_type" )
  VALUES ( "leavetypeid",
           "leavetype" )
WHEN matched THEN
  UPDATE SET "id" = a."leaveTypeId",
             "leave_type" = a."leaveType";
```

Bulk Data Upload

The user can make bulk data upload of a .csv or .xlsx file . It calls the API to upload the data and make the chunk of data and asynchronously insert into the database raw table.
After it inserts the data into the raw table , it makes use of similar SQL scripts as above to normalize the data.

Visualization

The javascript library chart.js is used for visualization.Since chart.js has limited charts , I also made use of the D3.js visualization library.

Since javascript is used , all the I/O operation is asynchronous. It renders all the visualization individually and does not wait for other visualization to complete.
Each visualization makes use of different API calls , so every visualization is rendered from their own API call.

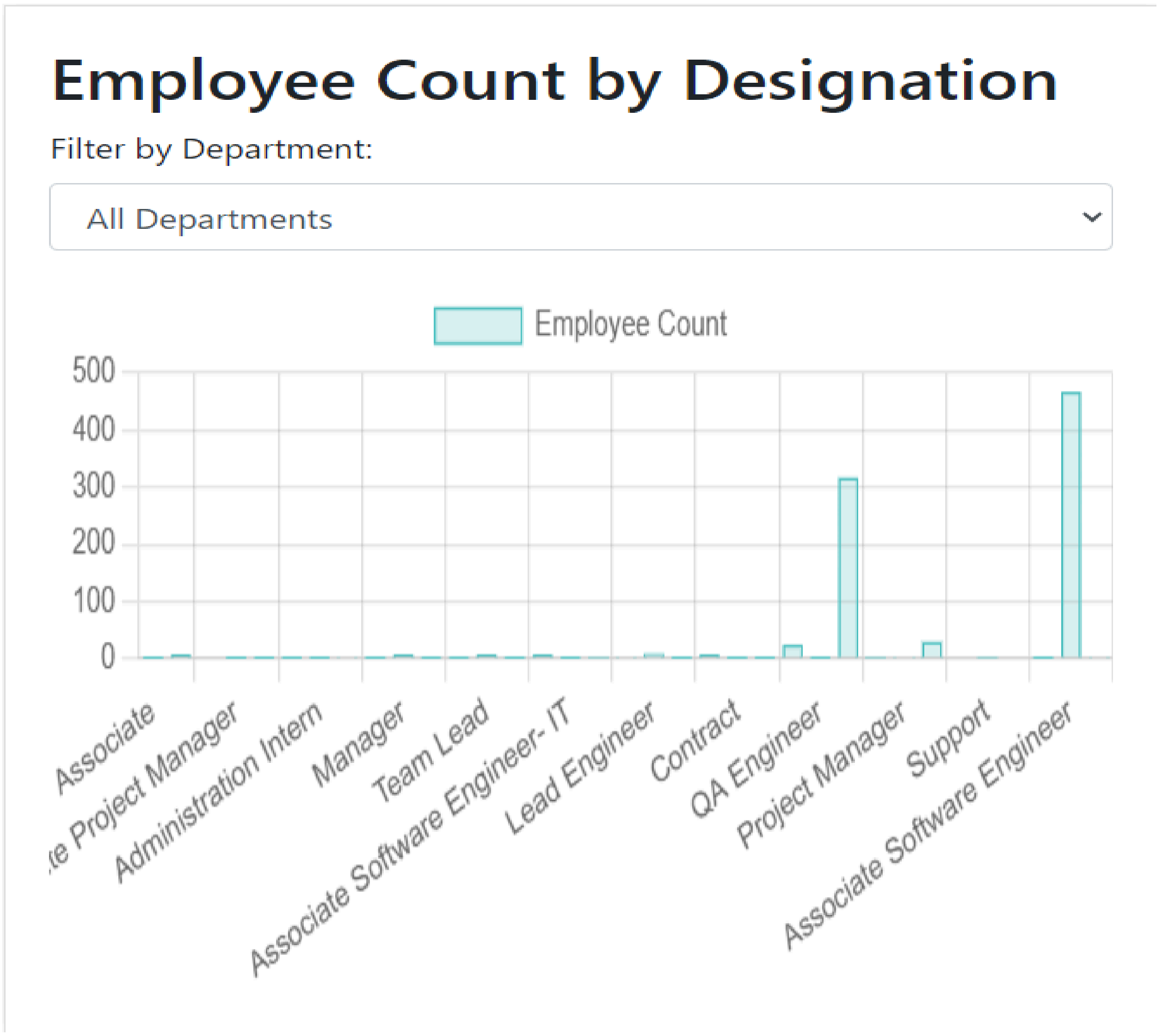


Fig 3: Employee Count by Designation

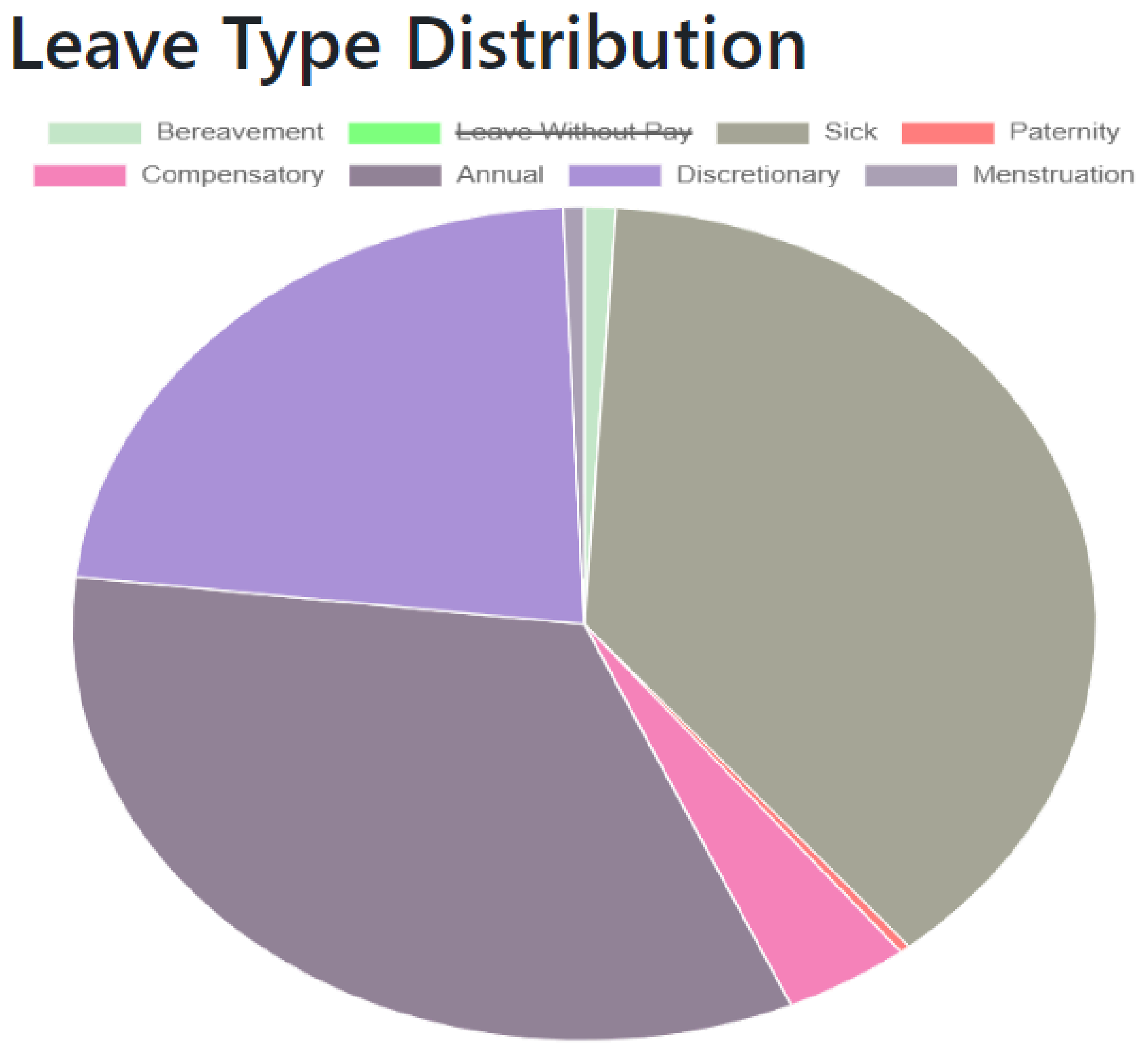
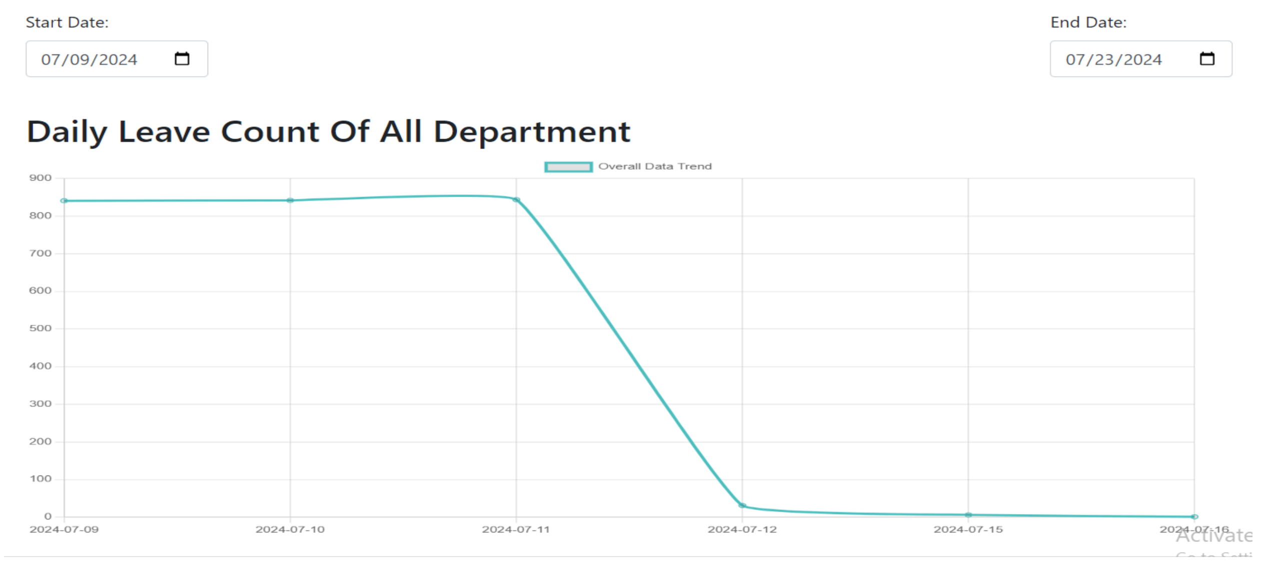


Fig 4: Leave Type Distribution

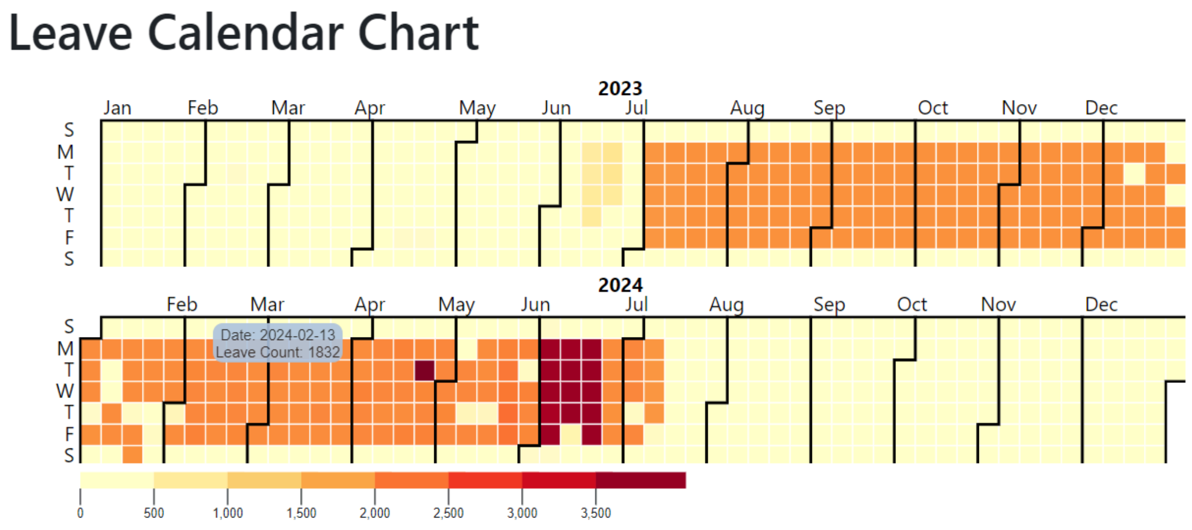


Start Date: 07/09/2024

End Date: 07/23/2024

Daily Leave Count Of All Department

Fig 6: Daily Leave Data Trend



Leave Calendar Chart

Fig: Calendar Chart

Application Screenshot

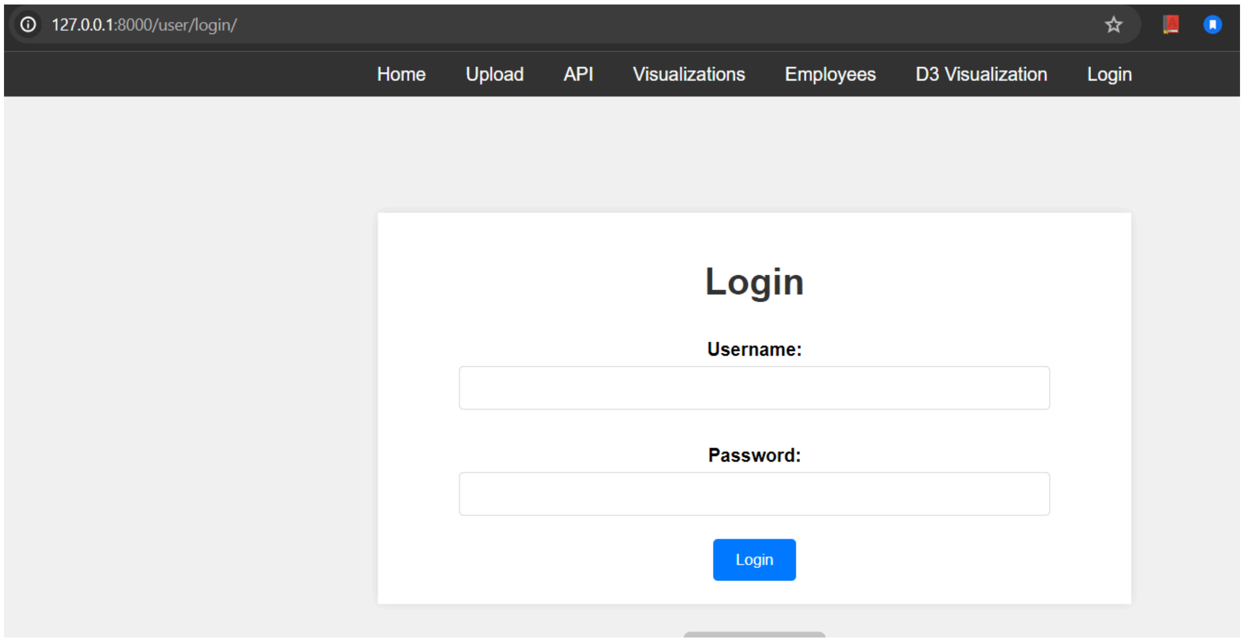


Fig: Login page

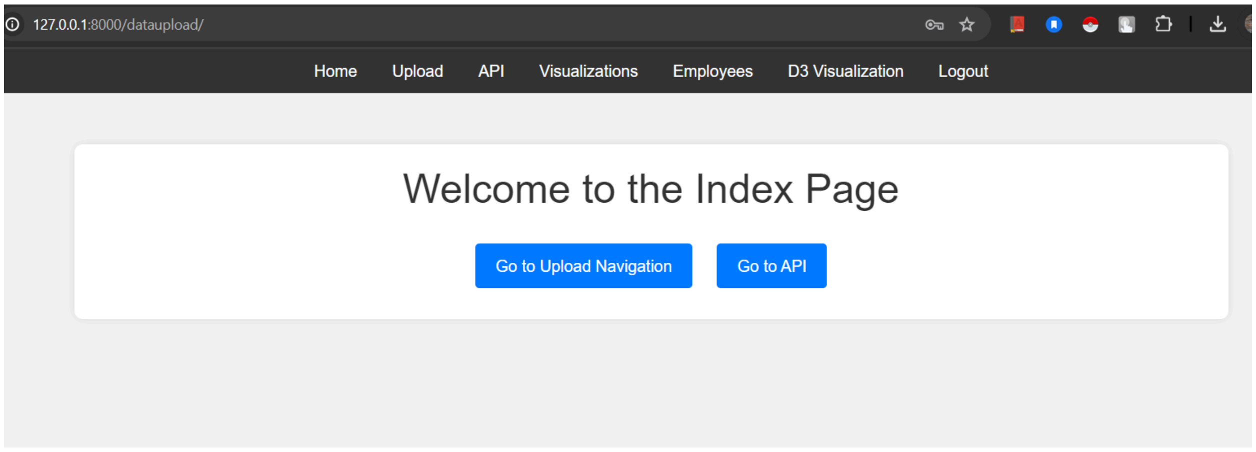


Fig: Home page

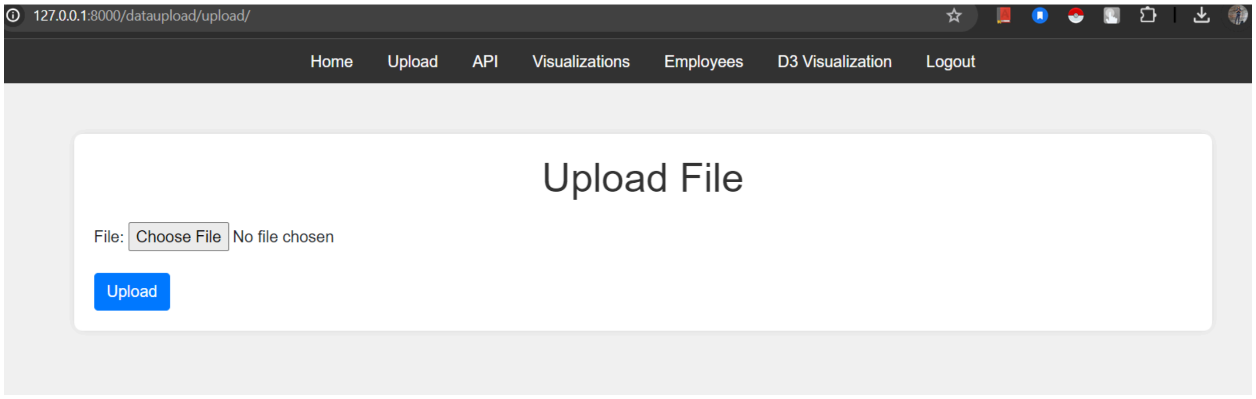


Fig: CSV upload page to DB

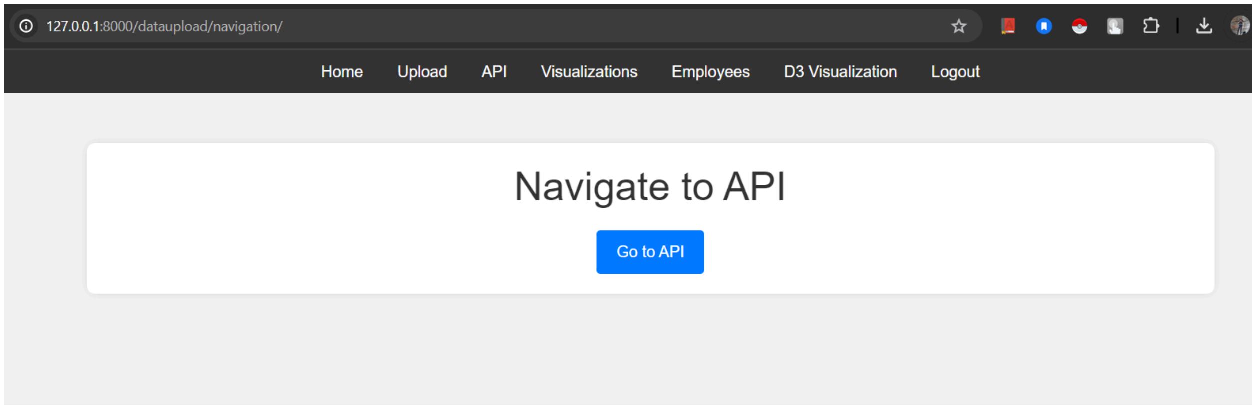
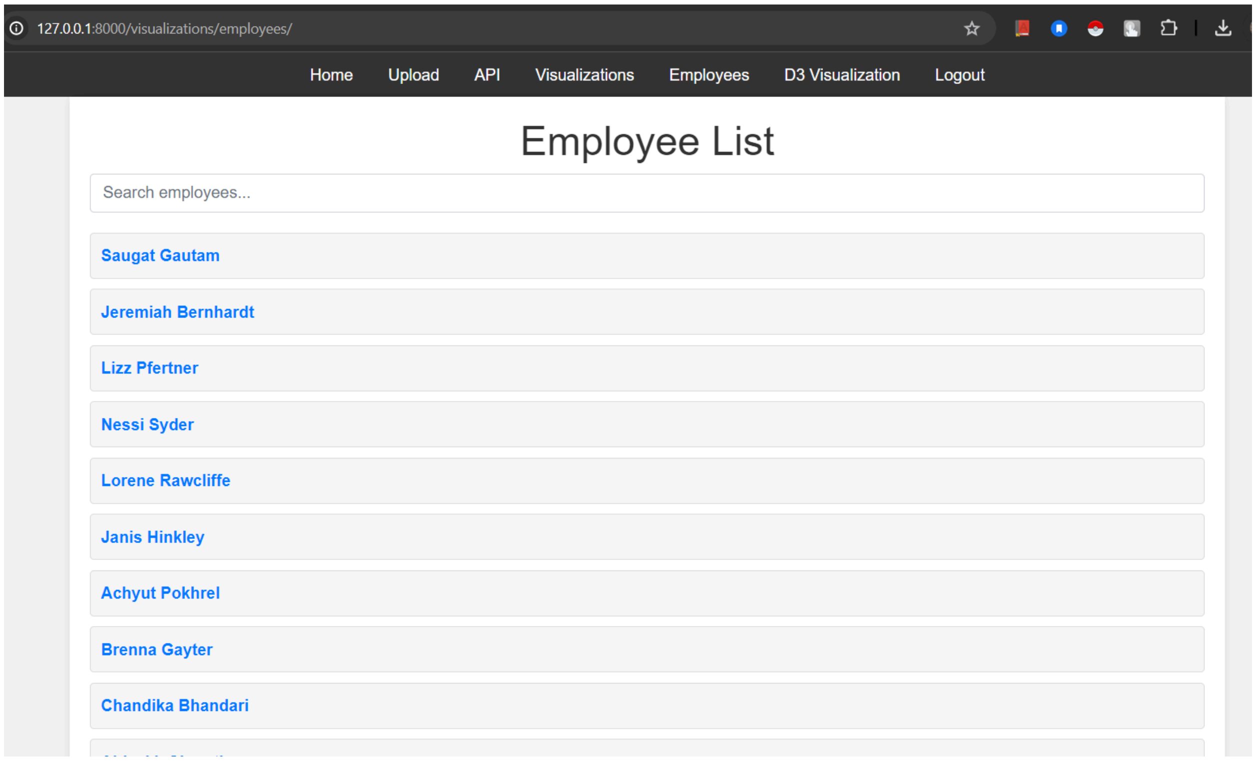


Fig: API data fetch and upload to DB page



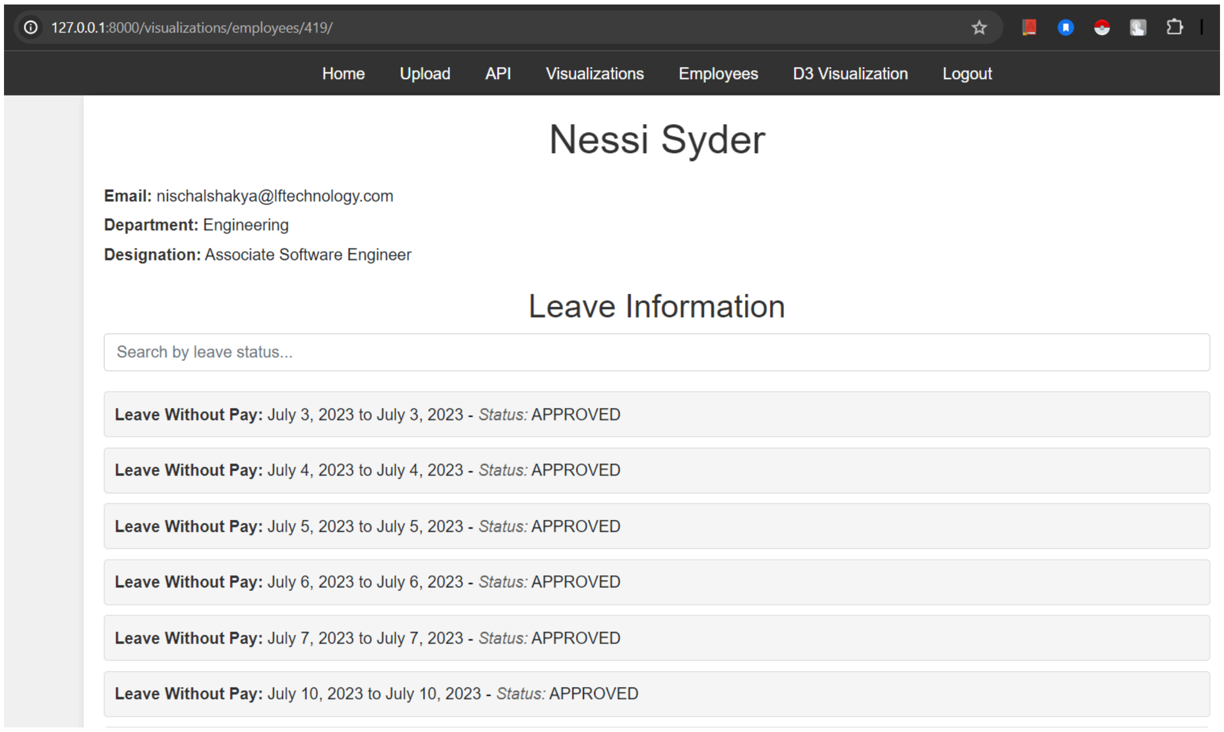
127.0.0.1:8000/visualizations/employees/

Employee List

Search employees...

- Saugat Gautam
- Jeremiah Bernhardt
- Lizz Pfertner
- Nessi Syder
- Lorene Rawcliffe
- Janis Hinkley
- Achyut Pokhrel
- Brenna Gayter
- Chandika Bhandari

Fig: Employee List Page



127.0.0.1:8000/visualizations/employees/419/

Nessi Syder

Email: nischalshakya@lftechnology.com
Department: Engineering
Designation: Associate Software Engineer

Leave Information

Search by leave status...

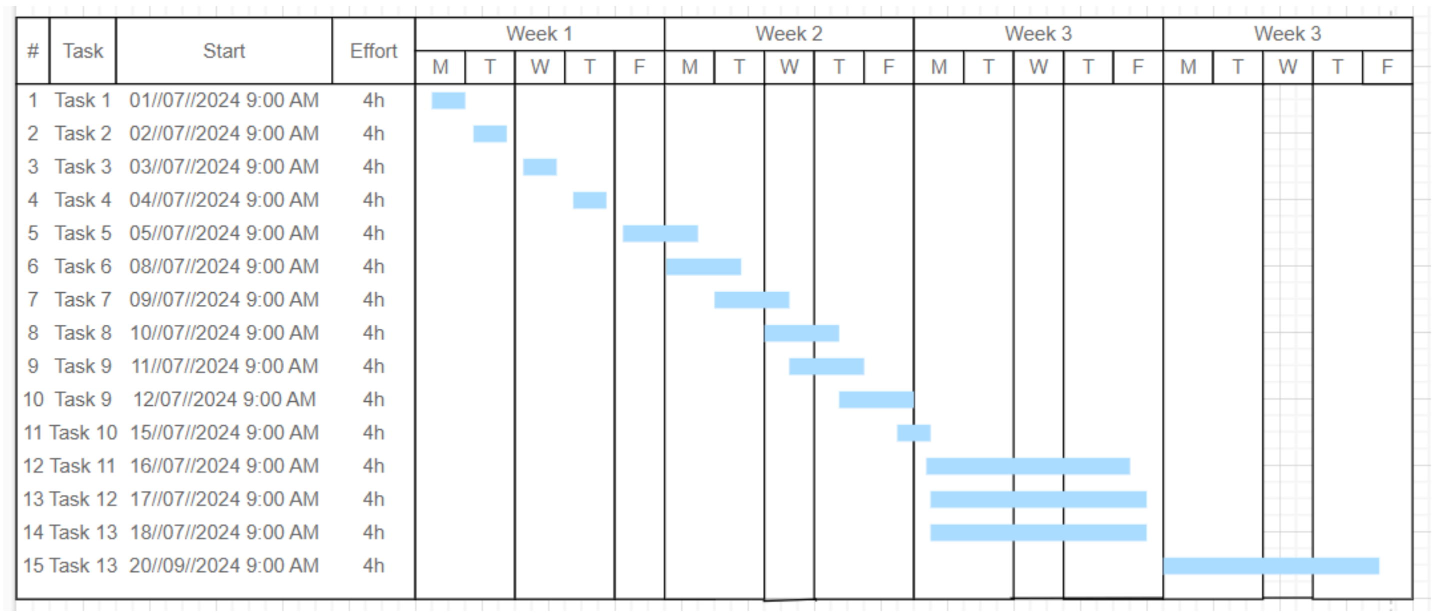
Leave Without Pay: July 3, 2023 to July 3, 2023 - *Status:* APPROVED
Leave Without Pay: July 4, 2023 to July 4, 2023 - *Status:* APPROVED
Leave Without Pay: July 5, 2023 to July 5, 2023 - *Status:* APPROVED
Leave Without Pay: July 6, 2023 to July 6, 2023 - *Status:* APPROVED
Leave Without Pay: July 7, 2023 to July 7, 2023 - *Status:* APPROVED
Leave Without Pay: July 10, 2023 to July 10, 2023 - *Status:* APPROVED

Fig: Employee Details Page

Gantt Chart

The list of the tasks:

Task 1. Set up django project and database
Task 2. Check out the API data (data exploration) and create models in django as required.
Task 3. Fetch data from the API and post it to the database.
Task 4. Make a proper template and routing path and views for the process of fetching data and posting it to the database and optimize the Task process.
Task 5. Set up the process for the bulk upload of the leave data through csv or excel file.
Task 6. Set up the login for the user(authentication)
Task 7. Make template for the login page
Task 8. Testing the authentication.
Task 9. Prepare schemas and views for the data visualization
Task 10. Make a separate app (data visualization) in the django for visualization of the data and connect it with the database
Task 11. Make use of the visualization tool to visualize the leave data.
Task 12. Optimize the process wherever necessary
Task 13. Documentation
Task 15: Setup Cron job for the data fetching from the API and inserting into DB



#	Task	Start	Effort
1	Task 1	01//07//2024 9:00 AM	4h
2	Task 2	02//07//2024 9:00 AM	4h
3	Task 3	03//07//2024 9:00 AM	4h
4	Task 4	04//07//2024 9:00 AM	4h
5	Task 5	05//07//2024 9:00 AM	4h
6	Task 6	08//07//2024 9:00 AM	4h
7	Task 7	09//07//2024 9:00 AM	4h
8	Task 8	10//07//2024 9:00 AM	4h
9	Task 9	11//07//2024 9:00 AM	4h
10	Task 9	12/07//2024 9:00 AM	4h
11	Task 10	15//07//2024 9:00 AM	4h
12	Task 11	16//07//2024 9:00 AM	4h
13	Task 12	17//07//2024 9:00 AM	4h
14	Task 13	18//07//2024 9:00 AM	4h
15	Task 13	20//09//2024 9:00 AM	4h

Fig: Gantt Chart