Asset Management System (AMS)

A PROJECT REPORT

Submitted by

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(16CP052)

in partial fulfilment for the award of the degree of

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ABSTRACT

Asset Management system is used to maintain assets of company requires a significant amount of time if we do it without software.Every organization has their own Asset Management System in order to perform the resource activities.Managing Asset or utilizing assets or keeping track of assets are significant task of IT team. The main work of the IT team is to maintain all assets of the company like laptop and any other devices and also maintain the condition of that Asset . In order to support the IT's there are some electronic based systems called AMS- Asset management system. Organizations maintained assets with excel sheets which is a very tedious job. But this application is cost effective one that allows them to manage their asset's data in a simple manner. This project belongs to a category of web application that can be accessed through PC with internet connection. This Asset Management System allows the IT team to provide various types of permission to other IT members and also manage Asset's data, status, category, location, etc.

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Chapter 1
Introduction

1.1 PROJECT SUMMARY

Asset Management System is an application used by the company to automate and keep track of the equipment and inventory that are vital to the day-to-day operation of their businesses. Exactly how those assets are managed, though, is highly variable. A lot of organizations are managing their equipment and inventory through a manual process, including spreadsheets over which an employee or employees are tasked with the responsibility of maintaining. So, this application helps to keep track of these vital assets and manages efficiently and provides an ease to use.

This project is intended to replace the Manually managed system and provide a platform that is more efficient, reliable and robust.

1.2 PURPOSE

IT asset management ties the assets with the IT infrastructure of the organization. With a robust asset management system, management and IT professionals can review and monitor all types of assets within the organization. The information can be used to make detailed decisions about the purchase and other aspects of the asset's life cycle. So, the purpose of IT asset management is to :

1.2.1. Effectively help manage the assets.
1.2.2. Improve visibility of assets.
1.2.3. Ensure optimum utilization of assets.
1.2.4. Reduce IT and software costs.
1.2.5. Ensure compliance with regulatory requirements.

1.3 OBJECTIVE

The objective of the IT asset management system is to provide an organization with a deep knowledge of its information systems to use this information for the identification and rapid resolution of problems. And also complete information about the configuration of assets and their relationship among each other and also make sure that this data is available whenever it is needed.

The goal of this project is to reduce the effort required to maintain a variety of assets and automate the task of managing assets. Using the software can help in efficient resource planning. The main focus of this project is to provide management functionalities like Manage Asset, Manage Asset category, Manage Status, Manage Rooms, Employee Listing, Manage Permission, Generate Reports, and the Activity Logs.

1.4 SCOPE

Following features are there in the scope:

- Keep track of the company's hardware and software purchases. That determines the exact time to renew a license, update software, or replace a piece of equipment.
- Effective Resource Planning: Maximize utilization and reduce cost.
- Increase Security: Protection of data found in the company systems. Also, know the status of their security tools.
- Definition of service levels: Helps IT specialists define the level of service that can be offered to customers based on the number of existing assets.

1.5 TOOLS AND TECHNOLOGY USED

Following are the Technology used in the system:

- **Backend:** Python 3.8, FastAPI, SQLAlchemy, Redis Cache
- **Frontend:** Angular 9, Angular Material
- **Database:** PostgreSQL

Distributed 3-tier Architecture. Each tier contains a separate Docker Container.

Overview of FastAPI [1]:

FastAPI is a modern, fast (high-performance), web framework for building APIs with Python 3.6+. FastAPI provides the following:

- OpenAPI for API creation, including declarations of path operations, parameters, body requests, security, etc. It also generates automatic data model documentation with JSON Schema.
- Swagger UI for Interactive API documentation and exploration web user interfaces by exploration, call and test your API directly from the browser.

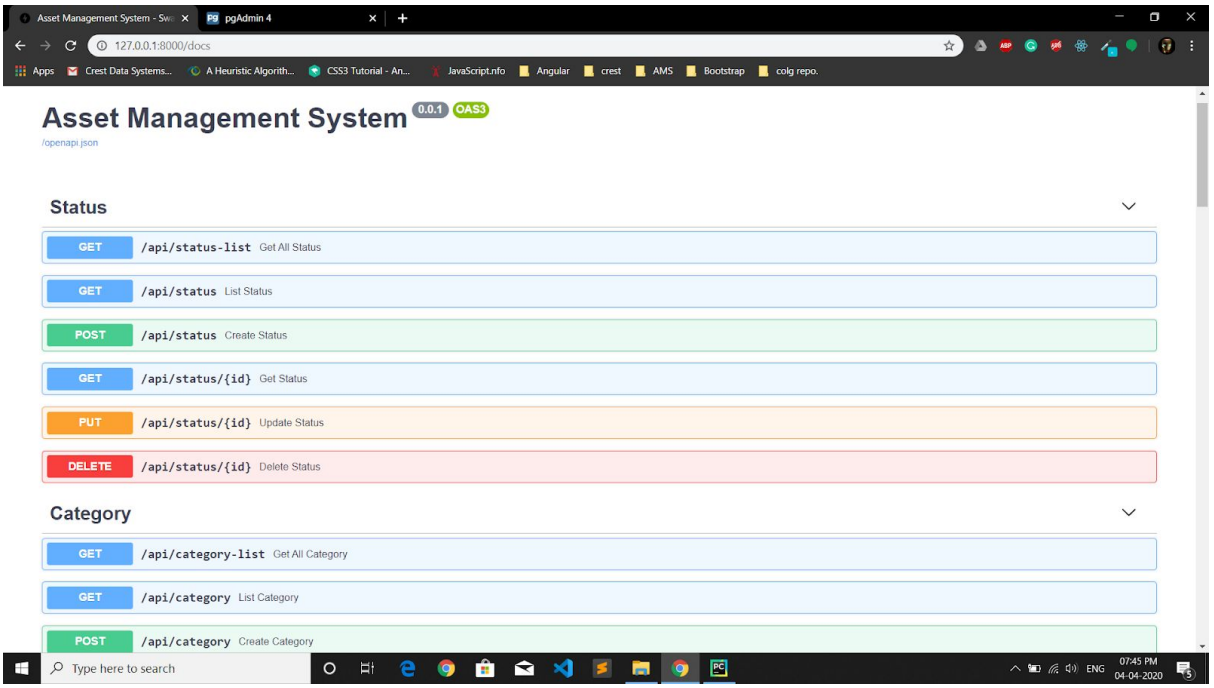


Fig. 1.5.1 Swagger UI of Application

FastAPI provides validation for most python data types including JSON object, JSON array, String, Number with min and max values, etc. It also provides validation for exotic types like Email, URL, UUID, etc.

Security and authentication are also integrated into FastAPI. It gives security on HTTP Basics and authentication provides by OAuth2 (also with JWT tokens). It uses uvicorn for the server that loads and serves our application.

I preferred FastAPI for this project because of its high performance, robust, easy to use and standard-based features.

Overview of SQLAlchemy [2]:

SQLAlchemy is the toolkit and Object Relational Mapper which is written in Python and provides the flexibility of SQL for application development.SQLAlchemy provides object-relational mapper (ORM), using which classes can be mapped to the database, thereby allowing the object model and database schema to develop in a cleanly decoupled way from the beginning.

I preferred this because it will be beneficial for the application as it provides good support to FastAPI. Here I use the Postgres ORM model for development.

Overview of PostgreSQL [5]:

PostgreSQL is a powerful, open-source object-relational database system that uses and extends the SQL language combined with many features that safely store and scale the most complicated data workloads. PostgreSQL differs from other relational database management systems for its proven architecture, reliability, data integrity, robust feature set, extensibility, and the dedication of the open-source community behind the software to consistently deliver performant and innovative solutions. PostgreSQL runs on all major operating systems and has extensive support for ACID properties.

As the project requires a database having features like better support for Parallel merge joins and Parallel aggregation, So the PostgreSQL would be most suitable for this project. PostgreSQL is preferable for this project as a schema for the table is fixed of data models and because of PostgreSQL object-relational feature relation between data models would be well defined. Also, joins between data tables would easily be handled in the PostgreSQL database. PostgreSQL performance is utilized best in systems requiring the execution of complex queries. PostgreSQL has roles and inherited roles to set and maintain permissions. PostgreSQL has native SSL support for connections to encrypt client/server communications. It also has Row Level Security.

Overview of Angular 9 [6] and Angular Material [7]:

Angular is open-source frameworks for building web and mobile applications. A new version of Angular 9 is smaller, faster, and easier to use. With Angular 9, community can benefit from smaller, high-performance applications, and better developer experience.

From Angular 9 the Ivy compiler is available for all apps. The main benefit of Ivy is that it is able to significantly reduce the size of large-sized applications.

Angular Material is a UI component library for Angular developers. Angular Material components help in constructing attractive, consistent, and functional web applications while adhering to modern web design principles like browser portability, device independence, and graceful degradation. It helps in creating faster, beautiful, and responsive websites.

Overview of Docker [8]:

Docker is an open platform for developing, shipping, and running applications. Docker enables us to separate our applications from our infrastructure so we can deliver software quickly. With Docker, we can manage infrastructure in the same ways we manage our applications. By taking advantage of Docker's methodologies for shipping, testing, and deploying code quickly, we can significantly reduce the delay between writing code and running it in production.

In this project, I have used four dockers containers for each tier: Backend, Frontend, Redis and Database, which will increase the production rate significantly.

All the Docker containers use Alpine Version Image as a base image,on top of that each container has its own separate volumes that are maintained and updated with the content of each docker container respectively.

We have two separate docker-compose files one for the Frontend and one for the Backend.

The Frontend docker-compose file includes AMS Frontend Image which internally uses Node's Alpine Image and NGINX's Alpine Image and also has instructions regarding to create Production Build of the project and COPY the BUILD into the NGINX container volume.

The Backend docker-compose comprises of the Postgres, Redis and AMS Backend Images which internally uses Python v3.8.2 Alpine image. The environment variables are set for all the images using the environment property of each docker-compose service.

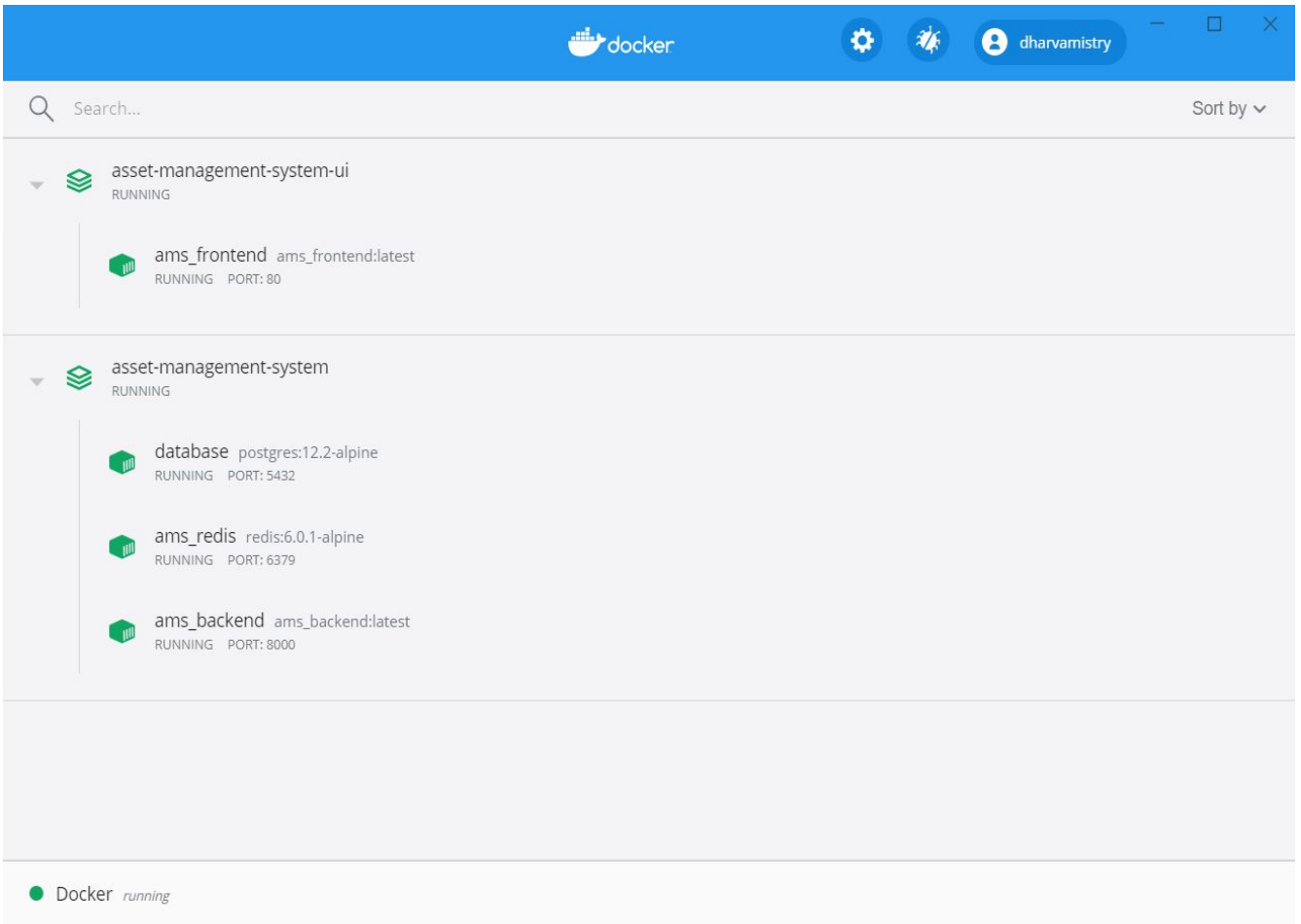


Fig. 1.5.2 Docker Containers in Execution

Overview of Redis [10]:

Redis is an open source, in-memory data structure store, used as a database, cache and message broker. It supports data structures such as strings, hashes, lists, sets, sorted sets with range queries, bitmaps, geospatial indexes with radius queries and streams. Redis has built-in replication, LRU eviction, transactions and different levels of on-disk persistence, and provides high availability via Redis Sentinel and automatic partitioning with Redis Cluster.

Chapter 2
About the system

2.1 SYSTEM REQUIREMENTS STUDY

2.1.1 USER CHARACTERISTICS

Application intended to use by mainly two users :

1. Super Admin
2. IT supervisor

Assets management will be managed by both users. The application would provide asset and user mapping. Users would manage assets like being able to add assets, update the asset, delete an asset, assign/unassign assets to users. SuperUser(Admin) will assign permission to the other IT supervisor. The application would also generate reports based on duration, asset details, employee details and would also manage activity logs.

2.1.2 HARDWARE AND SOFTWARE REQUIREMENTS

Client Requirement

- Processor: Dual Core 2.0 GHZ or latter CPU
- RAM: 4 GB
- Browser: Chrome, Firefox

Server Requirement

- Processor: 4 Core CPUs
- RAM: 4 GB RAM minimum
- Hard Disk: 100 GB storage minimum

2.1.3 ASSUMPTIONS

It is assumed that:

- The Employee database will be accessible using the HRMS APIs.
  (HRMS is the company's internal system that manages the Employee Details.)
- Authorized users will be able to assign different permissions to the other users.
- The IT supervisor would be managing the Meeting/Conference/Training
- Rooms Assets (TV issues, WebCam Issues, Projector and its accessories, etc).

2.1.4 SECURITY CONSIDERATION

These are security considerations :

- The application components should not use any third-party modules, frameworks which have known vulnerabilities.
- In order to provide the best security, the web application would use JWT authentication tokens.
- To provide HTTPS support the web application would require to have its own dedicated HOST with its dedicated IP address and SSL Certificate.

2.2 SYSTEM ANALYSIS

2.2.1 STUDY OF CURRENT SYSTEM

Companies manage their equipment and inventory through a manual process, including spreadsheets over which an employee or employees are tasked with the responsibility of maintaining.

2.2.2 PROBLEMS AND WEAKNESSES OF CURRENT SYSTEM

Due to manual processes, IT supervisors suffer problems like forgotten items, broken or lost equipment, human error, hours spent searching for items that have mysteriously disappeared, inaccurate information needed for accounting and compliance, customer dissatisfaction.

2.2.3 REQUIREMENTS OF SYSTEM

2.2.3.1. Functional Requirements

Functional requirements involve calculations, technical details, data manipulation and processing, and other specific functionality that define what a system is supposed to accomplish.

- **Functional requirement of API Endpoints**
    - **Manages Asset Details**

        By this functionality, the IT supervisor can maintain the asset detail by Adding new assets, editing existing asset details and deleting assets not required from the system.

        Input: Asset Details

        Output: Record changes in the system

        Processing: Fire Query of PostgreSQL and perform changes in database

- **Assignment or Unassignment of Asset to Employees or Rooms**

  IT supervisor can Assign/Unassign/Reassign the variant assets to the single employee or group of employees or maybe room.

  Input: Employee details, Room Details, Asset Details

  Output: Assign or Unassign Assets to employee or room

  Processing: Based on the Asset availability assignment would be performed

- **Set Notification and Get Notified on Events**

  IT supervisors would set reminders regarding assets like time to renew a license, update software, or replace a piece of equipment. Also, set a notification for the employee when the asset is assigned for a specific time duration. Get notified on events set in Notification when it occurs.

  Input: Time Interval for Asset or Employee

  Output: Acknowledgement on the successful set reminder

  Processing: Set Time period for the specified asset or employee and record in database

- **Generate Reports of Assets and Employees**

  IT supervisors can generate the report based on filtering criteria and export it into formats like document or PDF.

  Input: Filtering criterion of assets and employee

  Output: Asset-Employee details based requirements.

  Processing: Perform Search Query on Employee data and/or Asset data then show data in well-formed UI.

2.2.3.2. Non-Functional Requirements

2.2.3.2.1. Security

The system uses HTTPS to transmit data so it passes through SSL. Authentication would be done by JWT token-passing mechanism.

2.2.3.2.2. Confidentiality

The system protects sensitive data of employees and allows only authorized access to the data.

2.2.3.2.3. Reliability

The application consistently performs the specified functions without failure by an efficient error handling mechanism.

2.2.3.2.4. Usability

The system is easy to use as Angular 9 is used as a frontend and due to Angular Material Component, controls look attractive and easy to use.

2.2.3.2.5. Maintainability

The ease with which faults in a software system can be found and fixed. The system would be extensible by adding new functionality.

2.2.3.2.6. Reusability

The API endpoints are reusable and also able to integrate with other systems efficiently.

Chapter 3
Analysis

3.1 USE CASES

3.1.1 APPLICATION USE CASES

This section describes the use cases of the system.

3.1.1.1. Ability to Manage Assets

Description:

Users would be able to manage the details for assets.

Acceptance criteria:

1. Users should be able to add a new asset.
2. Users should be able to update an existing asset.
3. Users should be able to delete an existing asset.
4. Users should be able to view assets based on filtering criteria or using search.
5. Users should be able to Import multiple assets from the file(.XLS or .CSV).
6. Users should be able to Export the assets(.XLSX, .CSV).
7. Users should be able to assign/unassign assets to the user/room.
8. Users should be able to view the asset details.
9. Users should be able to send asset for maintenance
10. Users should be able to extend the warranty.
11. Users should be able to send notification (mail) to the owner of the asset.
12. Users should be able to add an image of an asset.

3.1.1.2. Ability to Manage Asset Category

Description:

Users would be able to manage the asset category.

Acceptance criteria:

1. Users should be able to add an asset category like Laptop, Mouse, etc.
2. Users should be able to update an existing category.
3. Users should be able to delete an existing category.
4. Users should be able to view different assets based on category filtering criteria or using a category search.

3.1.1.3. Ability to Manage Locations

Description:

Users would be able to manage asset locations.

Acceptance criteria:

1. Users should be able to add locations.

2. Users should be able to update the existing locations.
3. Users should be able to delete existing locations.
4. Users should be able to view locations.
5. Users should be able to view different assets based on Location filtering criteria or using a Location search.
6. Location is associated with Rooms.
7. Users should be able to add Room to Particular Location.

3.1.1.4. Ability to View Employee Listing

Description:

Users would be able to view the list of employees and their asset usage history.

Acceptance Criteria:

1. Users should be able to view all employees list
2. Users should be able to view the employee details
3. Users should be able to view the history of the assigned/unassigned assets.
4. Users should be able to assign/unassign Asset to Employees

3.1.1.5. Ability to Manage log

Description:

The system would be managing the logs of every action made by the IT supervisor or Employee.

Acceptance criteria:

1. Users should be able to view the activity logs for any time duration, for any assets, for any employee.
2. Users should be able to export the activity logs.
3. Users should be able to perform auditing.

3.1.1.6. Ability to Generate Reports

Description:

Users would be able to generate reports based on criteria like status, duration, Asset Category.

Acceptance criteria:

1. Users should be able to generate asset reports.
2. Users should be able to generate employee reports.

3.1.1.7. Ability to Manage Laptop

Description:

Users can manage a Laptop which is a special kind of Asset, which is an essential asset, which has many extra features.

Acceptance criteria:

1. If the Asset category is Laptop then Laptop has more features like wifi and lan mac address, laptop is for splunk, cisco etc.
2. Wifi and Lan mac address should be unique.
3. If Laptop is for Splunk then Splunk id is unique.

3.2 CLASS DIAGRAM

Asset

This class stores asset details(Id, name, model, arrival time, category, status, description). Users can manage and search assets in this class. Users can sort assets.

Asset-Category

This class stores asset categories like Mouse, Keyboard, Laptop, etc.

Asset-Status

This class stores asset status like assign, unassign, new, destroyed, etc.

Employee

This class lists all employees of the organization. Based on permission associated with the users, they can manage assets.

Location

It contains details regarding the locations of the organization.

Room

This class contains details regarding rooms in the organization and assets assigned to these rooms.

Supplier

It contains the supplier details and assets delivered by them.

Permission

This class provides permission to users. Based on permission, users can manage assets.

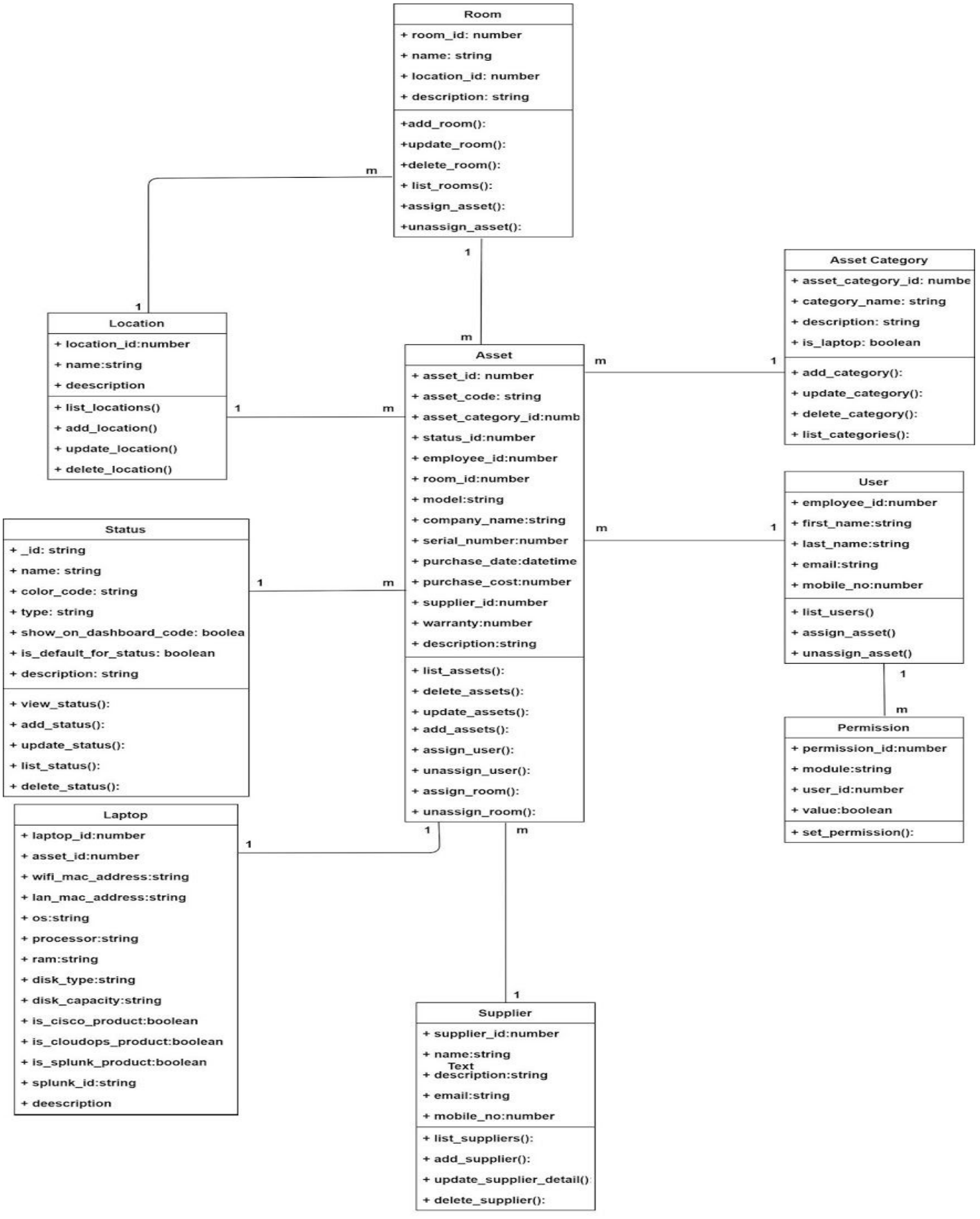


Fig. 3.2.1 Class diagram of system

Chapter 4
Design

4.1 SYSTEM UI ARCHITECTURE

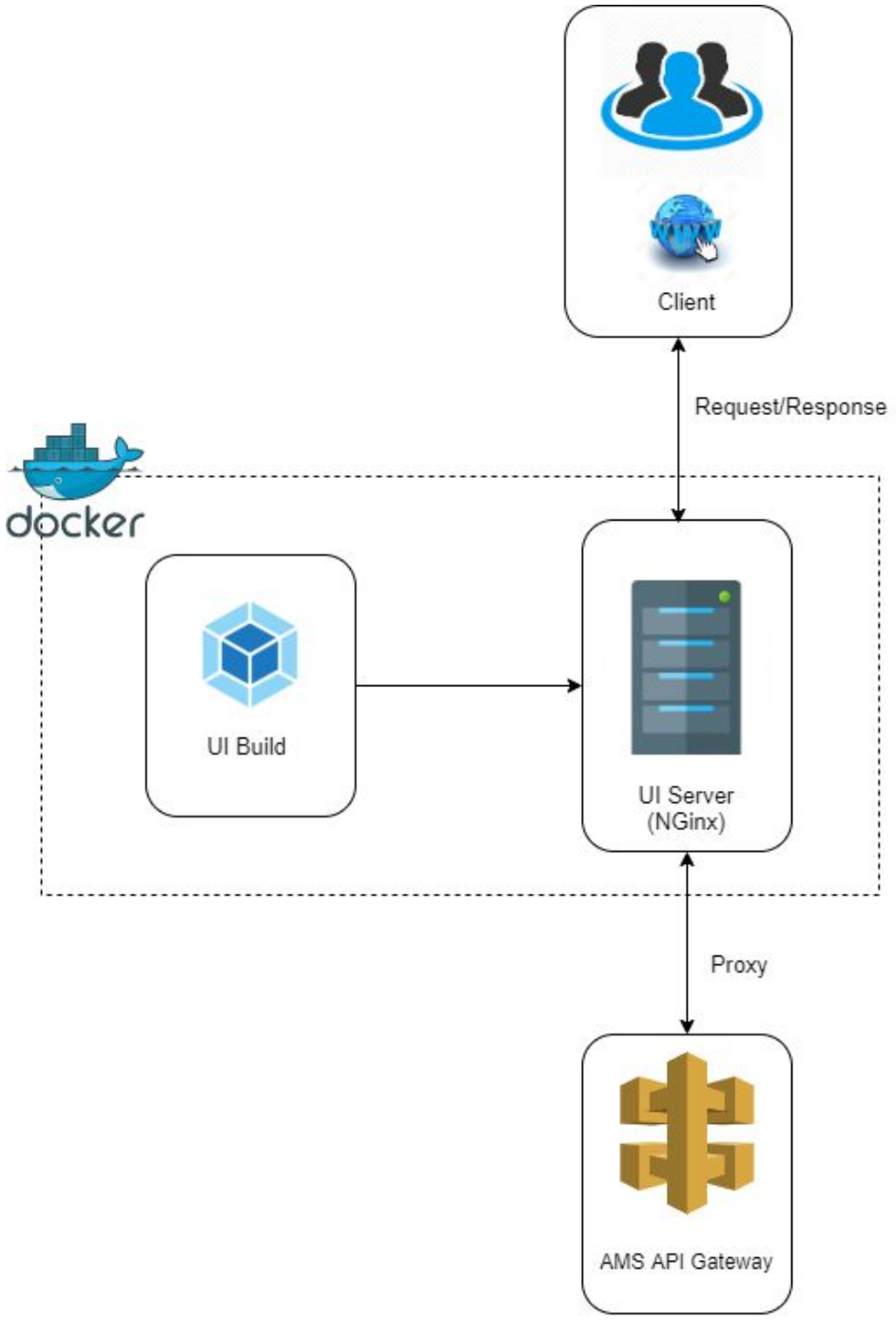


Fig. 4.1.1 System UI architecture

4.2 SYSTEM CORE ARCHITECTURE

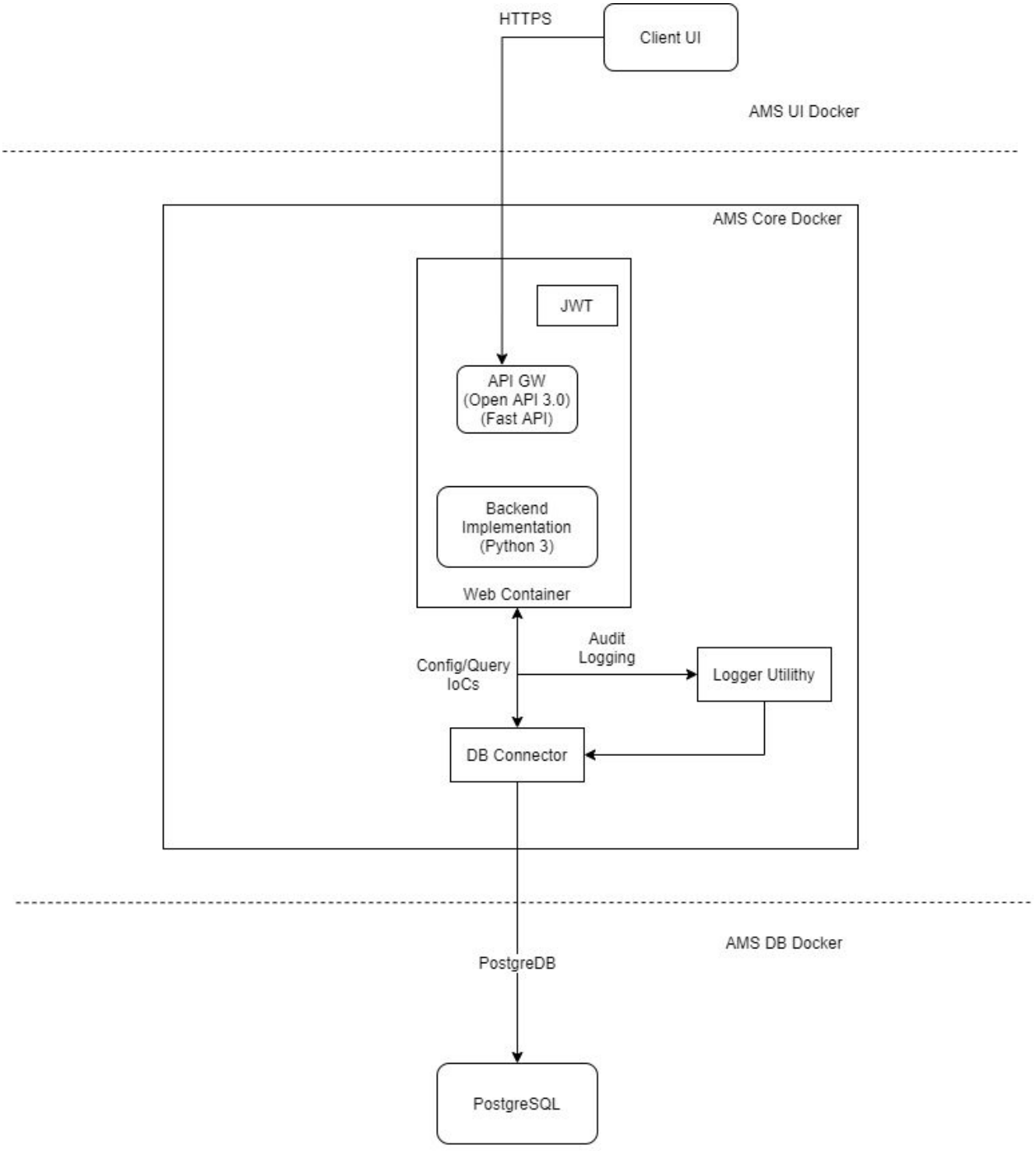


Fig. 4.2.1 System Core Architecture

Application components

This section lists the components required for the UI module.

4.2.1. Web Server

NGINX will be used as a webserver to serve HTML/CSS and JS files.NGINX became famous as the fastest web server, the scalable underlying architecture has proved ideal for many web tasks beyond serving content.

It can handle a high volume of connections, NGINX can be also used as a reverse proxy and load balancer to manage incoming traffic and distribute it to slower upstream servers.

4.2.2. Angular[6]

Angular is a JavaScript library for building user interfaces. Angular can be used as a base in the development of a single-page or mobile application. Angular also provides Webpack and Babel tools. Webpack will be used to create a build of Angular application. It will create a build that can be served with the Web server. It is a module bundler primarily for JavaScript, it can transform front-end assets like HTML, CSS, and images if the corresponding loaders are included. Webpack takes modules with dependencies and generates static assets representing those modules. Babel is used to converting ECMAScript 2015+ code into a backward-compatible version of JavaScript that can be run by older browsers(JavaScript engines).

- **Angular Material[7]**

Angular Material is a UI component library for Angular developers. Angular Material components help in constructing attractive, consistent, and functional web pages and web applications while adhering to modern web design principles like browser portability, device independence, and graceful degradation. It helps in creating faster, beautiful, and responsive websites.

4.2.3. API Gateway

The solution will contain an API gateway that will be used to interact with the core services of the AMS. All the API calls are authenticated using the JWT authentication scheme.

The API gateway will use the FastAPI framework along with uvicorn to serve the requests. Rate limiting of the API will be a setup-time parameter. List of Endpoints that will be exposed by API gateway. The API documentation is auto-generated.

Context	Method	Functions
/api/auth	POST	Authentication endpoint to validate the user credentials and store an authentication token.
/api/category-list	GET	Provides list of all category
/api/category	GET	Get category range based on parameter.
/api/category	POST	Create new Category.
/api/category/{id}	GET	Get category using id.
/api/category/{id}	PUT	Update category using id.
/api/category/{id}	DELETE	Delete category using id.
/api/location-list	GET	Get list of all location.
/api/location/{id}/room	GET	Get all room of particular location.
/api/location	GET	Get range of location using parameter.
/api/location	POST	Create new location.
/api/location/{id}	GET	Get location using id.
/api/location/{id}	PUT	Update location using id.
/api/location/{id}	DELETE	Delete location using id.
/api/asset-list	GET	Get list of all asset.
/api/asset	GET	Get range of asset using parameter.
/api/asset	POST	Create new asset.

/api/asset/{id}	GET	Get asset using id.
/api/asset/{id}	PUT	Update asset using id.
/api/asset/{id}	DELETE	Delete assets using id.
/api/asset/{id}/status	PUT	Update asset-status using asset id.
/api/asset/{id}/room/assign	PUT	Assign asset to room.
/api/asset/{id}/room/unassign	PUT	Unassign asset from room.
/api/asset/{id}/employee/assign	PUT	Assign Asset to Employee.
/api/asset/{id}/employee/unassign	PUT	Unassign Asset from Employee.
/api/asset/import	POST	Import Excel or csv file for asset.
/api/asset-export	GET	Export Asset details.
/api/employee-add	GET	Add Employee in Redis cache.
/api/employee-list	GET	Get list of all employees.
/api/employee	GET	Get range of employee based on parameter.
/api/employee/{id}	GET	Get employee using id.

Table 4.2.3. API Gateway

4.3 DATA MODELS

This section lists the data models required for state persistence within the application.

4.3.1. Asset :

Table Name: asset_master

Name	Type	Unique	Required	Description	Default
id	number	True	True	asset id	Auto Increment
asset_tag	varchar	True	True	asset tag of the company	
company_name	varchar		True	the asset's manufacturer company name.	
model	number		True	asset's model name	
description	varchar			asset's description	
warranty	varchar			asset warranty details	0 (Zero)
serial_number	varchar	True	True	asset's serial number	
purchase_date	datetime		True	asset's purchase date	
purchase_cost	number		True	asset's purchase cost	
category_id	number		True	asset's category	
status_id	number		True	asset's status	
employee_id	number			assigned employee id	
room_id	number			assigned room id	

Table 4.3.1. Asset

4.3.2. Asset Category :

Table Name: asset_category_master

Name	Type	Unique	Required	Description	Default
id	number	True	True	category id	Auto Increment
name	text	True	True	category name	
description	varchar			category's description	
is_laptop	boolean			to specify category is belonging on laptop	False

Table 4.3.2. Category

4.3.3. Location :

Table Name: location_master

Name	Type	Unique	Required	Description	Default
id	number	True	True	Location id	Auto Increment
name	varchar			Locationname	
description	varchar			Location's description	

Table 4.3.3. Location

4.3.4. Laptop :

Table Name: laptop_master

Name	Type	Unique	Required	Description	Default
id	number	True	True	Laptop id	Auto Increment
asset_id	varchar			asset id	
wifi_mac_address	varchar			wifi mac description	
lan_mac_address	varchar			lan mac description	

os	varchar			os name	
processor	number			name of processor	
ram	varchar			Ram type	
disk_type	varchar			disk_type like SSD, HDD	
disk_capacity	varchar			disk_capacity description	
is_cisco_product	boolean				false
is_cloudops_product	boolean				false
splunk_id	varchar	true			

Table 4.3.4. Laptop

4.4 WIREFRAMES[11]

4.4.1. DASHBOARD

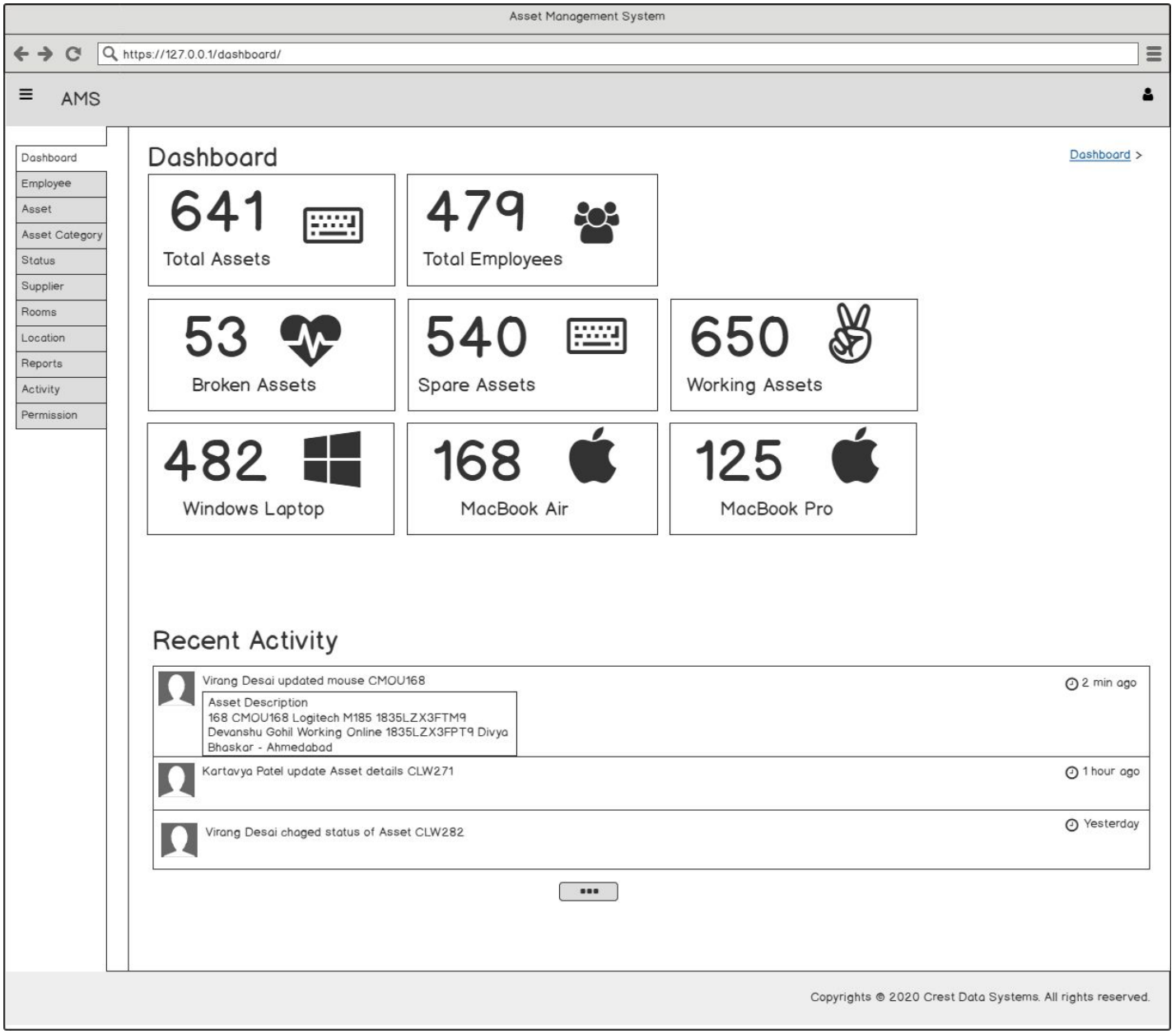


Fig 4.4.1. Dashboard

Application Dashboard shows the various counts and Recent Activity log on screen.

4.4.2. EMPLOYEE LIST

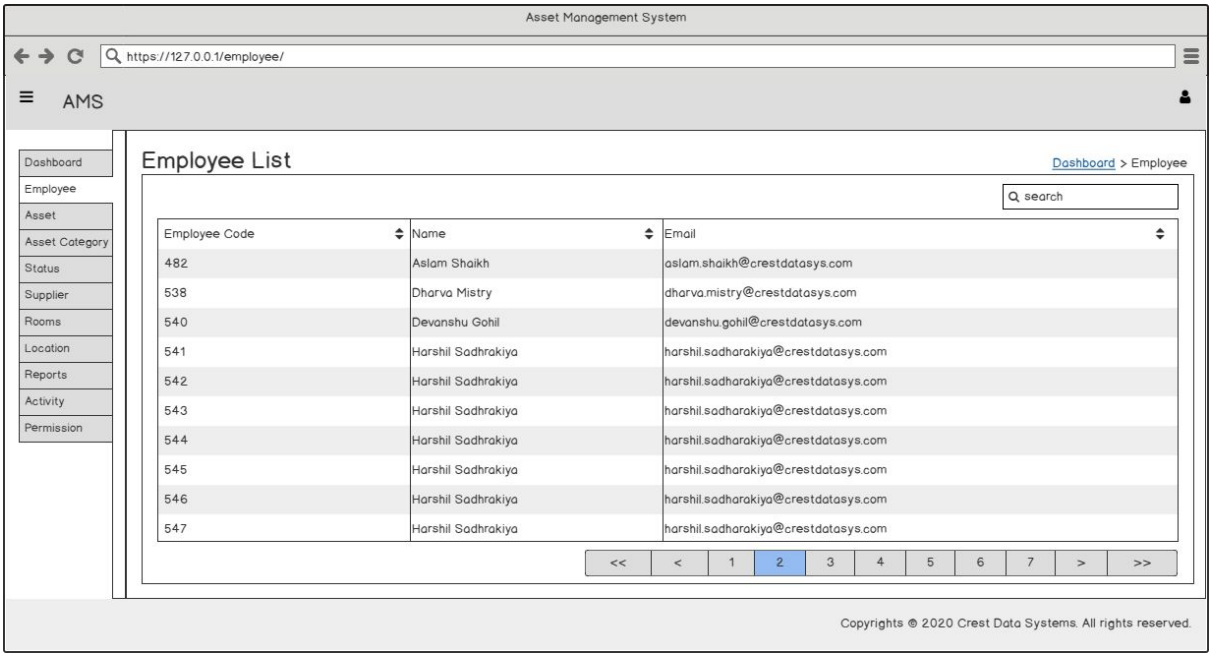


Fig 4.4.2. Employee-list

List down all the Employees with details.

4.4.3. EMPLOYEE CURRENT ASSET

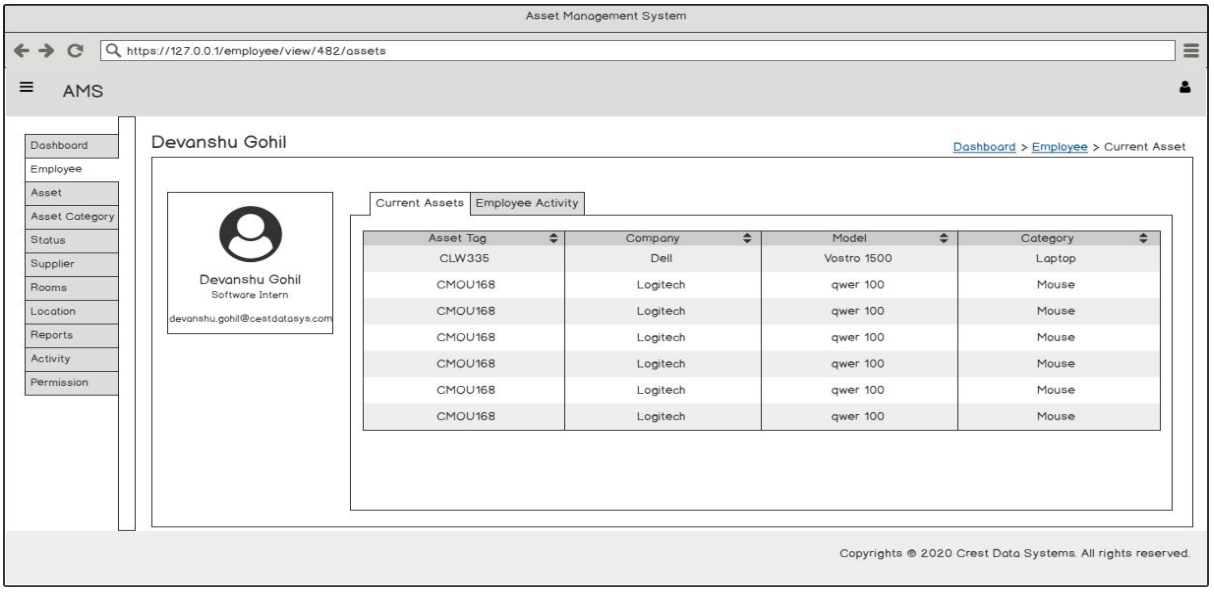


Fig 4.4.3. Employee-asset-detail

By clicking on a particular Employee, the system shows Asset details that are currently assigned to that employee.

4.4.4. EMPLOYEE ASSET ACTIVITY

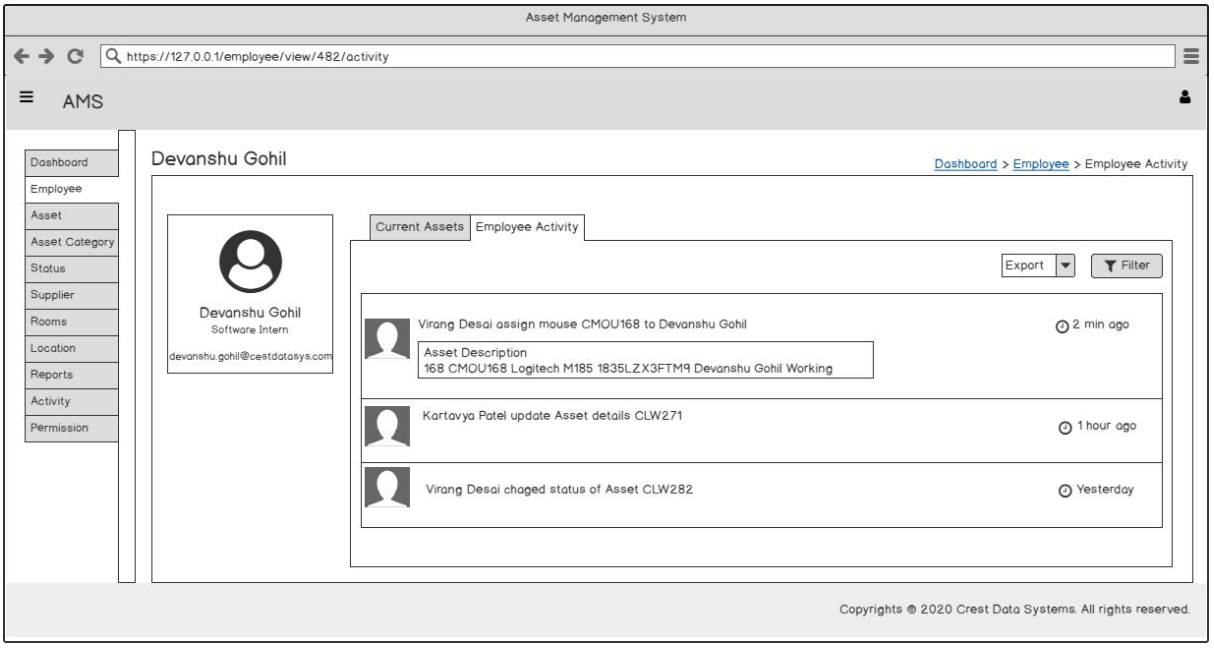


Fig 4.4.4. Employee-activity

Shows the various assets activity logs that are performed by a particular Employee.

4.4.5. REPORT ASSET ACTIVITY

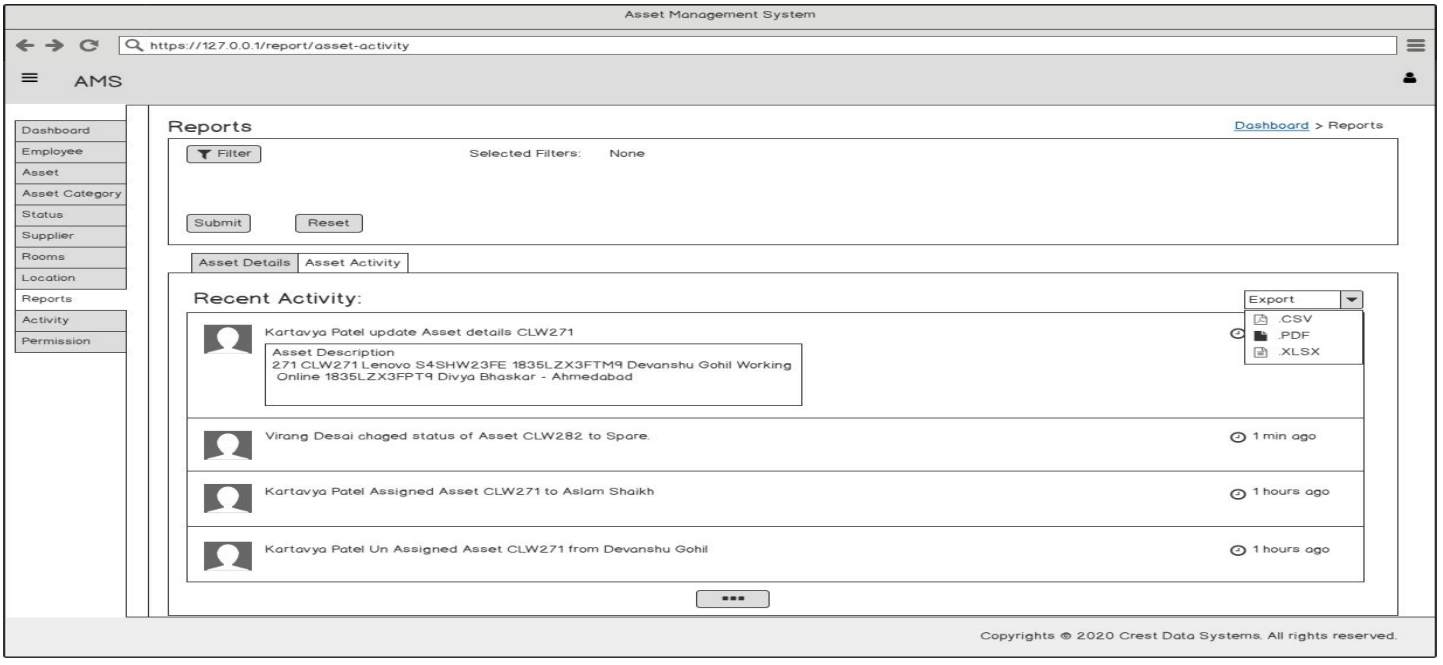


Fig 4.4.5. Report-asset-activity

Based on filtering criteria and requirements various Assets Activity would be sorted out and it would be exported based on user choices like CSV, PDF or XLSX file format.

4.4.6. REPORT ASSET DETAILS

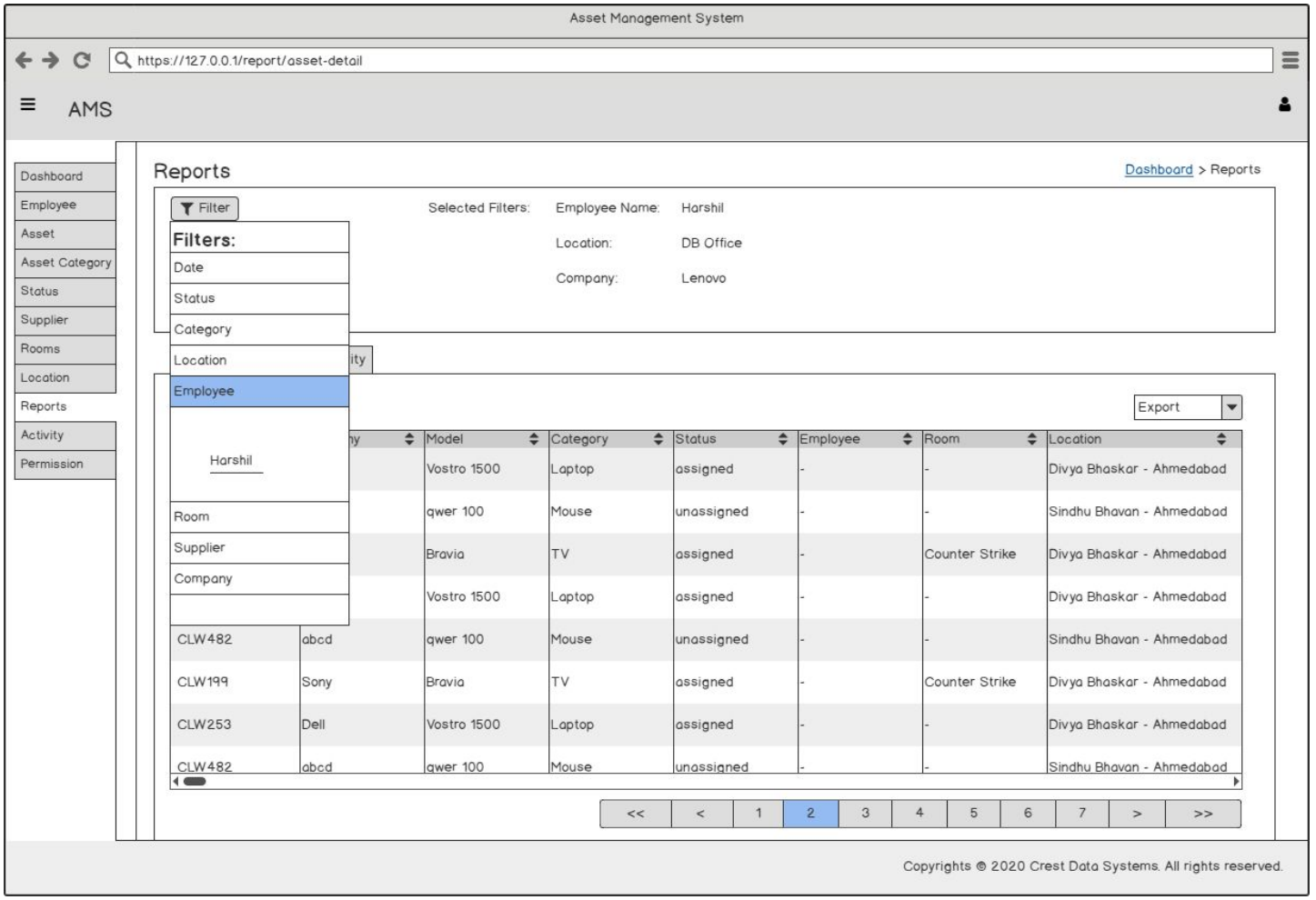


Fig 4.4.6. Report-asset-details

Based on filtering criteria and requirements various Assets details would be sorted out and it would be exported based on user choices like CSV, PDF or XLSX file format.

4.4.7. RECENT ACTIVITY

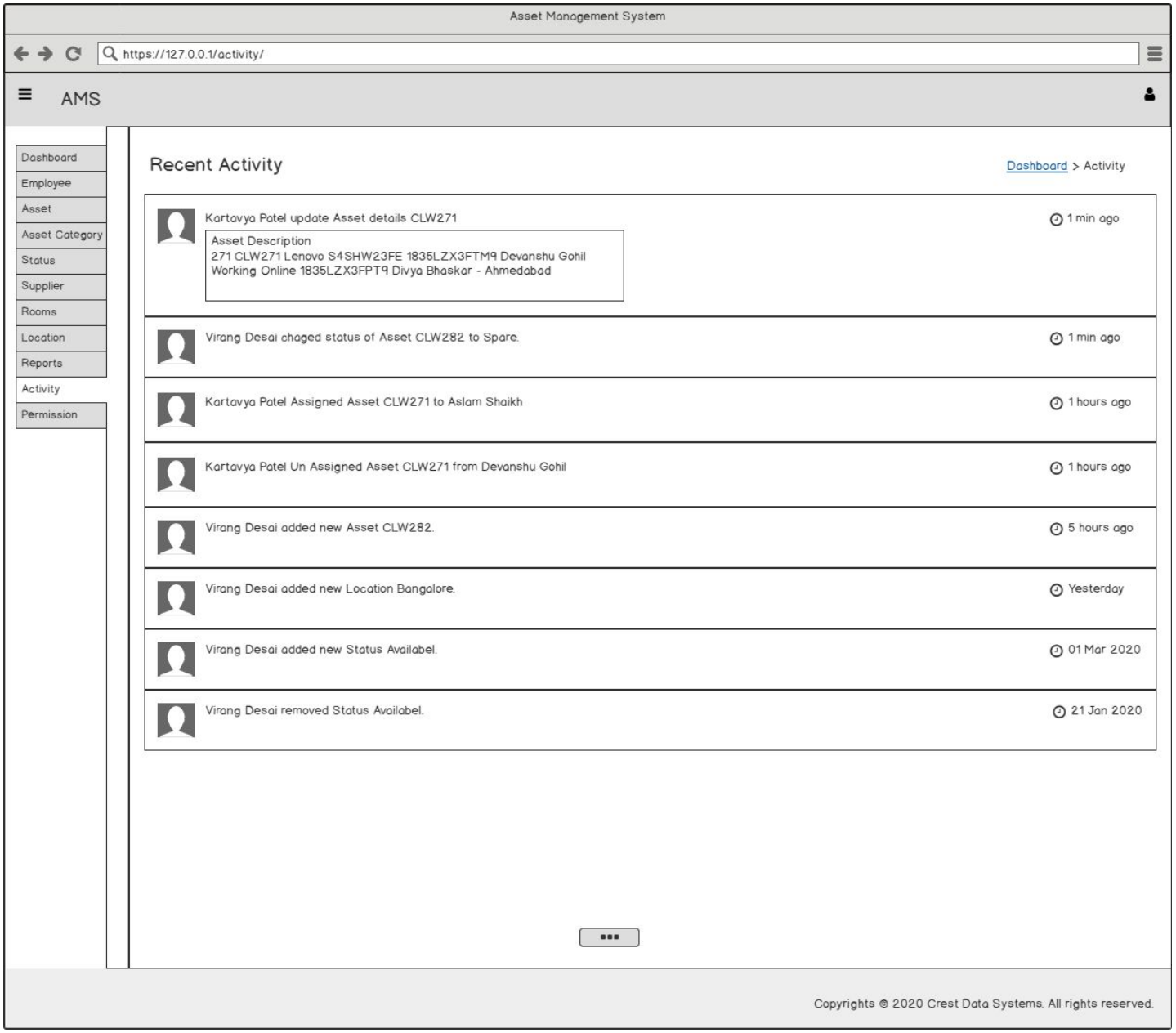


Fig 4.4.7. Recent-activity

The screen shows the Recent Activity logs which represent tasks recently performed onto the system.

4.4.8. PERMISSION

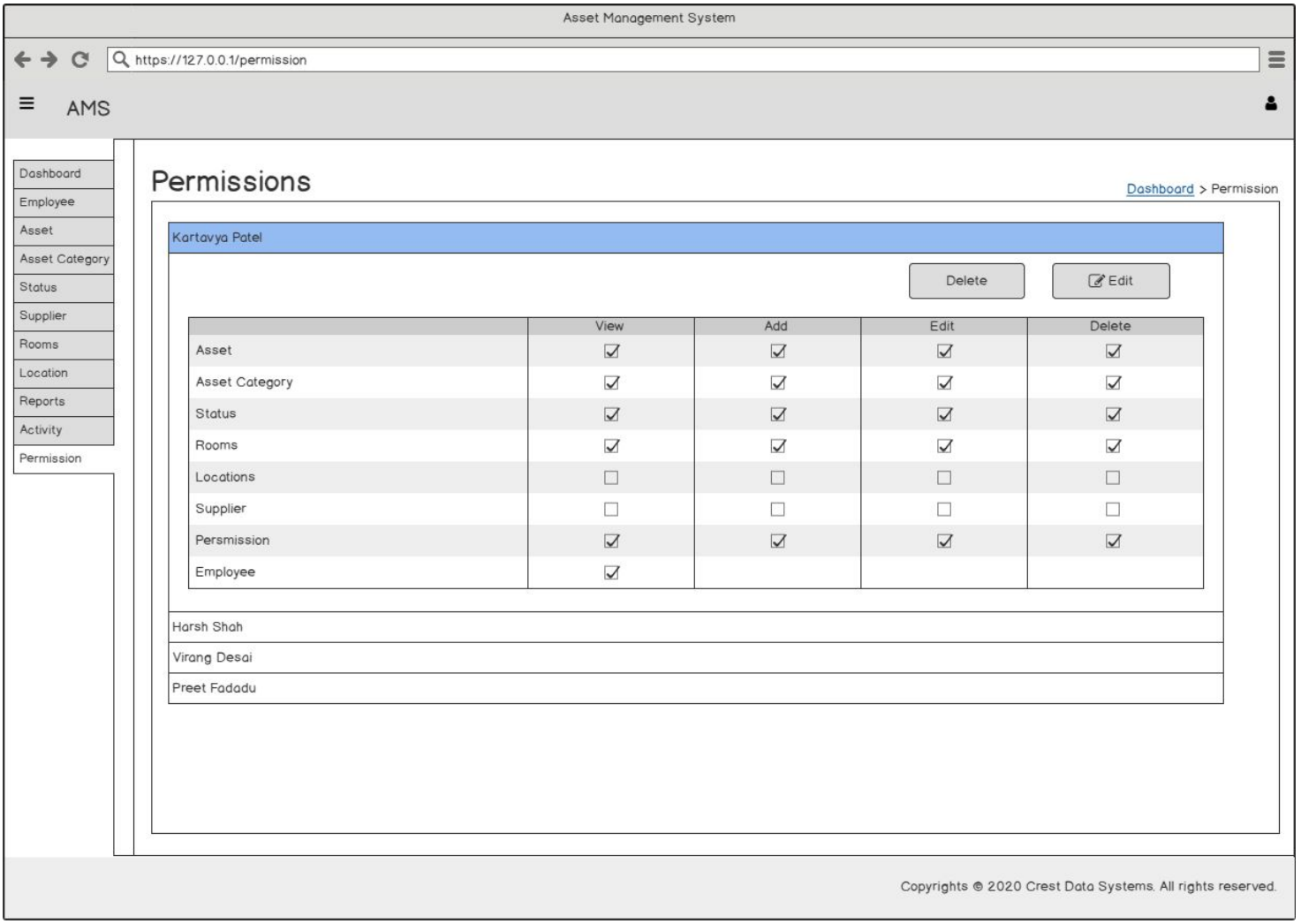


Fig 4.4.8. Permission

Screen shows which permission is given to which employee. And can also change the permission of employees by admin or other authenticated person.

Chapter 5
Implementation

5.1 IMPLEMENTATION ENVIRONMENT

In this project, the implementation environment is made up of three components: FastAPI, Angular 9 and PostgreSQL. FastAPI is the library that is used to manage backend logic and provides APIs for each module like Asset, Employee, Room, Supplier, Asset Category, Status and Manage Permissions. Now, PostgreSQL is a Relational Database Management architecture used to record all occurrences of data. It helps in application to manage the relationship between data models efficiently by its Object-Oriented feature. And PostgreSQL has the Dashboard with real-time analysis, Servers connections, IO operation frequency, Transaction per Second and Efficient UI for data analysis. Angular 9 is used for UI design. Angular 9 is having a rich feature set with dynamic data and event behavior is useful for this project. Angular has a modular structure with Modules, Components, Services, and a lazy loading routing mechanism. Angular Material components help in constructing attractive, consistent, and functional web pages and web applications while adhering to modern web design principles like browser portability, device independence, and graceful degradation. It helps in creating faster, beautiful, and responsive websites. And all these components are integrated into Docker using a docker-compose file.

5.2 KEY IMPLEMENTATIONS OBJECTIVE

- Simple and Easy UI interactions should be developed.
- All API calls and functionality should be properly working.
- Consistent data should be there in the database.
- Activity Log should be recorded for specified operations.
- The report should be generated as per user requirements.

5.3 IMPLEMENTATION MODULES

Each module are Integrated into FastAPI, PostgreSQL, and Angular

- Asset: Manages Asset
- Employee: Assign, Reassign and Unassign Asset
- Room: Assign, Reassign and Unassign Asset
- Report: Generate Report based on specifications

5.4 IMPLEMENTATION STEPS FOR MODULES

1. First Install all required python libraries for FastAPI and SQLAlchemy with PostgreSQL ORM.
2. Create a database connection code with PostgreSQL service by providing connection server url, port and database name.
3. Develop database table-column Model by specifying the column name and data type store in that field.
4. Decide request time data schema and response time data schema.
5. Develop API that defines backend implementation includes database query.
6. Test APIs using SwaggerUI with realtime database server connection and also, Proper validation Error messages.
7. Integrate APIs into Angular UI design with proper user interaction.
8. Integrate API data into Angular Material components.
9. Develop Docker files for each component with specified configurations.
10. Combine all Docker services into a docker-compose file.
11. Upload docker images into Docker Hub and fetch that image into the real-time server then run a Docker container on the server.

Chapter 6
Testing

6.1 TEST PLANNING

Test planning is the phase to describe how Testing would be performed. It includes a plan to test before going to start making the test suite. The first step of testing is to test each system module that is once the module has been completed, we test the module. For this, white box testing and black-box testing is used. In white-box testing, structural testing is done so all the modules are tested one by one and finally when the project is completed black box testing is used to test the whole system together.

The objective of the system testing is to ensure that all individual programs are working as expected, that the programs link together to meet the requirements specified and ensure that the computer system and the associated clerical and other procedures work together.

6.2 TESTING STRATEGY

Following Testing Strategies are used in the Application:

6.2.1. UNIT TESTING

Unit testing focuses on the smallest unit of software design, like a module or system component. This testing strategy conducted on each module interface to access Boundary conditions are tested and all error handling paths are tested.

6.2.2. INTEGRATION TESTING

This testing strategy follows the testing of combined parts of an application to determine if they function correctly. The purpose of this level of testing is to expose faults in the interaction between integrated units. Testing performed to expose defects in the interfaces and interaction between integrated components.

6.3 TEST SUITES DESIGN

Sr. No.	Test Case	Expected Output	Actual Output	Test Case Result
1.	FastAPI connection with PostgreSQL database service	Connection Success message is shown on the Server log	As Expected	Pass
2.	Add asset category with unique category name and asset tag	JSON Object with input values of the asset category	As Expected	Pass
3.	Add asset category with an existing name or asset tag	Error message to give other name or asset tag for a category as it is already exist	As Expected	Pass
6.	Add company location with a unique name	JSON Object with input values of location	As Expected	Pass
7.	Add company location with an existing name	Error message to give other names for the company location	As Expected	Pass
13.	Add Asset with auto-generated Asset tag and number as per selected asset category	JSON Object with input values of the Asset	As Expected	Pass
14.	Assign asset to an employee with unassigned asset status	Success message of assign asset to an employee	As Expected	Pass
15.	Assign asset to an employee with assigned asset status	Error message ‘Asset is already assigned to a specific employee or room’	As Expected	Pass
16.	Assign asset to room with unassigned asset status	Success message of assign asset to a room	As Expected	Pass
17.	Assign asset to room with assigned asset status	Error message ‘Asset is already assigned to a specific employee or room’	As Expected	Pass
19.	Filter asset based on category, Status, Location, Employee, Room, Supplier or Asset Company	Display asset details based on filtering criteria	As Expected	Pass

20.	Import Asset from .csv, .xls or .xlsx format file	JSON object list with asset details	As Expected	Pass
21.	Import Asset from other format files	Error message for the invalid file format	As Expected	Pass
22.	Export Assets to format like .csv, .xls, xlsx or PDF	Download file into the machine with the specified file format and requirement	As Expected	Pass

Table 6.3 Test Suites Design

6.4 API AND UI VALIDATIONS SNAPSHOTS

6.4.1. Asset Status Validation[12]

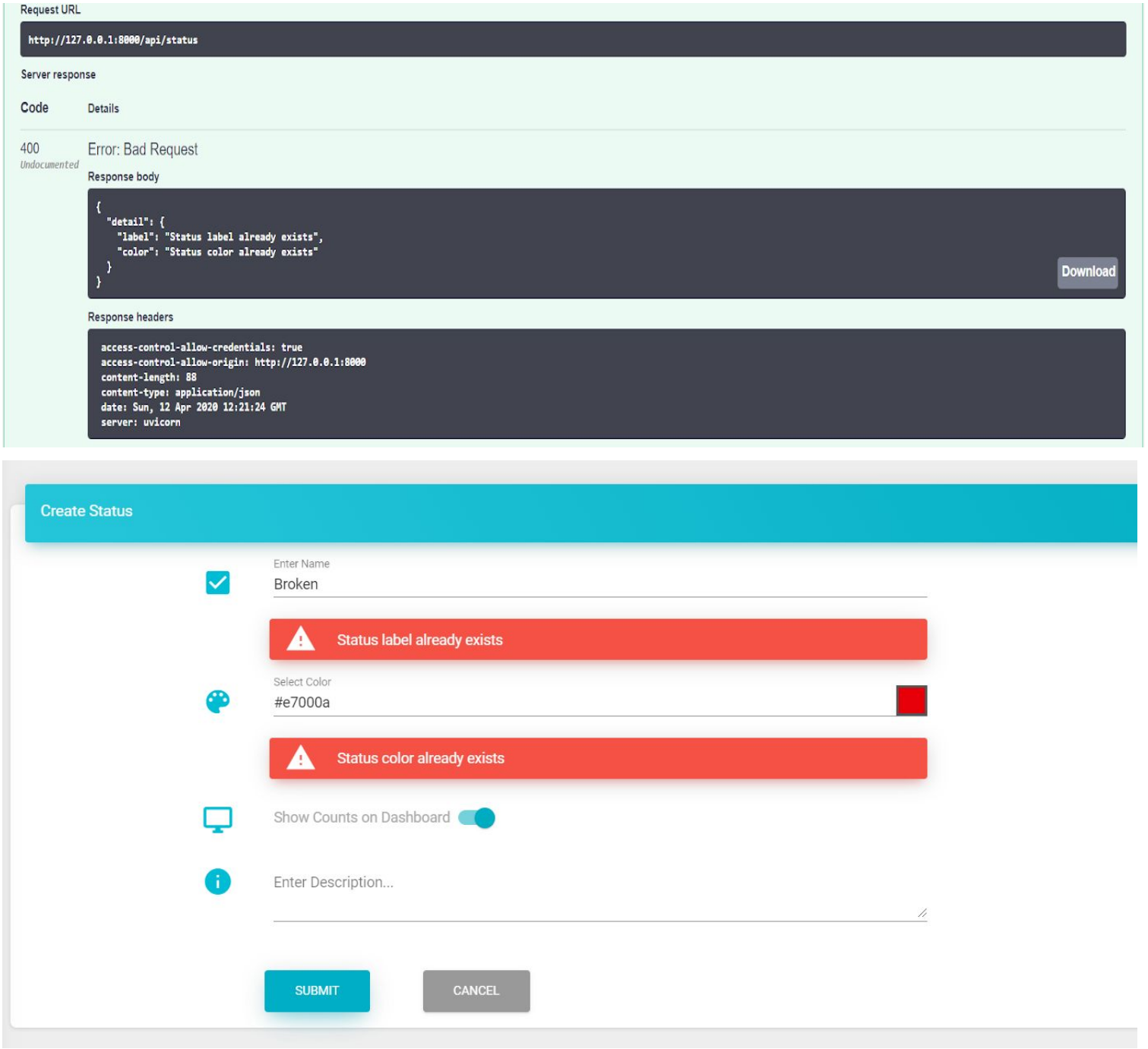


Fig 6.4.1. Asset-status-validation

Asset Status Label name and hex color code value should be unique.

6.4.2. Company Location Validation

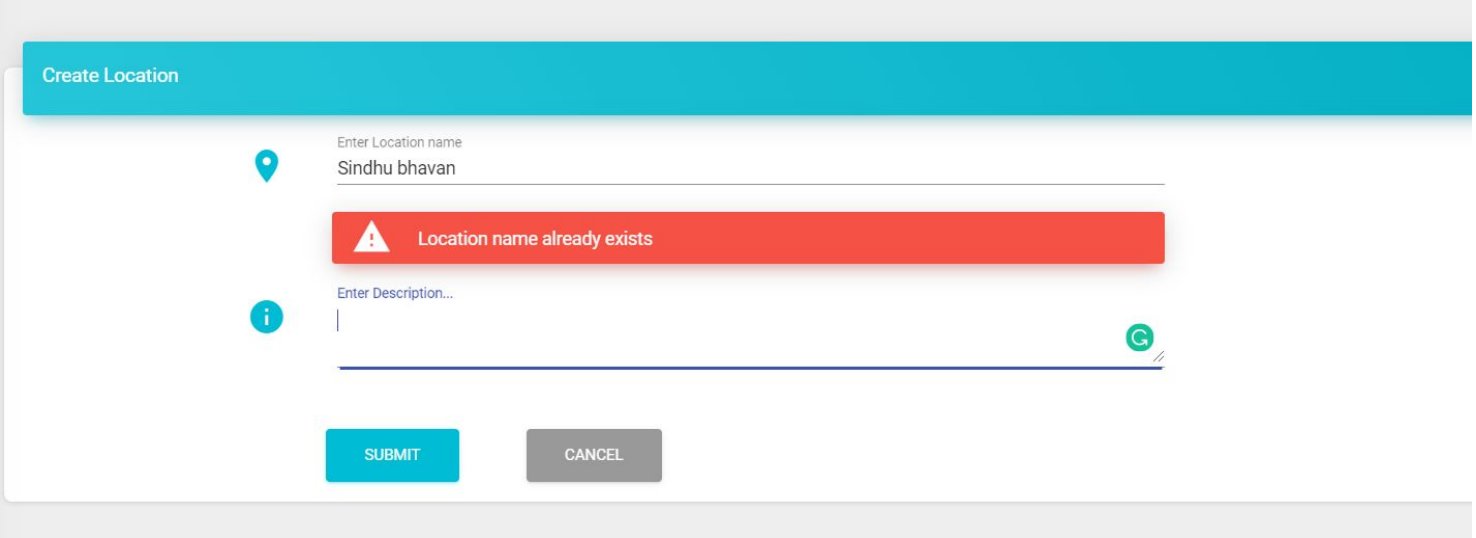


Fig 6.4.2. Company-location-validation

The location name should be unique.

6.4.3. Room Validation[12]

Request URL

```
http://127.0.0.1:8000/api/room
```

Server response

Code	Details
400 *Undocumented*	Error: Bad Request

Response body

```
{
  "detail": {
    "name": "Room name already exists on this location"
  }
}
```

Download

Response headers

```
access-control-allow-credentials: true
access-control-allow-origin: http://127.0.0.1:8000
content-length: 63
content-type: application/json
date: Sun, 12 Apr 2020 12:24:15 GMT
server: uvicorn
```

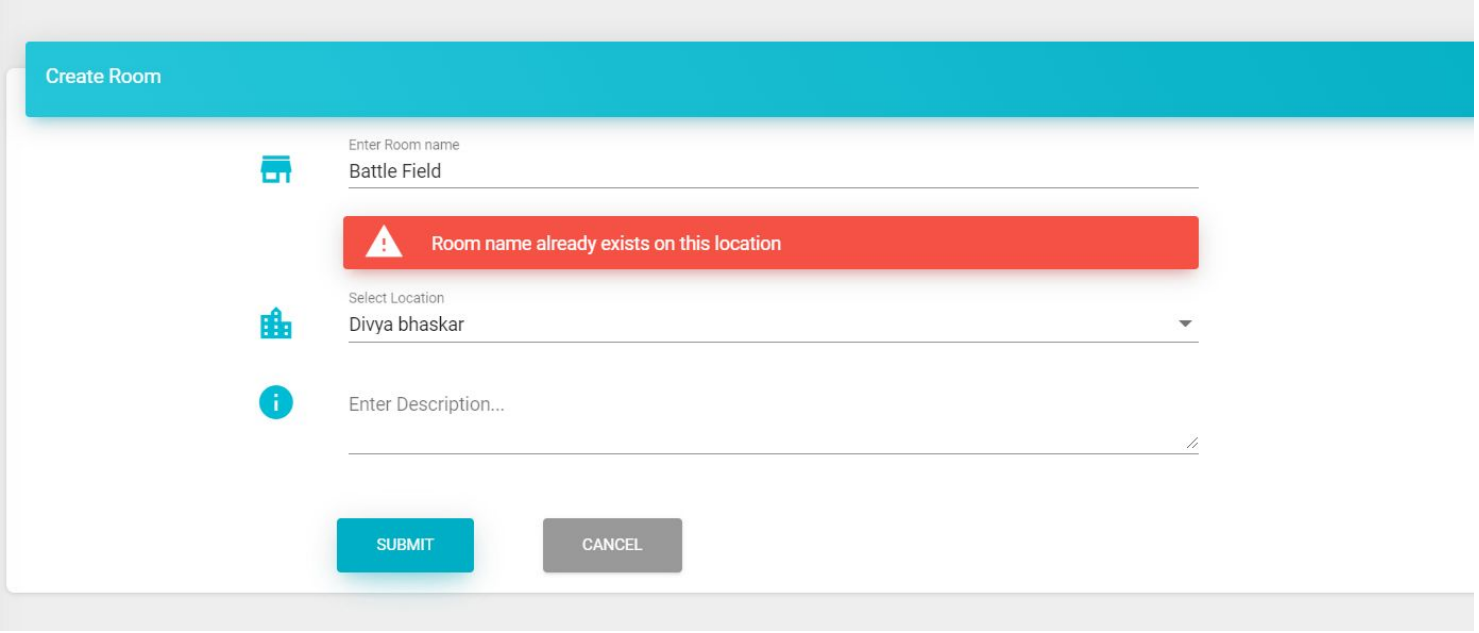


Fig 6.4.3. Room-validation

The room name should be unique for the same location but the different locations can have the same name.

6.4.4. Supplier Validation[12]

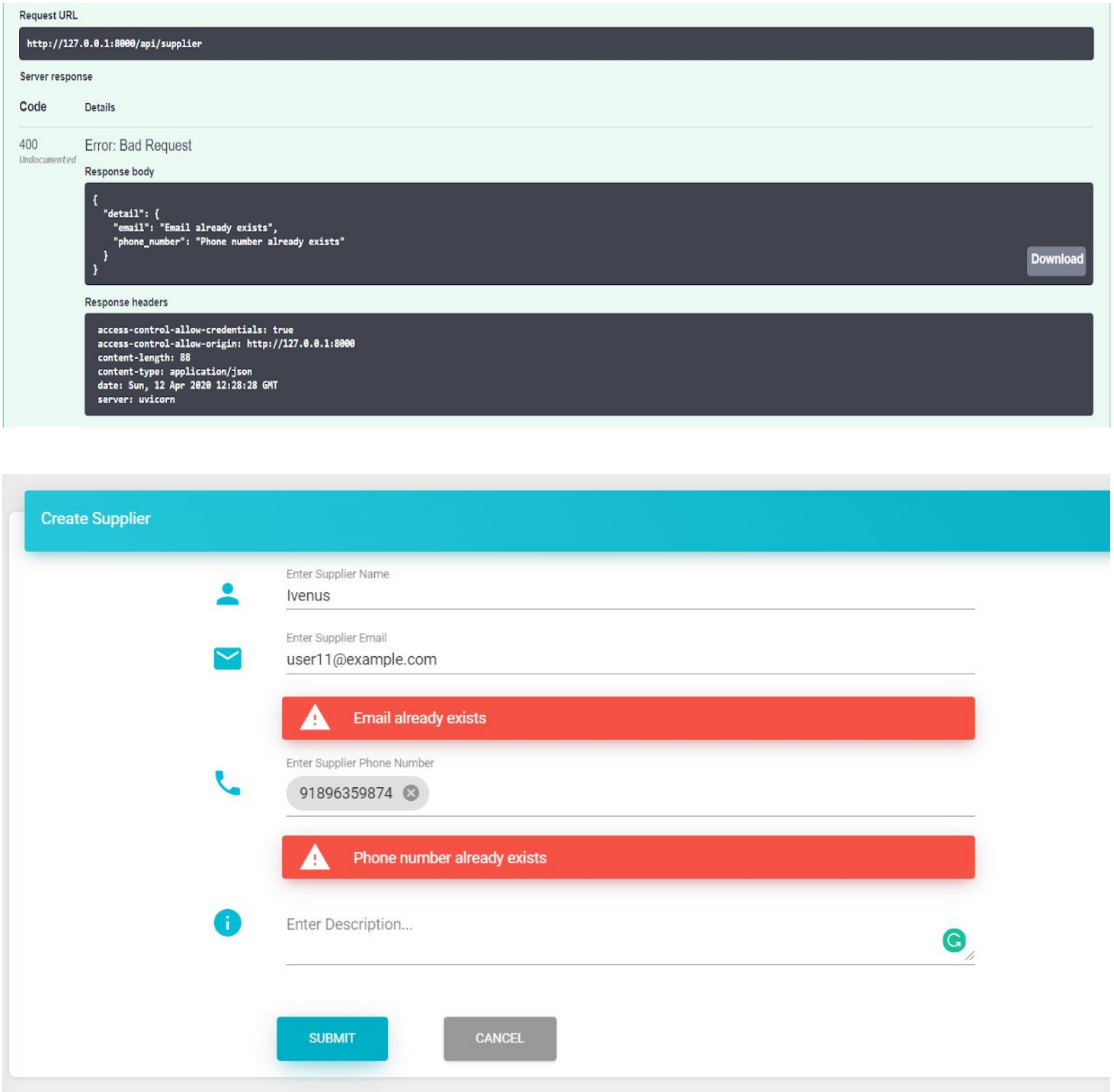
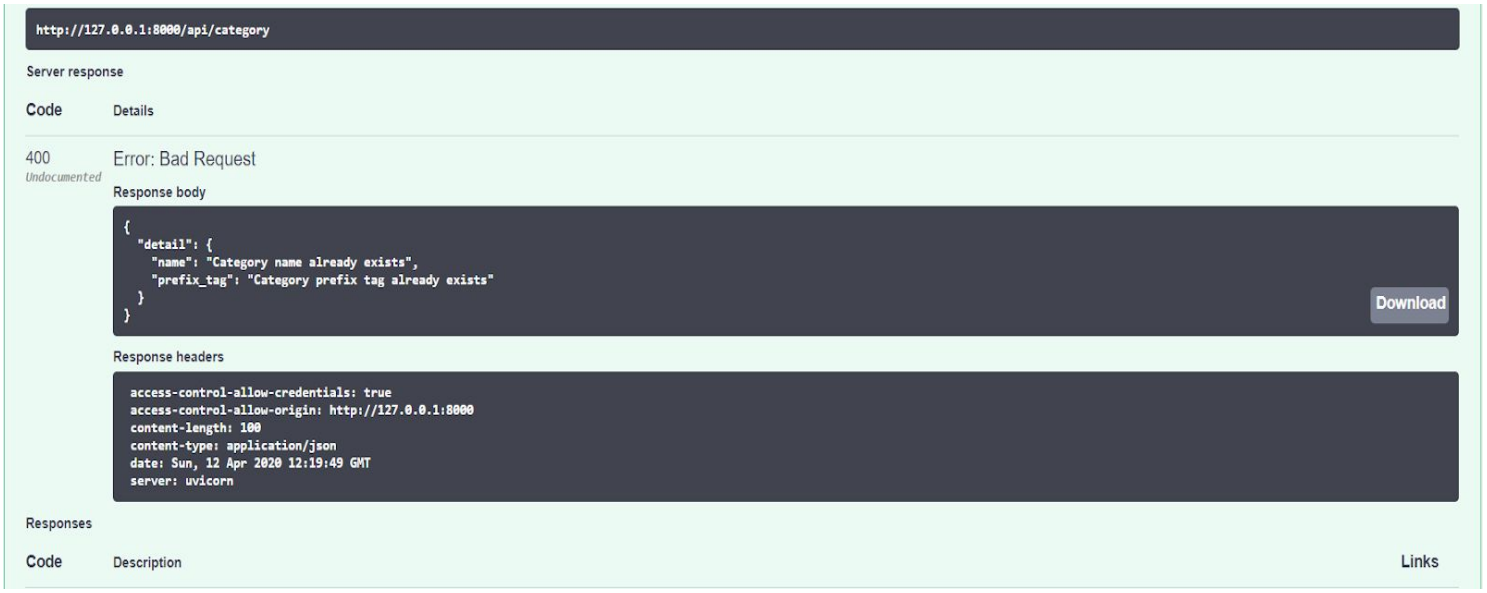


Fig 6.4.4. Supplier-validation

The supplier email and Contact number should be unique.

6.4.5. Asset Category Validation



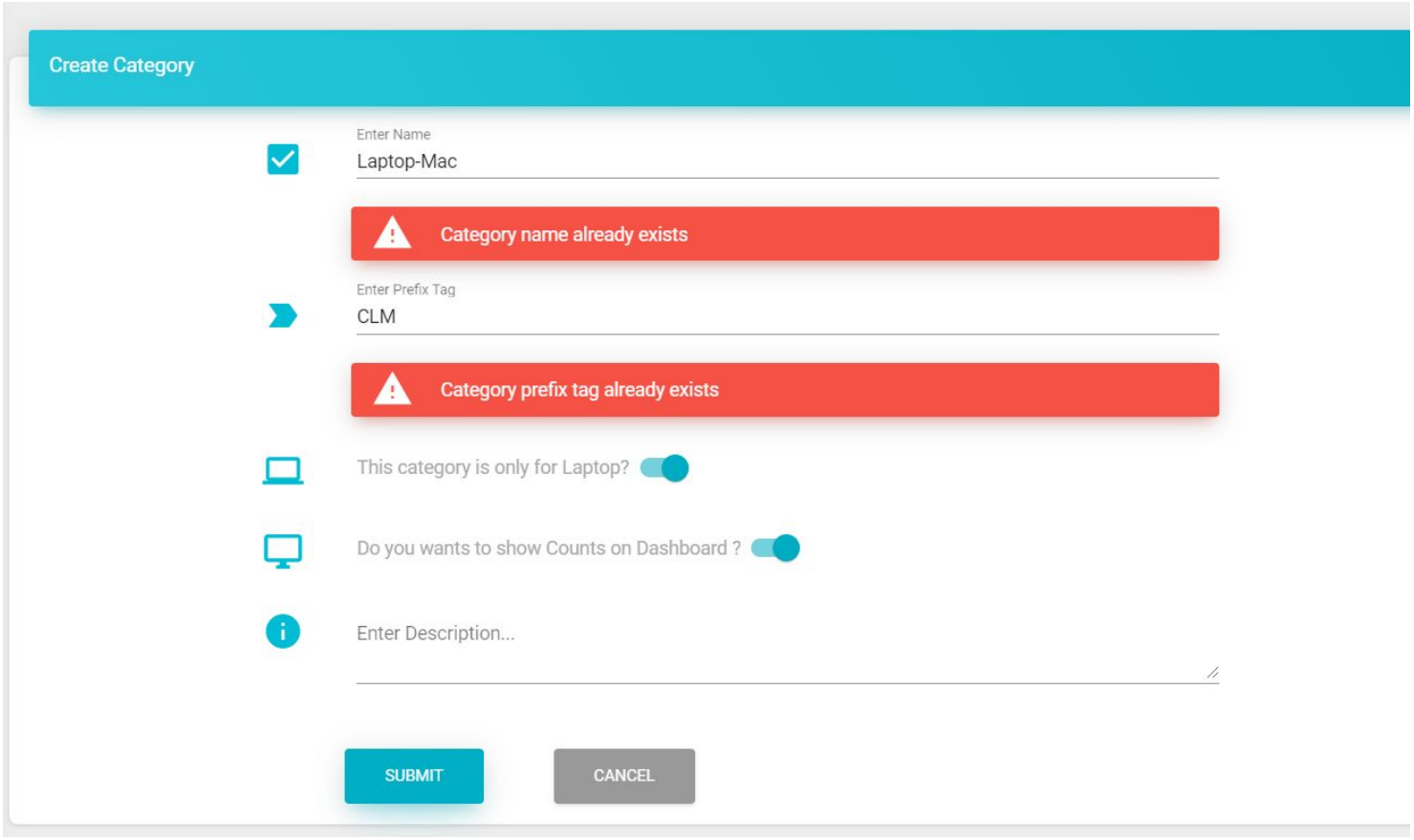


Fig 6.4.5. Asset-category-validation

Category name and Asset Prefix Tag should be unique.

6.5 APPLICATION SNAPSHOTS

6.5.1 Dashboard

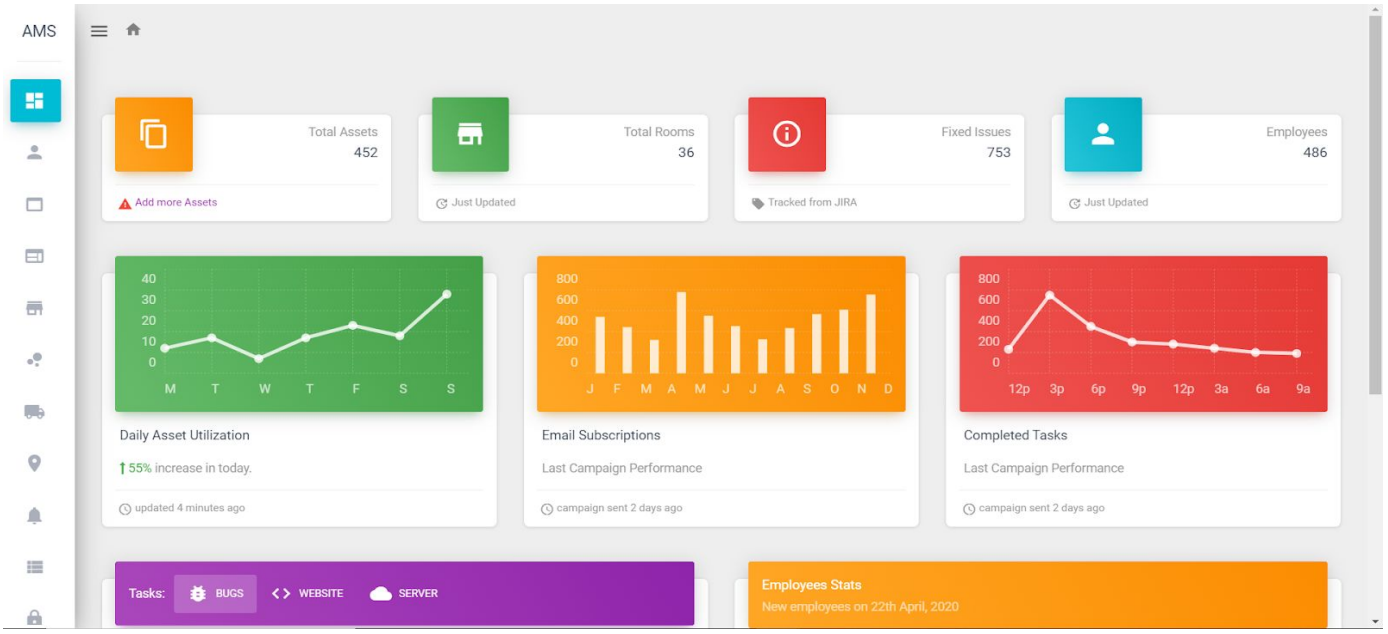


Fig 6.5.1. Dashboard

Dashboard shows the various counts and Activity log of various Assets. Also, there are some statistical graphs and charts shown.

6.5.2 Asset List

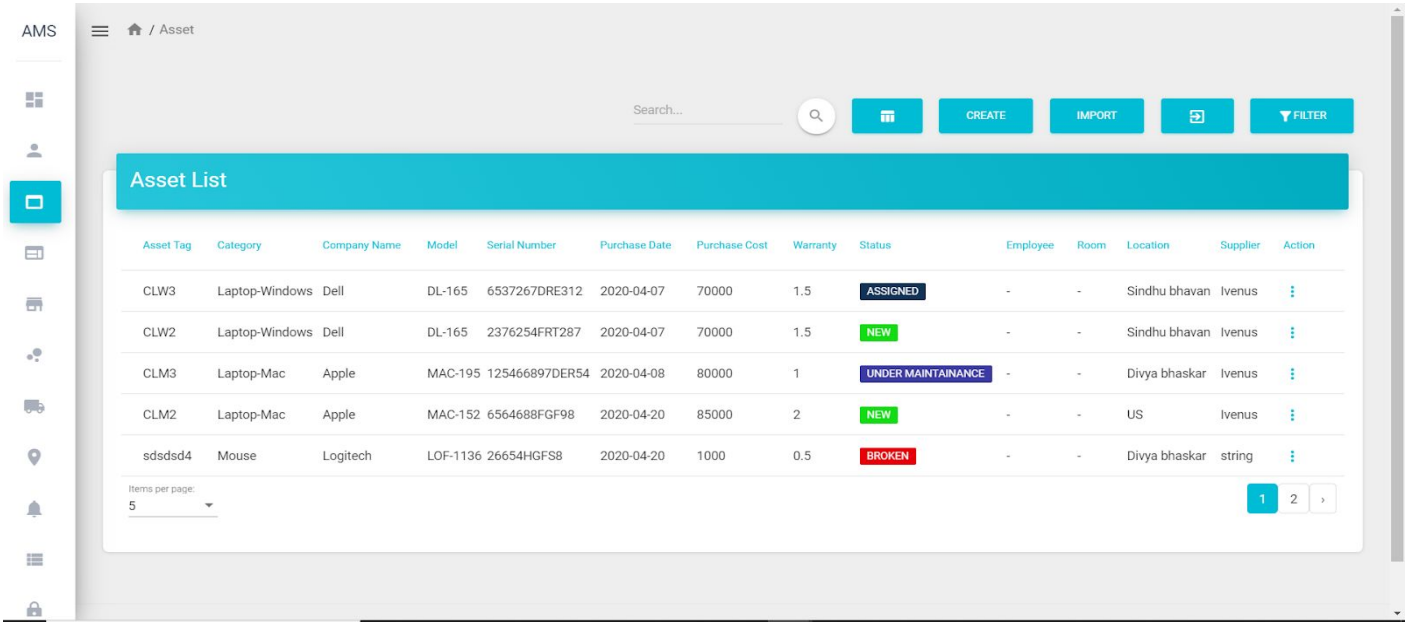


Fig 6.5.2. Asset-list

List of All Assets with status code and relevant details.

6.5.3 Asset List Filters

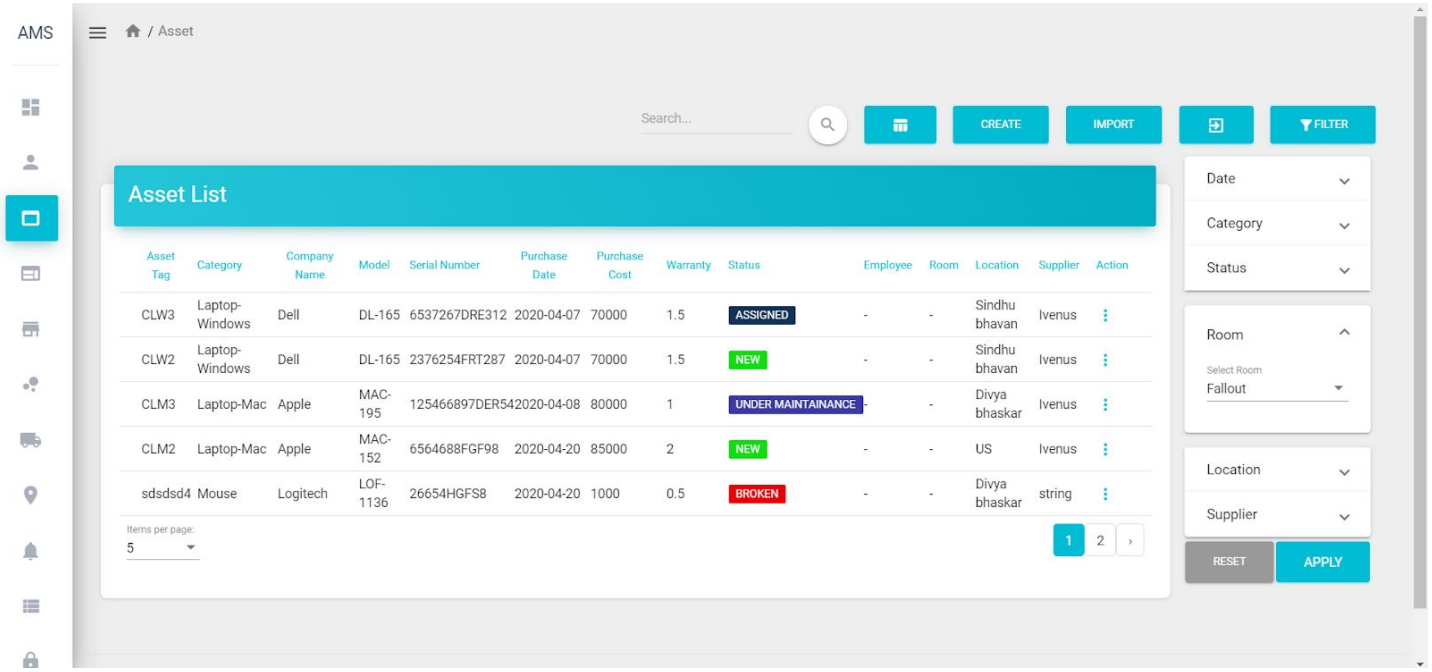


Fig 6.5.3 Asset-list-filter

Asset list with various filters like Status, Category, Location and Activity from start date to end date. So, based on filtering criteria Assets will be sorted out.

6.5.4 Add Asset into System

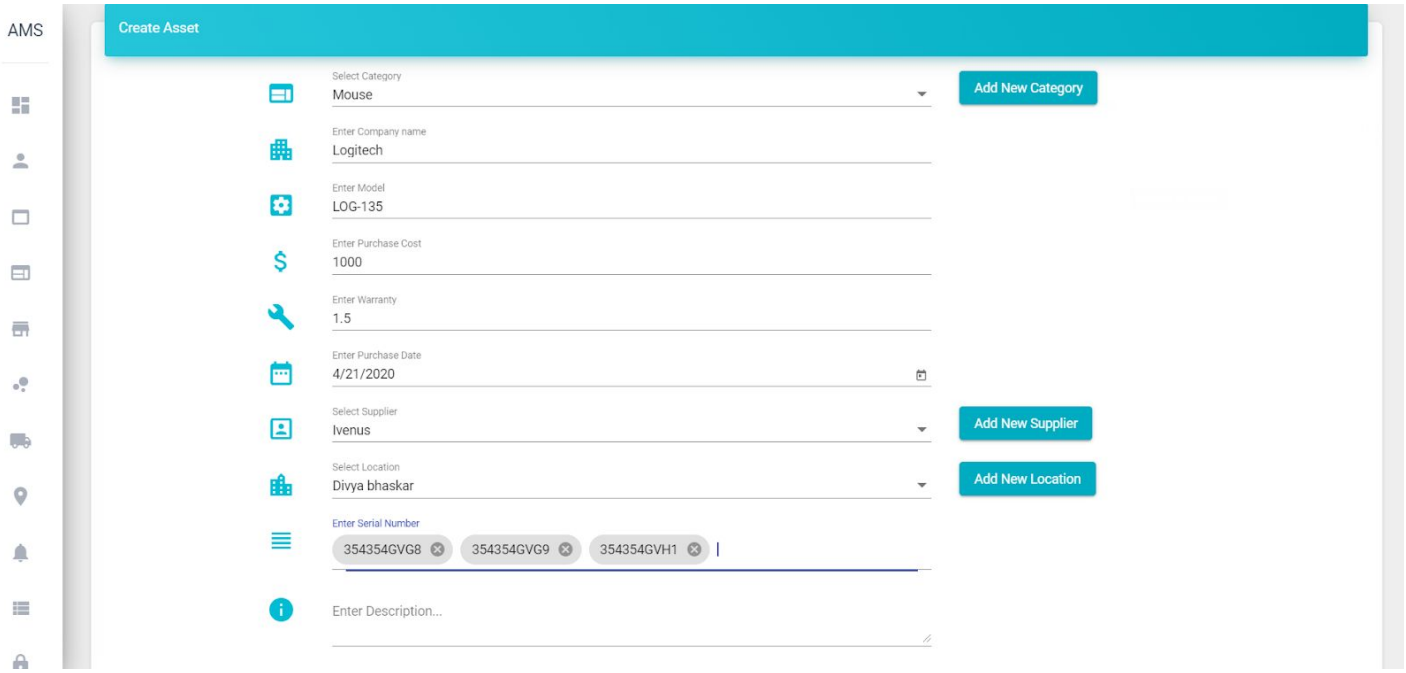


Fig 6.5.4. Add-asset-into-system

Add multiple Asset within the system with same configuration and different serial number

Chapter 7
Conclusion and Future Extension

7.1 CONCLUSION

As keeping a track of assets is important for every organization. This application ties the assets with the IT infrastructure of the organization. With a robust asset management system, management and IT professionals can review and monitor all types of assets within the organization. The information can be used to make detailed decisions about purchase and other aspects of the asset's life cycle.

The system helps in an accurate record of all types of assets. Using the software can help in efficient resource planning. It can also reduce the risk of theft of assets. An asset management system will help to monitor the assets located in different locations and departments. We will get to know where the assets are located. We can run reports to know about ownership, service details, and other insightful information.

The Project provides meaningful information regarding assets to optimize asset utilization and remove manual management tasks of maintaining a spreadsheet for various assets. The featured dashboard can help to get a quick decision by asset count and statistic charts or graphs information.

7.2 FUTURE EXTENSION

- Develop a request module by that Employee can request for a particular asset with a specific configuration and based on that assignment-reassignment of asset tasks would be automated using AI-based algorithms.
- Lost and Found: In the case of asset Lost, If someone lost his/her physical asset in the organization then put asset information (like Assert Tag) onto the system then a notification is sent to employees. In the case of asset Found, If someone found an asset then find the owner name of that asset by entering Asset Tag into the system and send an acknowledgment to the owner.

References

[1] FastAPI Inc. (2020,April). Documentation. https://fastapi.tiangolo.com/

[2] SQLAlchemy Inc. (2020,March). Documentation. https://docs.sqlalchemy.org/en/13/

[3] Psycopg2 Inc. (2020,March). Documentation. https://wiki.postgresql.org/wiki/Psycopg2_Tutorial

[4] Python Inc. (2019,Dec). Documentation. https://docs.python.org/3/

[5] PostgreSQL Inc. (2020, February). Documentation. https://www.postgresql.org/docs/

[6] Angular 9 Inc. (2020,February). Documentation. https://angular.io/docs

[7] Angular Material Inc. (2020,June). Documentation. https://material.angular.io/

[8] Docker Inc. (2020,May). Documentation. https://docs.docker.com/

[9] StackOverflow Inc. (2020,April). Community. https://stackoverflow.com/questions

[10] Redis Cache. https://redis.io/documentation

[11] Balsamiq Wireframing.(2020,February) https://balsamiq.cloud/

[12] Dharva Mistry. (17CP301**),** BVM Engineering College, Vallabh Vidyanagar.

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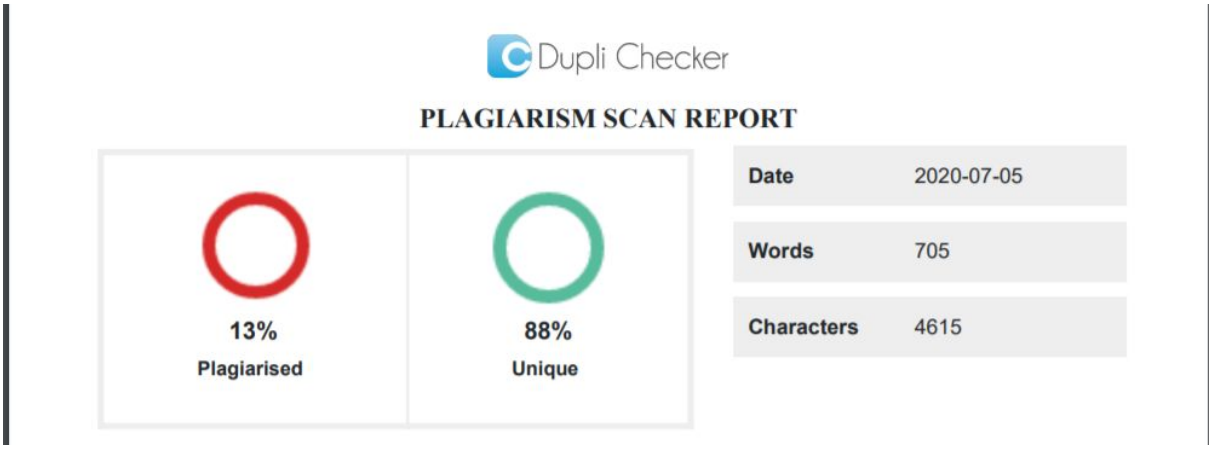

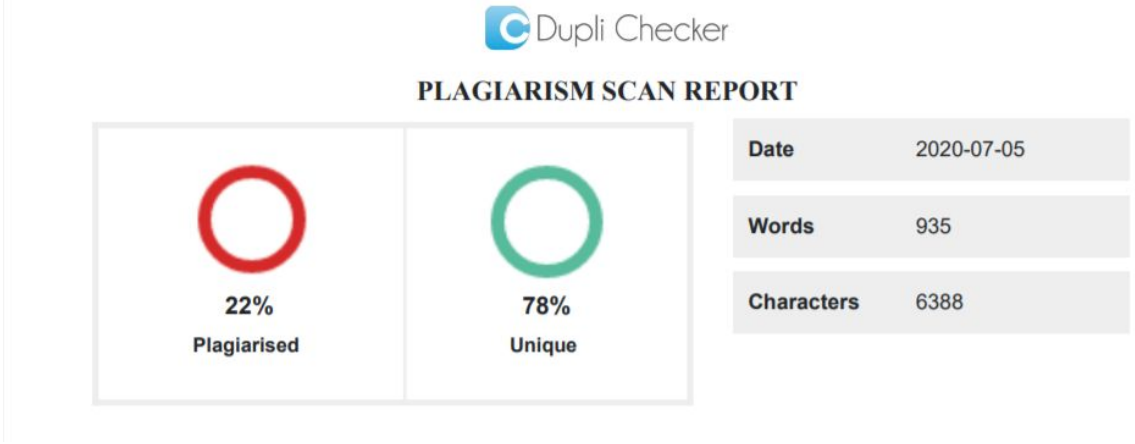

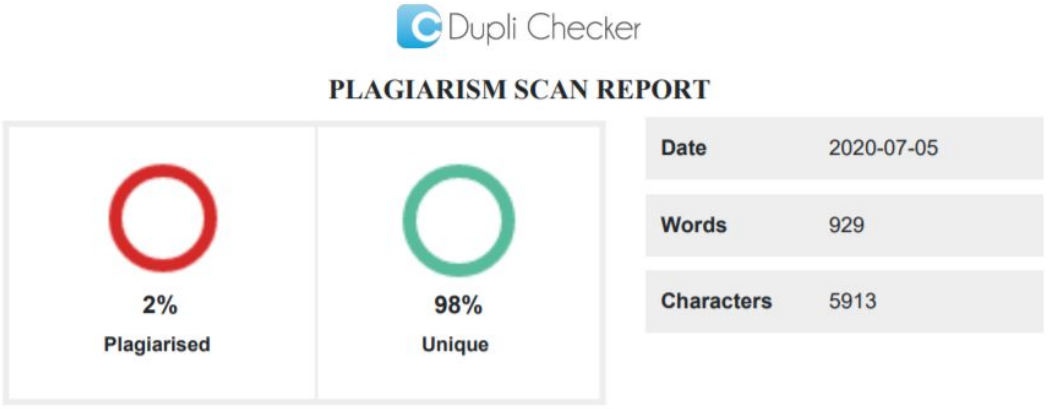

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