

IoT MANAGER - ASSET MANAGEMENT

A PROJECT REPORT

Submitted by

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to

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In partial fulfillment of the requirements for the award of the degree of

MASTER OF COMPUTER APPLICATION



**Thangal Kunju Musaliar College of Engineering
Kerala**

DEPARTMENT OF COMPUTER APPLICATIONS

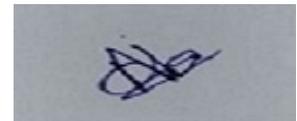
MAY 2023

DECLARATION

I undersigned hereby declare that the project report on **IoT MANAGER - ASSET MANAGEMENT**, submitted for partial fulfillment of the requirements for the award of degree of Master of Computer Application of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of **Prof. Vaheetha Salam**. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not previously served as the basis for the award of any degree, diploma, or similar title by any other University.

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CERTIFICATE

This is to certify that the report entitled **IoT MANAGER - ASSET MANAGEMENT** submitted by **ARJUN B** (TKM21MCA-2009) to the APJ Abdul Kalam Technological University in partial fulfillment of the Masters degree in Computer Application is a bonafide record of the project work carried out by him under our guidance and supervision. This report, in any form, has not been submitted to any other University or Institute for any reason.

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TO WHOM IT MAY CONCERN

This is to certify that Mr. Arjun B from TKM College of Engineering, Kollam has completed the internship on “IoT Manager” project at **Knowledge Lens Pvt Ltd** from 16th January 2023 to 16th May 2023. During the period of his training with us he was found punctual, hardworking, and inquisitive.

We wish him all the success in future endeavors.

Yours Truly,

For **Knowledge Lens Pvt Ltd**.



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ABSTRACT

IoT MANAGER - ASSET MANAGEMENT, The IoT Manager Asset Management portal is specifically designed for configuring assets and their corresponding parameters. These assets include all equipment utilized throughout the entire project. The system allows users to easily create and assign parameters and units necessary for each piece of equipment. Additionally, the system offers a valuable asset modeling feature that promotes asset reusability. This means that users need only create an asset model once, even if the site has multiple plants.

By providing a downloadable template, this system eliminates the need for manual data entry, as users can upload their data directly from an Excel sheet.

One of the key features of this application is its ability to handle asset model, once a model is created that can be used in multiple plants of a site. The system enables users to publish an asset model to a global catalog and duplicate an asset by accessing the same catalog. Each asset within the system is associated with specific parameters, which are accompanied by corresponding units of measurement. Additionally, the system provides a clear definition of the raw materials used in the plant process, including information about their availability and quantities.

Overall, this web application provides a comprehensive solution for managing the asset, helping users to reduce manual entry of huge data and reusability of the asset model.

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Chapter 1

Introduction

IoT MANAGER - ASSET MANAGEMENT is specifically designed for configuring assets and their corresponding parameters. These assets include all equipment utilized throughout the entire project. The system allows users to easily create and assign parameters and units necessary for each piece of equipment. Additionally, the system offers a valuable asset modeling feature that promotes asset reusability. This means that users need only create an asset model once, even if the site has multiple plants.’ Asset Management module empowers industries to make data-driven decisions and improve overall operations. This model can be reused for other industries as well. Any industry that employs IoT devices to monitor and manage its operations can use the web application for monitoring remote edge and IoT devices. Small startups and huge corporations of all kinds can use it to monitor and maintain their IoT devices. The tool is especially helpful for businesses like manufacturing plants, logistics and transportation firms, and healthcare facilities that need to monitor and operate massive networks of devices.

Based on their rights, users are given access to the platform. Each role has its own set of privileges, and unique roles are developed. Users have access thanks to super admins. The system can only be accessed by people who have access. Both Google and a custom login are options for users. Super admins have the authority to add, view, and modify users in the system as well as to design unique user roles. An integral part of the overall system is the login and user management system created for the IoT Manager platform. This method aids in ensuring the security and integrity of the data being gathered and analysed by allowing users to log in and use the platform only with the necessary privileges.

Users can also establish rules to monitor each device using the project’s alarm and rule

creation module. Rules function as thresholds, and alarms are set off when a particular threshold is attained. Users can reuse code written for related reasons thanks to rule functions. The produced rule templates can be applied to numerous circumstances that are identical. The IoT Manager platform has a number of other features and capabilities in addition to the Asset Manager and Alarm and Rule Setup modules that are intended to make it simple for customers to manage and keep an eye on their IoT devices. These include the capability to export data and produce reports, as well as real-time alerts and notifications.

The application must have a number of crucial components in order to successfully run the manufacturing facility. First and foremost, it should have a system for managing users that permits different user kinds, such as super admin, support admin, support user, site user, vendor, and client to sign in with their unique roles and access privileges. Second, it needs to make it possible for users to set up, manage, and keep an eye on edge and IoT devices inside the manufacturing facility. Thirdly, in order to let users examine the data generated by the devices, the application must contain data analysis tools like charts, graphs, and dashboards. Fourthly, it must include a mechanism for notifying customers of any anomalies or issues with the goods or the production process.

1.1 Company Profile

The Lens product line from Knowledge Lens automates and simplifies the discovery of hidden insights within Big Data. The objective is to convert unstructured data into actionable business insights. We are big data technology nerds with a wide range of big data projects, including big data engineering, data science, and industry expertise.

1.1.1 Products

- **iLens(Intelligent Lens)**

iLens offers a centralised platform for the intelligent integration of several devices or sensors in major businesses, the manufacturing sector, the household, commercial properties, etc. In order to record time series data in real time, iLens offers a MQTT interface for smooth integration of various field sensor devices. iLens has the capacity to produce alerts and alarms depending on pre-configured rules.

- **MLens**

MLens is a one-step solution for managing disaster recovery for big data and platforms.

Features of MLens :

1. Big Data Backup Migration
2. Automated Disaster Recovery
3. Data Encryption, compression Archival
4. High Speed Batch Data Ingestion
5. Monitoring Scheduling
6. Secured Access controls

- **AiLens**

Next-generation AI platform with a collaborative workspace, experiment designer, engineering workbench for modelling features, and integrations for enterprise security and DevOps with the repository of AI/ML assets.

AiLens is an intelligent AI assistant with a single graphical user interface for creating Data Engineering and AI/ML pipelines. AiLens' unified AI orchestrator enables users to launch model executions on any runtime, including Tensorflow, SparkML, H2O, MxNet,

Theano, PyTorch, and AWS / Azure, via a centralised console. Given that every user will have the same experience, AiLens is extremely adaptable. regardless of any future technology developments due to the platform's meta model-driven design. Our software stands out from the competition by a wide margin thanks to its intuitive job submission and monitoring structure, secure integration with external entities, built-in encryption, and support for role-based access control. Key features are:

1. Any AI Stack, Any AI Algorithm, Anywhere
 2. Unified AI Orchestrator
 3. Simplified User Experience
 4. Intelligent Assistant for AI
 5. Integrated Data Preparation AI Modelling Environment
 6. Seamless Enterprise Security Integration
- **GLens** GLens is available for the acquisition, monitoring, and analysis of industrial emissions, effluent discharges, and ambient air monitoring in real time. GLens DAS Software, GLens Server Platform, and GLens Environ Data Logger offer a comprehensive solution for all industrial environmental needs. Any analyzer, sensor, or device can be connected to the platform using a plug-and-play model, and real-time data can be acquired.

The key features of GLens are::

1. Rest based open protocol for multi-client deployment.
2. Real time alerts and alarms with SMS and Email integration.
3. Remote calibration and configuration of analyzers.
4. Plug and play complete protocol integration with any analyzer make and model. – Integrated and data quality codes as per ISO 7168.
5. Integrated analytics and predictive models for effective pollution control.
6. Live consolidated industry dashboards.

1.1.2 Services

- **Big Data Engineering Services**

This service provides end-to-end solutions for Big Data projects, including architecture design, development, testing, and deployment.

- **Big Data Security Services**

We are a niche consulting firm that offers specialised Big Data Services.

- **Big Data Analytics Services**

Using our pre-built analytical Lens, we deliver hidden insights from a wide range of data sources.

- **Big Data Competency Development**

Even in the absence of in-house Big Data expertise, we offer top-notch Big Data Competency Development programs for enterprises.

1.2 Existing System

The IoT-based asset manager project's current system may entail manual asset and equipment tracking, which can be time-consuming and prone to human mistake. Asset monitoring may also be restricted to fixed locations or recurring inspections, which may not offer real-time information on the performance and upkeep requirements of the assets. Additionally, the current system might not have a centralised platform for managing assets, making it challenging to monitor the state of assets and the data they are connected to. This system can be time-consuming for manual entry of huge data. This system leverages data collection to pinpoint areas for improvement, streamline operations, and cut costs.

1.3 Proposed System

The Asset Manager module presents a thorough model of every equipment, along with its relevant parameters, processes, materials, and resources. This module facilitates industries to manage their assets more efficiently, enhance performance, and minimize downtime. By offering real-time information on asset performance and maintenance requirements, the Asset Manager module empowers industries to make decisions based on data and enhance overall

operations. Moreover, it eliminates the need for manual data entry and promotes reusability of data. The suggested system analyses industrial data using sophisticated analytics methods like simulation and predictive modelling to find patterns and trends.

The platform permits users to establish rules for monitoring individual devices, functioning as thresholds. Whenever a threshold is surpassed, alarms are activated. The system generates rule templates that can be applied to multiple similar situations, and rule functions enable users to recycle code intended for comparable objectives.

The platform dispatches real-time notifications and alerts to users as soon as a device goes offline or when a rule is activated. Additionally, the platform furnishes the capability to export data and generate reports intended for device supervision and administration objectives.

1.4 Objective

The project deliverable are the following:

- Develop a system for Consolidating all equipment under a unified group, encompassing parameters, materials, rules, process, and resources. etc (eg ;The vessels V-1001, V-1002, and V-1003 have been combined into a single cohesive group known as Vessel.
- Clone the asset model from global catalog.
- Publish the asset model into global catalog.
- Uploading excel file to avoid manual entry.
- Create parameters and its unit that required for the asset(Equipment)
- Consolidating units and Parameters into a unified group and category.
- Performing direct unit conversion within the same system, such as converting centimeters to liters, is straightforward and can be done using a single conversion factor.

Chapter 2

Literature Survey

A literature survey, or literature review, is the analysis of academic sources pertaining to a particular subject. This examination of literature allows for a comprehensive understanding of the field by identifying relevant theories, approaches, and gaps in existing knowledge. When conducting a literature review from an audit perspective, the focus is on evaluating literature published in a specific field of study, which may be limited to a certain time period.

A literature review is a crucial tool for research as it provides a foundation for exploring a specific subject area. It not only identifies important theories and concepts but also reveals gaps in current knowledge and highlights areas that require further research. By analyzing multiple sources, a literature review provides a more complete understanding of the topic or issue.

Additionally, a well-crafted literature review enhances the credibility and authority of the author by demonstrating their familiarity with current research and debates in the field. Sometimes, a literature review may involve a meta-analysis, which involves analyzing the findings of multiple studies to identify common patterns or trends. It is important to note that a literature review is not a research paper or an argumentative essay but rather a focused examination of existing research and literature on a specific topic.

2.1 Purpose of the Literature Review

1. The purpose of a literature review is to make research on a particular topic easily accessible to readers by identifying and summarizing high-quality articles or studies that are relevant, meaningful, significant, and valid.
2. For novice researchers in a new field literature review provides an excellent starting point

by requiring them to summarize, evaluate, and compare original research in that field.

3. It ensures that researchers do not repeat work already completed.
4. A literature review may offer insights into the direction of future research or highlight areas that require greater emphasis.
5. The main focus of a literature review is to emphasize the principal findings of the studies or articles being reviewed.
6. Finding any discrepancies, gaps, or inconsistencies in the body of material being studied is one of the main functions of a literature review.
7. An effective study of the methods and strategies employed by other researchers in the topic being evaluated is part of a literature review.

2.2 Related Works

2.2.1 IIoT

The article suggests a cloud-based smart factory 4.0 based on the IIoT (Industrial Internet of Things). Through the use of sensors and other IIoT devices, this system enables real-time monitoring and control of production processes and equipment. Scalability, flexibility, and simple access to data and services from any location at any time are made possible by the cloud-based architecture. The introduction of the article covers the idea of Industry 4.0, which is the incorporation of digital technology into the industrial process. Industry 4.0 has been embraced by businesses all over the world and is a significant driver of innovation and productivity in the manufacturing sector. The next section of the report discusses Industry 4.0's opportunities and problems, including the need for real-time monitoring, sophisticated analytics, and enhanced supply chain management. The architecture of the proposed IIoT-based smart factory 4.0 over the cloud is then presented in the study. The system is made up of a number of layers, including the physical layer, the layer for data acquisition, the layer for communication, the layer for data storage, and the layer for applications. The sensors and other IIoT devices that collect data on the machinery and manufacturing processes are part of the physical layer. Data collection and transmission from the physical layer to the cloud are the responsibility of the data acquisition layer. Data is transmitted across the various layers via protocols like

MQTT, OPC UA, and Modbus, which are part of the communication layer. The cloud services Amazon S3 and others are part of the data storage layer, which is where data is processed and stored. The software applications that offer real-time monitoring and control of the industrial processes and machinery are included in the application layer. The benefits of the suggested method, which include greater productivity quality, less downtime, and enhanced efficiency, are then covered in the article. The real-time monitoring and control capabilities of the system allow for proactive maintenance and fault detection, reducing the risk of equipment failure and downtime. Real-time data analysis enabled by the cloud-based architecture also offers insights into the operation of the machinery and the manufacturing processes. The paper makes the case that by providing real-time monitoring, data analysis, and sophisticated analytics, the suggested system can assist businesses in achieving Industry 4.0 objectives. The development of the cloud-based architecture, the installation of sensors and other IIoT devices, and the system's integration with current industrial systems are all covered in the paper's implementation of the proposed system. The article covers the opportunities and difficulties involved in putting the suggested system into practice, including data security, interoperability, and the requirement for qualified employees. Overall, the paper presents a comprehensive overview of the proposed IIoT based smart factory 4.0 over the cloud. Through real-time monitoring and control, the system is intended to increase the effectiveness and dependability of industrial processes. The cloud-based architecture provides scalability, flexibility, and simple access to data and services. The article outlines the possible advantages of the suggested system and offers a direction for ongoing work in the area of IIoT-based smart manufacturing.[1]

Asset Management is an essential task for every industry. Keeping track of assets manually is a monotonous and time consuming task which is also error prone. Integrating asset management with IoT can automate it to a large extent. Proper management of assets can boost the company's productivity. With the advancements in the field of IoT, tasks like tracking location of assets, managing asset's parameters can be done with ease. The available solutions to Asset Management use Active or Passive Radio Frequency Identification Device (RFID) tags. These solutions have disadvantages like need of high and continuous battery power and are applicable only for small distances (up to 100m). Usage of Bluetooth Low Energy (BLE) Tags can overcome these problems. The data from sensor nodes can be sent to a cloud based central repository through message queuing telemetry transport (MQTT) protocol and then it can be further analyzed. This data can be visualized and managed through a web application.

The motivation for automating and improving current asset management solution has paved the way for a new architecture. This paper provides a detailed run down on that architecture and how it can be deployed for real time application. For any industry to thrive forward, the management of assets plays a vital role. Assets can be tangible such as buildings, machines or intangible such as human capital, financial assets and many more. Assets can be present onsite or at a distant location. Asset Management can be referred as a systematic process of maintaining and managing assets considering its cost, performance and risks. In most of the companies, keeping log of these assets is either done manually or semi-automatically which could be error prone. At times it may lead to errors and can cause damage to economy of the industry. In some extreme cases it can jeopardize the security of an organization. Also, poor management of assets like raw material and machinery equipments may hamper the quality of product. With introduction of IoT and Cloud computing in asset management, it can solve these problems as well as provide efficient and advance asset management. Introduction of IoT in enterprise also led to development of Remote Monitoring. [5] In this, data is sent to the cloud through a gateway and the cloud stores this data which is processed by an industrial application. Asset management can be build on remote monitoring which can increase the performance, maintainability and risk management in a cost effective way.[2]

Many systems are switching to wireless technology as a result of the expanding use of electronic devices and industrial automation technologies. The growth of the Internet-of-Things (IoT), which uses wireless devices to connect to each other through the internet, has been responsible for this transition. The phrase "Industrial Internet-of-Things" (IIoT), which includes the word "Industrial" for systems of industrial automation, is added to IoT. IoT and IIoT use comparable technology, but IIoT needs more functionality and resilience to function in challenging industrial environments. Sensors and actuators in industrial automation systems typically run on conventional electrical current (4–20 mA) and voltage (0–12 or 0–24V). Actuators transform electrical power into physical parameters, whereas sensors transform physical parameters into electrical parameters. To achieve closed-loop control, controllers examine the electrical parameters produced by sensors and send control signals to actuators. Machines in an industrial automation system communicate with each other through a Machine-to-Machine (M2M) or Device-to-Device (D2D) protocol, which involves communication between digital controllers using a specific protocol. One commonly used protocol is Modbus, which can operate on Modbus-ASCII or Modbus-RTU formats and either Modbus-Serial (RS-

485) or Modbus-TCP/IP (Ethernet) connections. This research focuses on IIoT devices that operate on Modbus-RTU with Serial (RS-485) communication because it is commonly used in industrial automation devices. [3]

The solution for industrial inventory automation using Industry 4.0 technology is presented in the article. The system automates the inventory management process in a factory setting using a variety of technologies, including RFID (Radio Frequency Identification), IoT (Internet of Things), and cloud computing. The challenges of using conventional inventory management procedures in a production setting are covered in the first section of the paper. The paper makes the case that conventional inventory management procedures are frequently labor-intensive, error-prone, and manual, which causes inefficiencies and delays in the production process. In order to automate inventory management and boost production, the report suggests using Industry 4.0 technology. The architecture of the proposed system is then shown, which makes use of cloud computing for data storage and analysis, IoT devices for data collecting and transmission, and RFID tags for item identification. Operators can keep track of inventory levels and avoid stock-outs and overstocks because to the system's ability to track inventory item movement in real-time. The paper explains how the suggested system was put into practise in a manufacturing setting. The technology is used to automate the raw material and finished goods inventory management process. Each item has an RFID tag attached, and IoT devices are utilised to gather information on the movement of these goods. The advantages of the suggested approach are covered in the article, including increased production and efficiency, lower expenses associated with maintaining inventory, and better accuracy and dependability in inventory management. The factory's performance can be enhanced by the operators thanks to the system's real-time data collection and analysis capabilities. The limitations and difficulties related to putting the suggested approach into practise are also covered in the article. These include the requirement for qualified employees for the system's development and deployment, the requirement for data security measures, and the requirement for compatibility with other technologies and systems. [4]

Fieldbus systems based on Ethernet dominate the industrial communication market. These systems have various implementations and ecosystems, which presents challenges for end users and device makers. Utilising several technologies increases expenses and restricts IoT potential. In this work, OPC UA TSN is presented as a novel solution that satisfies industrial communication needs while maximising the financial advantages of common

Ethernet hardware. OPC UA TSN is anticipated to revolutionise industrial automation by creating a comprehensive communication architecture that connects sensors to the cloud. [5]

Motion control system for automated warehouses that is IIoT-based, with the goal of increasing material handling process effectiveness. The IIoT platform, which enables real-time data collecting, analysis, and decision-making, is integrated with the motion control system in the system the authors suggest. To track the location and motion of the material handling equipment, the system incorporates a number of sensors, including proximity sensors and encoders, as well as a wireless communication module for data transmission. The advantages of installing an IIoT-based motion control system, such as better operational effectiveness, decreased maintenance costs, and improved safety, are also covered in the paper. The authors present experimental findings to show how the suggested approach might increase the efficacy of the material handling process. According to the findings, the system can cut down on both the energy used by the machinery and the cycle time of the material handling process by up to 20%. The advantages of installing an IIoT-based motion control system, such as better operational effectiveness, decreased maintenance costs, and improved safety, are also covered in the paper. The authors present experimental findings to show how the suggested approach might increase the efficacy of the material handling process. This paper gives a thorough description of the proposed IIoT-based motion control system for automated warehouses and shows how it could increase the effectiveness and sustainability of industrial operations. The authors also stress how crucial it is to integrate different system parts, including sensors, communication modules, and data analytics tools, in order to reach peak performance. [6]

Noninvasive control solution for energy efficiency in wastewater treatment plants,” addresses the important issue of energy efficiency in wastewater treatment plants. The authors propose a noninvasive control solution that uses artificial intelligence and machine learning to optimize energy consumption and improve the overall efficiency of the plant. Whether a non-invasive control method can be created to optimise energy use in wastewater treatment plants is the research issue that this work attempts to answer. Given the industry’s rising demand for energy-efficient operations, the authors present a convincing case for why it is crucial to answer this question. The authors test their noninvasive control solution at a wastewater treatment plant using a case study methodology. In the case study, data was gathered from the SCADA system of the plant and used to create a predictive model using machine learning methods. After optimising the plant’s energy use with the prediction model, the authors

compared their findings to historical energy consumption data for the facility. The study's findings demonstrated that the noninvasive control method may optimise energy use in the plant, leading to a notable drop in energy use and an increase in efficiency. The authors draw the conclusion that their noninvasive control method can be an effective tool for raising wastewater treatment plants' energy effectiveness. By suggesting a noninvasive control method that might increase energy efficiency in the sector, the article "Noninvasive control solution for energy efficiency in wastewater treatment plants" makes a significant addition to the field of wastewater treatment. The technique is well-explained, and the findings are backed up by statistics. Future research in the subject will benefit from the comprehensive analysis of the findings and acknowledgment of the study's limitations that are provided in the discussion section. Despite certain study limitations, the paper adds significantly to the body of knowledge on energy efficiency in wastewater treatment facilities. [7]

2.2.2 Python

The writers of this essay examine the benefits and applications of the Python programming language. They praise its adaptability, readability, and simplicity and point out that Python's sizable standard library, frameworks, and vibrant developer community have made it a well-liked option in industries including data science, web development, and machine learning. The writers also go through key advantages Python has over other programming languages, such as its platform independence, versatility, and simplicity of learning.

For many purposes, including data visualisation, web scraping, and machine learning, they offer Python code examples. Python, according to the authors, is the programming language of the future and will likely become more and more popular as a result of how simple it is to use and how well it can handle challenging jobs. They assert that because Python offers so many chances, studying it is crucial for both students and working professionals in the technology industry. Overall, this essay provides a clear and succinct review of Python's capabilities and uses, and it makes a strong case for why Python is the programming language of the future. Additionally, it offers code examples that both novice and seasoned programmers can find helpful. [8]

2.2.3 FastAPI

The article starts off by giving a summary of the important components of FastAPI, such as its high-performance, asynchronous design, and integrated validation and documentation capabilities. It also examines the framework's interaction with well-known data science and machine learning libraries like Pandas and Scikit-Learn as well as its support for contemporary Python syntax.

The paper then delves into FastAPI's fundamental design, emphasising how it uses the Pydantic and Starlette libraries to offer a quick, scalable, and type-safe web API framework. The use of dependency injection by the framework to streamline the administration of application dependencies and enhance code modularity is also covered.

FastAPI has built-in capability for automatic API documentation production, which is one of its notable features. The article gives a thorough explanation of FastAPI's use of the OpenAPI specification to automatically generate API documentation, making it simple for programmers to design thorough, self-documenting APIs.

The integration of FastAPI with the WebSocket protocol, which supports real-time applications, is also covered in this work. This makes it a great option for applications that need high speed and low latency since it enables developers to create real-time systems that are quick to construct, scalable, and with little overhead.

The article examines the FastAPI community and its expanding ecosystem of plugins, tools, and extensions in addition to its technical features. It indicates the framework's acceptance by the Python community as well as the FastAPI team's and open-source contributors' active development and support of it. It also emphasises the framework's robust ecosystem and community, which make it a dependable and long-term option for web API development. [9]

2.2.4 Angular

Developers frequently employ the open-source web application framework Angular to create cutting-edge, dynamic websites. An MVC (Model-View-Controller) framework called Angular was created to make it simpler for programmers to create and manage sophisticated online applications.

Google created the TypeScript-based web application framework known as Angular in 2010. AngularJS, which was also created by Google, has been completely rewritten in Angular.

Angular is a framework for creating scalable, maintainable, complex online applications that is built on the MVC architecture. To create web applications, Angular makes use of a number of concepts, including modules, components, services, templates, and directives. Developers may create web applications rapidly using the built-in directives and services that Angular offers.

A component in Angular is a building block used to design the user interface (UI) of a web application. A component is a standalone unit made up of a class, a template, and a collection of styles. The HTML that will be displayed on the web page is defined by the template. The class manages the component's data and behaviour and provides the component's logic. The components' outward appearance is determined by their styles. The `@Component` decorator, a TypeScript feature that enables developers to add metadata to a class, is used to define components.

For the creation of web applications, Angular offers various benefits. Angular is a comprehensive framework that offers all the functionality required to create sophisticated online apps. TypeScript, a statically-typed language that offers improved type verification and code completion, is the foundation of Angular. RxJS, a reactive programming toolkit that enables more effective handling of asynchronous events, is used by Angular. Additionally, Angular offers a collection of integrated directives and services that programmers may utilise to create web applications quickly. [10]

2.2.5 Redis

Redis is an in-memory data structure store used as a message broker, database, and cache. As a database, cache, and message broker, it is an open-source in-memory data structure store. Data structures supported by Redis include strings, hashes, lists, sets, and sorted sets. It offers atomic operations on these data structures, enabling highly efficient complicated data manipulation. Redis can handle millions of queries per second and is made to be incredibly quick and scalable. With built-in replication and failover methods that guarantee data is always accessible even in the event of hardware or network failures, it is also highly available. Redis has a number of additional characteristics that make it particularly well-suited for usage as a cache, such as support for key expiration durations and the capacity to automatically remove outdated or useless keys. Overall, Redis is a strong and adaptable technology that can be used for a variety of tasks, from straightforward caching to intricate data manipulation and storage. [11]

2.2.6 MongoDB

A well-known NoSQL (non-relational) document-oriented database system called MongoDB implements this data model. For developers, it was made to be adaptable, scalable, and simple to use. The document-oriented data model of MongoDB is one of its fundamental characteristics. Like conventional relational databases, MongoDB stores data in flexible documents with dynamic schemas as opposed to tables and rows. It is simple to store and query data of various types because each document can have a distinct structure. MongoDB is a fantastic option for applications that need to handle unstructured or semi-structured data, such as social media platforms, content management systems, and IoT (Internet of Things) applications because of its document-based approach.

Scalability is one of MongoDB's key advantages. It is simple to manage massive amounts of data and huge traffic volumes because MongoDB is built to grow horizontally across several servers. It distributes data among many cluster nodes using a method known as sharding to make sure that data can be retrieved fast and reliably. MongoDB is a fantastic solution for applications that need to manage a lot of data, such as e-commerce platforms, gaming platforms, and financial services, thanks to its scalability.

The performance of MongoDB has also been enhanced. It has a number of capabilities, like in-memory caching, indexing, and a strong query language that can perform complex queries with ease, that make it quick and effective. This makes MongoDB a fantastic option for applications like online marketplaces, social media platforms, and real-time analytics systems that need to give quick, real-time data access.

The ability to perform ad hoc queries is yet another crucial aspect of MongoDB. Ad hoc queries are supported by MongoDB, allowing you to search for data in any field, whether or not it has been indexed. This makes real-time data exploration and analysis simple, and it makes it simple for developers to test out new queries and data structures.

Additionally, MongoDB comes with an effective aggregation architecture that enables you to carry out challenging data analysis operations including grouping, sorting, filtering, and merging data from other collections. This framework makes it simple to carry out business intelligence and advanced analytics operations, and it can aid developers in identifying patterns and trends in their data.

MongoDB offers support for MapReduce, a programming approach for handling huge volumes of data concurrently over a cluster of servers, in addition to its aggregation architec-

ture. From straightforward data conversions to intricate analytics tasks that demand distributed computation, MapReduce can be employed for a variety of purposes.

Modern online and mobile applications can easily work with data thanks to MongoDB's JSON-based data structure. Additionally, it offers a robust ecosystem of libraries and tools and supports a wide variety of programming languages. Because of the sizeable and engaged developer community that supports MongoDB, new libraries, tools, and plugins are always being created.

In general, MongoDB is a well-liked option for developers that require a versatile, scalable, and user-friendly database system that can manage a variety of data types and volumes. Modern web and mobile apps benefit greatly from its document-based data model, support for ad hoc queries, robust aggregation framework, and scalability. [12]

2.2.7 PostgreSQL

Powerful open-source object-relational database system PostgreSQL, also referred to as Postgres, has been developed since 1986. It is famous for being reliable, strong, and capable of supporting cutting-edge features. Postgres is a popular option for many applications because it is free to use, modify, and distribute.

The relational database management system of Postgres is one of its key characteristics. Since Postgres employs a relational architecture, data is arranged into tables with columns and rows. This facilitates data management, structured data storage, and data integrity assurance. Applications that demand great scalability and performance, such financial services and e-commerce, frequently use Postgres because of its reputation for handling enormous amounts of structured data.

Support for SQL, the industry-standard language for handling relational databases, is another key feature of Postgres. Developers may carry out a variety of operations with the help of SQL, which is a strong and flexible language. These operations include creating, updating, and removing data as well as searching data using sophisticated criteria. All of the common SQL operations are supported by Postgres, along with a number of more sophisticated capabilities like stored procedures, triggers, and views.

Postgres is renowned for having sophisticated security measures. It supports a variety of authentication techniques, such as SSL and GSSAPI, and safeguards sensitive data with powerful encryption and hashing algorithms. Additionally, Postgres features role-based access

control, which enables administrators to specify user roles and permissions, ensuring that only authorised workers have access to sensitive data.

The extensibility of Postgres is a key component. Because of its modular architecture, Postgres enables developers to add additional features and functionality by way of extensions. In order to manage complex data types and operations, developers can add their own custom data types, functions, and operators to Postgres. Due to its flexibility, Postgres has generated a sizable ecosystem of third-party extensions, allowing it to be a robust and adaptable database system.

Additionally, Postgres is renowned for its ACID compliance and support for transactions. Transactions are completed reliably and with data integrity when ACID compliance is followed. In order to maintain consistent and dependable data, Postgres features multi-version concurrency control (MVCC), which enables several transactions to take place simultaneously without interfering with one another.

A variety of performance improvement tools are also included in Postgres, including indexing, caching, and query optimisation. With the aid of these characteristics, Postgres is more likely to function successfully even under demanding conditions and significant traffic levels. Additionally, Postgres offers parallel processing, enabling the execution of several queries concurrently, significantly enhancing performance and scalability.

Finally, Postgres has a sizable and vibrant development community that regularly adds new functionality, enhancements, and extensions to the software. By doing so, developers have access to the most recent tools and technology and Postgres is kept current and relevant. [13]

2.2.8 A qualitative analysis of the performance of MongoDB vs MySQL

This article provides a qualitative analysis of the insertion and retrieval performance of MongoDB and MySQL databases using a web/android application. The benefits of load balancing and sharding in MongoDB are also covered in this paper.

The paper begins by introducing the two database systems, MongoDB and MySQL, and analysing the significance of database systems in contemporary applications. The report emphasises the contrasts between the two databases' architectures and functionalities.

The experimental design and research technique are then presented in the publication. A web/android application is used in the study to compare the insertion and retrieval performance of MongoDB and MySQL databases. The study does load testing using the Apache JMeter tool

and evaluates the outcomes based on response time, throughput, and error rate.

The study's findings are presented and discussed in the paper. According to the study, MongoDB performs better than MySQL for both insertion and retrieval activities in terms of response time and throughput. MongoDB has a lower error rate than MySQL, according to the study.

The research offers a significant contribution to the study of database systems and performance analysis overall. The study offers a useful comparison of MySQL and MongoDB databases' performance based on actual use cases. The benefits of load balancing and sharding in MongoDB for contemporary applications are also discussed in the paper.

The paper's usage of Apache JMeter for load testing is remarkable. A popular tool for load testing and performance monitoring, Apache JMeter offers a useful and trustworthy method for assessing database systems. For contemporary applications, the usage of response time, throughput, and error rate as performance measures is also suitable and pertinent. [14]

2.2.9 Data management techniques for Internet of Things

The Internet of Things (IoT) has a number of data management difficulties, which are thoroughly examined in this paper, along with the many methods created to address them. The paper gives a general overview of IoT and the many elements that make up the IoT ecosystem. The issues of IoT data management, including security, scalability, and data heterogeneity, are then discussed. Each of these issues is thoroughly examined by the writers, who also discuss how they affect IoT data management. The study then looks at the many data management strategies created to deal with the enormous amounts of data produced by IoT devices. Data filtering, data aggregation, data fusion, and data mining are some of these methods. The authors describe how these methods function and how to utilise them to process and examine IoT data in order to get insightful information.

The use of cloud computing in IoT data management is also discussed in the article. The authors emphasise how scalable and affordable solutions for IoT data processing and storage may be provided by cloud computing. The authors also cover edge computing, a different method for managing IoT data, where data processing and analysis are carried out near the devices that are producing the data, at the network's edge. The authors summarise their findings in their conclusion and stress the need of efficient data management in maximising the potential of IoT.[15]

Chapter 3

Methodology

IoT MANAGER - ASSET MANAGEMENT is specifically designed for configuring assets and their corresponding parameters. These assets include all equipment utilized throughout the entire project. The system allows users to easily create and assign parameters and units necessary for each piece of equipment. Additionally, the system offers a valuable asset modeling feature that promotes asset reusability. This means that users need only create an asset model once, even if the site has multiple plants. Provided a global catalog that is used for clone and publish the asset model. This system allows for unit conversion if a specific asset requires it.

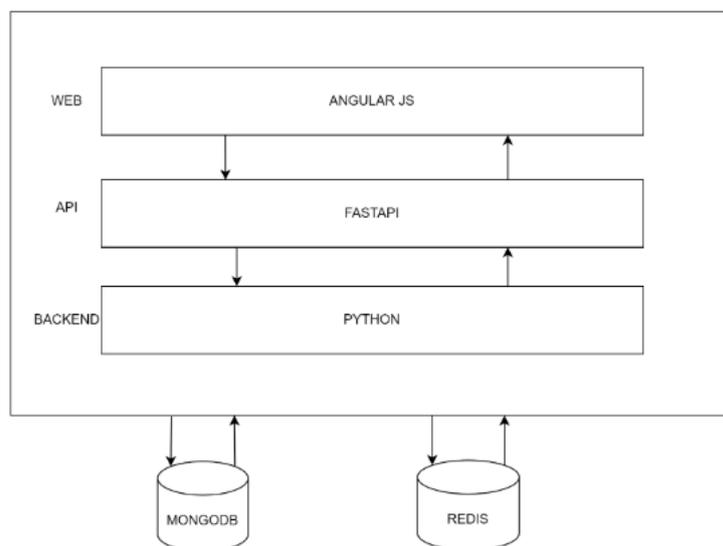


Figure 3.1: System model

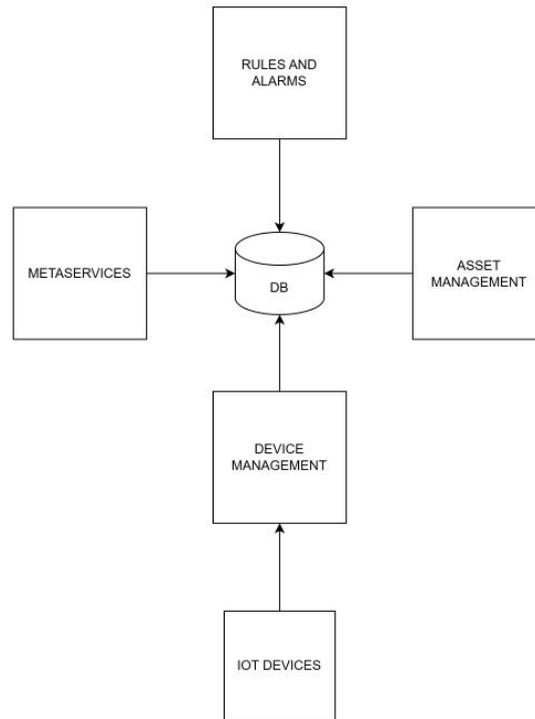


Figure 3.2: IoT Manager System

3.1 Key Features of IoT Manager Asset Management

- Create a model of an equipment at a site, and if there is an existing asset model available in the global catalog, you can clone it.
 - Create parameter
 - Unit of the parameter
 - Parameters and units are grouped and categorized together based on their shared characteristics or attributes to achieve organization and alignment.
 - The materials used in the plant process, along with their availability and quantities, are concisely defined.
 - Add research paper based on the asset.
- Reusability of an asset model.
- Publish asset model to global catalog.
- Instead of manual data entry, you can upload an Excel sheet.

- Parameter association and Unit conversion.

3.2 Module Description

Admin

- Create parameter.

The identifying elements or critical components of a system, also known as the nomenclature, are crucial for accurately recognizing and categorizing the system. To achieve organization and alignment, parameters should be grouped together based on their common characteristics or attributes. (eg; A,B,C,...etc to Alphabets.) or consolidate similar parameter groups into cohesive categories.

- Asset model creation

Assets encompass all the equipment used throughout the entirety of the projects, Consolidating all equipment under a unified group, encompassing parameters, materials, rules, process, and resources. etc (eg ;The vessels V-1001, V-1002, and V-1003 have been combined into a single cohesive group known as Vessel.

- Create unit of the parameter.

Measuring unit of particular parameter, The units of parameters are determined by the context in which they are used, and can include measures such as meters, seconds, kilograms, or other relevant units depending on the specific parameter being referred to.

- Add the process of the equipment.

The process of a particular project can be defined as a systematic and organized series of steps or activities aimed at achieving specific goals or outcomes in an efficient and effective manner.

- Clone the asset model.

Instead of creating the same asset multiple times for different sites, we can simply clone it from the global catalog.

- Publish the asset model to global catalog.

This module enables a user to publish an asset model to the global catalog, which can be used in the future if needed.

- Upload excel sheet.

To simplify the process of entering parameters, units, and parameter mappings, an Excel sheet can be uploaded, eliminating the need for manual entry. A template Excel sheet can be downloaded from the site to assist with this process.

- Add papers based on the equipment.

Resource paper regarding a asset model is used for understnading working of particular asset .

- Can define a unit conversion.

Unit conversion is a multi-step process that involves multiplication or division by a numerical factor, selection of the correct number of significant digits, and rounding..let us consider the user wants to convert 1 meter into centimeters, in the From field box, the user must enter "meter" and in the To field box, the user should enter "centimeters" the Value field box is where the user should mention the difference between one meter and one centimeter,

3.3 System Specifications

The application development architecture recognized for this project is specified in this section on the basis of requirements.

3.3.1 Hardware Requirements

- Processor: Minimum 1 GHz (Recommended 2GHz or more)
- Hard Drive: Minimum 4 MB (Recommended 6 GB or more)
- Memory (RAM): Minimum 1 GB (Recommended 4 GB or above)
- Internet connection

3.3.2 Software Specification

- Fast API(Python) - for building microservices
- AngularJS - Front end
- PostgreSQL,MongoDB,Redis - Database
- Windows, Mac, Linux, Any - OS
- Mozilla Firefox,Chrome,Microsoft Edge, Any - Browser

3.3.3 Software Description

- **Python**

Popular high-level programming language Python is used for many different things, including web development, scientific computing, data analysis, artificial intelligence, and more. It is renowned for its succinct and clear syntax, which even beginners would find simple to read and write. Python is a highly adaptable language with a wealth of tools and resources available thanks to its extensive standard library and a sizable developer community that contributes to its packages and modules. With applications ranging from small-scale scripts to massive enterprise systems, its ubiquity has made it one of the most extensively used languages in the world. Additionally, Python is cross-platform, meaning that it may be used with a variety of operating systems, such as Windows, macOS, and other various flavors of Linux.

- **FastAPI**

A contemporary and speedy web framework for creating Python APIs is called FastAPI. It is made to be user-friendly, scalable, and high-performing. FastAPI is based on Pydantic, a potent library for data validation and serialisation, and Starlette, a quick and light ASGI framework. Because of its ease of use, speed, and developer-friendly layout, FastAPI is frequently employed in the sector.

Performance is one of FastAPI's primary characteristics. To achieve excellent performance, FastAPI makes advantage of Python's asyncio package and asynchronous programming. It is an appropriate option for applications with strict scalability needs

because it can manage massive volumes of concurrent traffic and requests. Performance is further enhanced by FastAPI's built-in support for caching and database connections.

The ecosystem of FastAPI is constantly expanding thanks to the regular addition of new packages and plugins. Additionally, the developer community for FastAPI is large and active, supporting and advancing the framework. The extensive and well-organized FastAPI documentation makes it simple to get started and learn about the framework.

- **Angular**

A well-liked JavaScript framework for creating responsive and dynamic web apps is AngularJS. It was created by Google in 2009 and is currently utilised extensively in web development. With the help of AngularJS, programmers can easily and effectively write complex client-side apps utilising a declarative approach. AngularJS's two-way data binding, which enables model updates to automatically update the view and vice versa, is one of its core features. This makes it simpler to create intricate, interactive user interfaces and decreases the amount of boilerplate code required to manage the application state.

Additionally, AngularJS offers a complete set of tools and functionality for creating modular, scalable apps. It contains a built-in dependency injection system, which makes handling dependencies easier and makes the code less complicated. Furthermore, AngularJS enables directives and reusable components, making it simple to develop and reuse UI components throughout an application.

AngularJS' extensive community support and resources are a further benefit. It contains a significant ecosystem of plugins and third-party libraries that provide more features and capabilities. Furthermore, AngularJS offers a wealth of online tools and documentation, making it simple for developers to get started and learn about the framework.

- **MongoDB**

MongoDB is a flexible NoSQL database system that excels at managing document-oriented data due to its scalability and flexibility. Its popularity is due to characteristics like its flexible schema design, horizontal scalability, and load balancing, which make it a preferred option for illustrious companies. NoSQL databases store data horizontally and without schema, in contrast to relational databases, and only handle a few number

of join queries. Numerous programming languages, including C, C++, Go, Java, Python, Ruby, and Swift are supported by MongoDB. Due to its adaptability, readability, maintainability, interactive nature, and strong standard library, Python is a well-liked option. Additionally, MongoDB offers several ways to carry out aggregation operations and can be used as a file storage system (GridFS).

- **PostgreSQL**

The object-relational database system PostgreSQL combines the SQL language with cutting-edge capabilities for effective data storing and growth. It is very dependable. It has been improved over the period of more than three decades and was initially created as a part of the POSTGRES project at the University of California, Berkeley. Because of its stellar reputation for data integrity, durability, and a wide range of functions, PostgreSQL is a favourite among developers. To further enhance its image, its open-source community is committed to offering high-performance and cutting-edge solutions. Additionally, PostgreSQL is compatible with all common operating systems and has been ACID-compliant since 2001. The majority of businesses today, like Uber, Netflix, Spotify, and Instagram, use Postgres in their infrastructure. Psql, a command-line tool, or Postgres can be used to access Postgres client PgAdmin.

- **RedisDB**

Redis is a well-liked, open-source in-memory data structure store with several uses, including acting as a database, cache, and message broker. Strings, hashes, lists, sets, and sorted sets are just a few of the various data structures that Redis supports. It is renowned for its lightning-fast performance and ability to manage massive amounts of data. Replication, transactions, Lua scripting, and pub/sub messaging are further built-in features. Web applications, message queuing systems, and real-time analytics are just a few examples of the many areas where Redis is frequently utilised. Additionally, Redis offers client libraries for a number of computer languages, such as Python.

- **Kairos DB**

In order to store and analyse time-stamped data, KairosDB is an open-source time series database. It is designed specifically to manage massive amounts of time series data, including metrics, measurements, and events. Fast access to historical data is

made possible by KairosDB's effective data storage and retrieval features. An active open-source community supports KairosDB, offering ongoing updates, bug fixes, and community-based assistance. It has uses in many different fields, such as monitoring systems, Internet of Things (IoT) gadgets, financial data analysis, and more.

3.4 System Design

IoT manager - Asset management is made specifically for configuring assets and the parameters that control them. These resources comprise all of the machinery used for the entire project. Users can quickly define and assign the parameters and units required for any piece of equipment using the system. The technology also provides a useful asset modelling function that encourages asset reusability. This means that even if the site includes several plants, users only need to construct an asset model once.

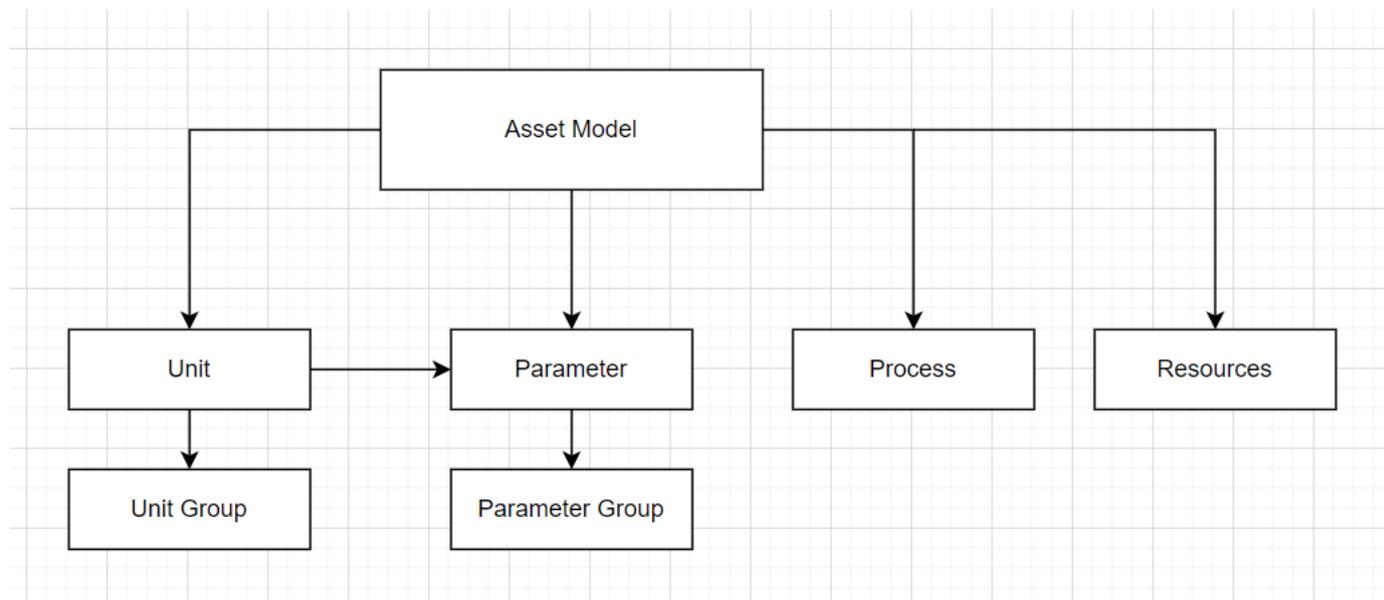


Figure 3.3: System design

Asset model is a model of a an equipment that can be reuse if the site have multiple plant .A asset model have parameter,process,resources.

– Unit

The units of parameters are established by the context in which they are used and, depending on the particular parameter being referred to, can include measurements

such as metres, seconds, kilogrammes, or other pertinent units. With regard to their resemblance, units can be grouped or categorised.

– Parameter

The parameters, sometimes referred to as the nomenclature or identifying aspects of a system, are essential for correctly identifying and classifying the system. Parameters should be grouped together based on their shared qualities or properties in order to establish organisation and alignment. We can also categorise parameters.

– Process

A project's process can be characterised as a methodical and well-planned sequence of actions intended to achieve particular objectives or results in a time- and cost-efficient manner.

– Resource

Paper pertaining to specific equipment. This aids the user in comprehending how the asset functions.

– Processes

A project's process can be characterised as a methodical and well-planned sequence of actions intended to achieve particular objectives or results in a time- and cost-efficient manner.

Chapter 4

RESULT AND DISCUSSION

Testing is the primary method of quality control in software development. After the coding stage, programs are tested by running them to identify any flaws that may have been introduced during development or earlier phases. The goal of testing is to identify flaws in program requirements, design, or coding. Successful testing is achieved when a program is run, and errors are identified. The objective is to develop test cases that can systematically uncover many types of issues with minimal time and effort. Through testing, software functionalities are confirmed to operate as expected, and performance criteria are met. The information gathered during testing is an excellent predictor of program reliability and a partial indicator of overall software quality. However, testing has a drawback, as it can only reveal the presence of software defects and not their absence.

4.1 Testing Methods

Testing is crucial to ensure the absence of errors in the system. Its main goal is to identify errors and omissions by running the software, while also ensuring that the developer meets all project objectives.

4.1.1 User Acceptance Testing

The success of any system depends largely on user acceptance. To ensure this, the system must undergo continuous evaluation and testing throughout the development phase. This entails maintaining open communication with potential end-users and incorporating their feedback into the system's design. In this project, a menu-driven system, input screen design, and output

screen design were carefully considered and implemented to achieve user approval. User-centered design is the process of involving users in the design and development of the system, ensuring that their needs and preferences are met. This leads to higher levels of user satisfaction and system adoption. In this project i used this testing method for: Test senarios:

- The parameter curreclty Associate to a particular asset model.
- Verify the unit conversion that is required for a paramter.
- publish asset model to global catalog and clone from same.
- ensuring that the parameters, units, and asset models added through the uploaded Excel sheet are verified as being added correctly.
- making sure that unit conversions are accurate when entering data.

4.1.2 Validation Testing

Validation testing is the process of verifying whether a system fulfills the expectations and requirements of its users or clients. The validation testing process begins by verifying that all the specified requirements for the asset manager system have been implemented correctly. This includes checking if the system can accurately identify and track assets.

Functional testing focuses on testing individual features and functions of the asset manager system. This includes validating asset registration,association parameter,if uploading a excel sheet curreclty added to the currending field, and add process and resources to the asset.

Since the asset manager system operates in real-time, it is important to evaluate its performance under different loads and conditions. Performance testing involves measuring system response times, throughput, and scalability. It ensures that the system can handle a significant number of assets, process data efficiently, and maintain acceptable performance levels during peak usage periods.

4.2 Output Screens and Results

1. Parameter overview

View of all parameters. The parameters of the entire site are displayed in their entirety on this page. You can define a parameter by In the appropriate field boxes, provide the parameter name, label, and description. Select the appropriate Unit from the drop-down list in the General Properties section. Choose the Data Source and Parameter Group to which the parameter belongs.

Parameters / Parameters

Parameters | Parameter Groups | Parameter Categories

↑ ↓ Create New +

Parameter Name	Description	Unit	Parameter Group	Data Source	Parameter Cate...	Input Type	Actions
Reactive Power Total	Reactive Power Tot...	KVAR	Power	Raw	Energy		  
Power Factor Total	Power Factor Total			Raw			  
Voltage L-L Avg01	Voltage L-L Avg			Raw			  
Voltage L-N Avg	Voltage L-N Avg	volt	parameter	Raw	Energy		  
Current Avg	Current Avg	Ampere	Current	Raw	Energy		  
Frequency	Frequency	Hertz	Power	Design	Process	Text Entry	  
R Apparent Power	R Apparent Power	Kilowatt-hours		Derived			  
Total Rows: 53919							

Figure 4.1: Parameter overview

2. Parameter Group

A Parameters can be grouped using certain common characteristics. parameter group is created by entering the group's name and a brief description in the Parameter Group Name and Description field boxes, respectively.

Parameters / Parameters

Parameters | **Parameter Groups** | Parameter Categories

Create New

Parameter Group Name	Description	Actions
Temperature	Temperature	
Measures	Measures	
Carpet property	Carpet property	
Production tags	Production tags	
Alarm tags	Alarm tags	
Carpet quality parameters	CAMPEN carpet quality parameters	
Production Plan data from PLC	Production Plan data from PLC	

Total Rows: 224

Figure 4.2: Parameter Group

3. Parameter Category

Display the all parameter categories, to consolidate similar parameter groups into cohesive categories.

Parameters / Parameters

Parameters | Parameter Groups | **Parameter Categories**

Create New

Tag Category Name	Icon	Description	Actions
Process		Process	
Quality		Quality	
Environment		Environment	
Energy		Energy	
Equipment		Equipment	
Temperature			
CPP		CPP	

Total Rows: 54

Figure 4.3: Parameter Category

4. Unit Overview

A page view of all units that is used for parameter. The units of parameters are determined by the context in which they are used, and can include measures such as meters, seconds, kilograms, or other relevant units depending on the specific parameter being referred to.

Parameters / Parameters

Parameters | Parameter Groups | **Parameter Categories**

Create New

Tag Category Name	Icon	Description	Actions
Process		Process	
Quality		Quality	
Environment		Environment	
Energy		Energy	
Equipment		Equipment	
Temperature		Temperature	
CPP		CPP	

Total Rows: 54

Figure 4.4: Unit

5. Unit Conversion

Overview of the all unit conversion used in the project. Unit conversion is a multi-step process that involves multiplication or division by a numerical factor, selection of the correct number of significant digits, and rounding.

Units / Units

Units | **Unit Conversion** | Unit Groups

Create New

From Unit Name	To Unit Name	Multiply the length value with	Actions
Minutes	HOURS	0.0016	
Kilowatt-hours	INR	9.15	
Degree Centigrade	Ampere	5	
Tonnes	MtCH ₄	1	
Tonnes	MtCO ₂ E, GWP25	25	
Pound-Mass	Square centimeter	200	
Graph	Square centimeter	200	

Total Rows: 72

Figure 4.5: Unit conversion

6. Overview of an Asset

Assets encompass all the equipment used throughout the entirety of the projects. This page will display all the details about the asset.

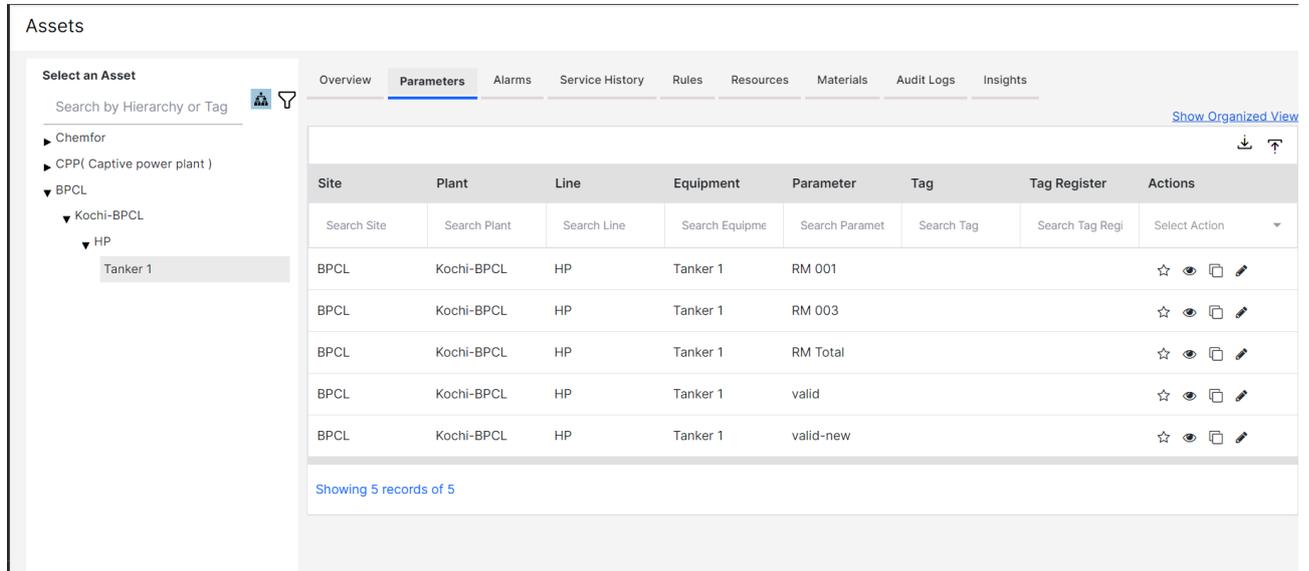


Figure 4.6: Asset

7. Asset Model Parameters

View and edit Parameters associated with the asset.

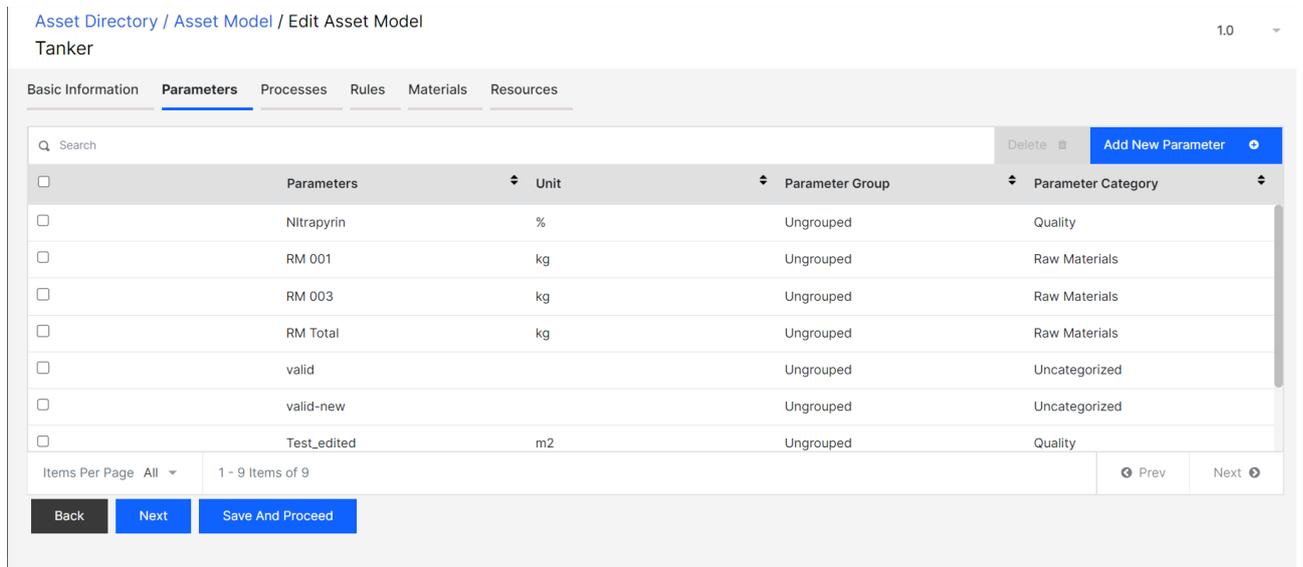


Figure 4.7: Parameters associated with an asset

8. Resource paper

All the uploaded resources for the particular Asset Model will be listed on this page. To upload a resource, click on the Upload Resource button and the Upload New Resource sidebar will open.

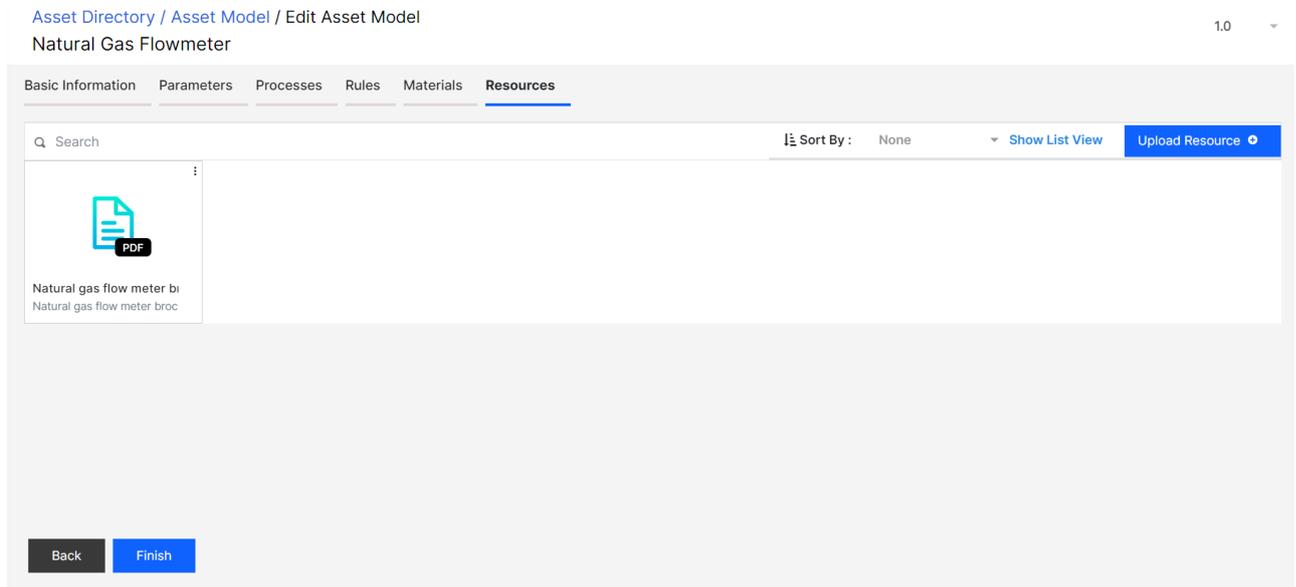


Figure 4.8: Resource papers based on Asset

Chapter 5

CONCLUSION

The project is a asset manager module of IoT manager.This module is designed for configuring asset and its parameters.This avoid the manual entry of huge data and one of the key features of this application is its ability to handle asset model,once a model is created that can be use in multiple plants of a site.The system enables users to publish an asset model to a global catalog and duplicate an asset by accessing the same catalog.Each asset within the system is associated with specific parameters, which are accompanied by corresponding units of measurement.

5.1 Future Enhancement

A potent tool for managing assets in an industrial setting is the IIoT-based asset management system. However, there are a number of potential future improvements that might be done to significantly improve the system's capabilities as technology develops. These improvements include, among others: AR is used in asset management systems powered by the IIoT. Technicians could receive real-time information regarding equipment, such as maintenance schedules and repair instructions, through the use of augmented reality (AR). By using this strategy, equipment uptime could be increased while repair time and cost are decreased.

Another potential future improvement for the IIoT-based asset management system is the usage of blockchain technology. A safe and transparent record of all asset transactions, including upkeep, maintenance, repairs, and upgrades, might be provided through blockchain. This strategy might lower the possibility of fraud and enhance asset tracking in general.

The use of predictive maintenance is one of the most important future improvements for IIoT-based asset management systems. The technology might forecast when equipment

is likely to break using advanced analytics and machine learning algorithms, enabling preventative maintenance to be carried out. This strategy might lower maintenance expenses and downtime while enhancing overall equipment reliability.

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APPENDIX

Screenshots

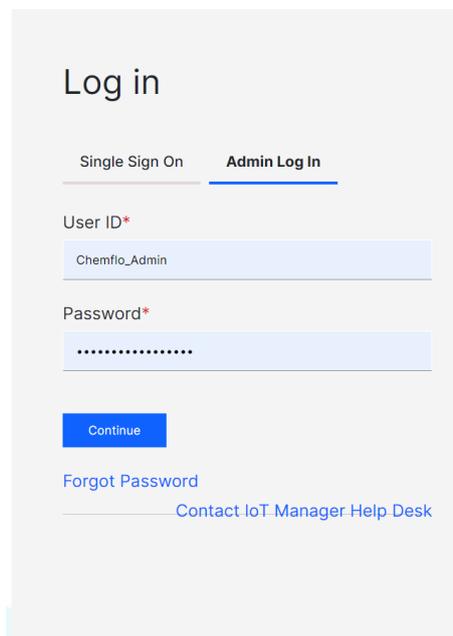


Figure A.1: Login Page

Parameters / Create New Parameter

Parameters

Parameter Name *
Cell Voltage

Parameter Label
Cell Voltage

Description *
Cell Voltage

General Properties

Unit
MVA

Parameter Group
Energy

Data Source *
Raw

Parameter Category
Energy

Data type
Float

UI Input Type
Numeric Entry

Default Value
Set Default Value

Input Required

[Add another field](#)

Save and Proceed Back

Figure A.2: parameter

Upload CSV

Choose file Download Template Format

only .csv, .xls, .xlsx files allowed
Max file size is 5MB.

Close Preview

Figure A.3: upload template

Add New Parameter

Select Type *

Parameter Group Parameter Category

Select Parameter Group *

Ungrouped

Select Parameters *

Search

Select All Deselect All

- Test_edited (m2)
- New parameter test1 (cm2)
- Nltrapyrin (%)
- RM 001 (kg)
- RM 003 (kg)
- RM Total (kg)

Close Save

Figure A.4: parameter association

The screenshot shows a web form titled "Configure Parameter Group" under the breadcrumb "Parameter Groups /". The form contains three input fields: "Parameter Group Name" (with a red asterisk indicating it is required), "Description", and "Parameter Category" (a dropdown menu with the text "Select Parameter Category.."). At the bottom of the form are two buttons: "Save Changes" (in blue) and "Cancel" (in black).

Figure A.5: parameter group

The screenshot shows a web form titled "Configure Parameter Category" under the breadcrumb "Parameter Category /". The form contains three input fields: "Parameter Category Name" (with a red asterisk indicating it is required), "Description", and "Icon". The "Icon" field features a large circular area with an upload arrow icon and two buttons: "Delete" (with a trash icon) and "Upload" (with a download icon). At the bottom of the form are two buttons: "Save Changes" (in blue) and "Cancel" (in black).

Figure A.6: parameter category

Materials / Edit Material
Nickel based alloy

Material Name * Nickel based alloy	Material Code * Nickel based alloy	Material Type ▼	Image/Icon only .jpeg, .jpg, .png files at 500KB or less  Add Image
Cost Per Unit Enter Cost Per Unit	Quantity Enter Quantity	Unit of Measure ▼	Vendor Enter Vendor
Make Enter Make	Model Enter Model	OEM Code Enter OEM Code	ERP Code Enter ERP CODE
Minimum Stock Required Minimum Stock Required	Priority Priority ▼	Link this Material to Asset Model(s) <input checked="" type="checkbox"/>	Select Asset Model(s) x Diesel Generator (1.0) ▼
Save Cancel			

Figure A.7: Raw materials