

Internship project report

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Abstract

Our project aims to create an innovative web platform that acts as a management centre for maintenance tasks. Data from a CMMS relating to tasks to be carried out, planned by managers, is retrieved and presented interactively to technicians via glasses equipped with AR technology. This information, integrated directly into their field of vision, gives technicians rapid access to instructions and task details, improving their efficiency and accuracy when working in the field. By using Django based on the MVT model, we are ensuring a robust and scalable architecture to support this complex integration between maintenance data and AR technology.

Chapter 1

Introduction

In the field of industrial maintenance, the efficient management of tasks and resources is crucial to ensuring the productivity and reliability of operations (Malta, Mendes, and Farinha 2021) [1]. Our project addresses this issue by proposing an innovative solution that exploits emerging technologies to facilitate the maintenance process. Inspired by recent advances on ICMMS (Fu et al. 2002) [2], we aim to design an integrated Django-based web platform to orchestrate coordination between managers and technicians, while integrating Augmented Reality (AR) features for an immersive experience.

Chapter 2

What is CMMS ?

A Computerised Maintenance Management System (CMMS) is an essential tool for the efficient management of maintenance activities within an organisation. Whether in industry, services or public institutions, a CMMS provides a centralised platform where maintenance teams can effectively plan, execute and monitor their tasks.

One of the key benefits of a CMMS is its ability to integrate new technologies such as mobility and traceability applications. Using mobile devices such as smartphones or tablets, field technicians can access maintenance information in real time, enter data on the spot and receive instant instructions. This significantly improves the responsiveness and efficiency of the maintenance team, reducing unplanned downtime.

In addition, traceability of maintenance activities is a crucial element in ensuring regulatory compliance and optimising processes. Modern CMMSs offer advanced monitoring and reporting capabilities, enabling managers to track maintenance histories, analyse trends and make informed decisions to improve overall asset performance.

Studies and articles have been published to demonstrate the effectiveness of CMMS in different sectors. For example, research carried out by experts in maintenance management revealed that the implementation of a CMMS in an industrial company led to a significant reduction in downtime and maintenance costs, while improving equipment availability (Shankar, Singh, and Singh 2021) [3].

Similarly, another case study that highlighted the benefits of a CMMS in the utilities sector, showing how a municipality was able to optimise its public infrastructure maintenance operations through the use of an integrated CMMS solution (Kour et al. 2022) [4].

In summary, CMMS are essential tools for maintenance teams, providing efficient management of maintenance activities while taking advantage of new technologies

to improve responsiveness and traceability. Studies and research articles support the positive impact of CMMS in different sectors, highlighting their value as a key element of asset management and preventive maintenance.

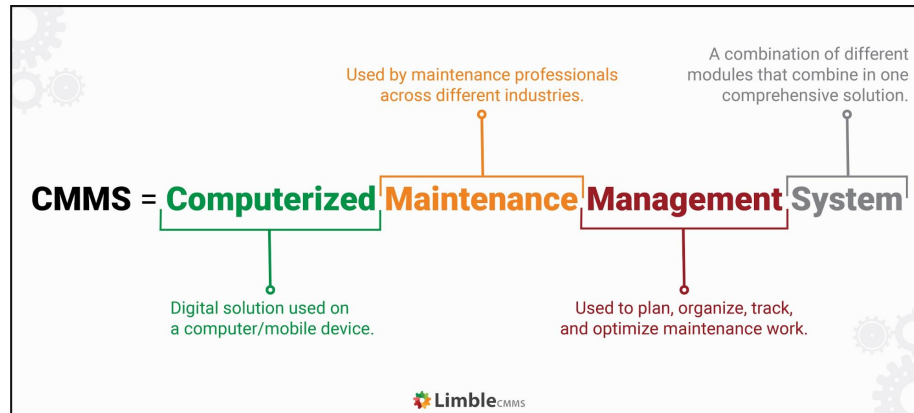


Figure 1: CMMS

What are Maintenance Management Systems?

Maintenance is a critical aspect of any manufacturing or industrial process. It ensures that equipment, machines and facilities operate at their optimum level, avoiding breakdowns and costly downtime. To achieve this, companies need to put in place a well-defined Maintenance Management System (MMS). An MMS is a holistic approach to maintenance management that involves the integration of people, processes and technology to optimise maintenance activities.

The main objective of an MMS is to improve equipment reliability, minimise downtime and increase productivity. It does this by providing a structured approach to maintenance planning, scheduling and execution. This helps maintenance teams to proactively identify and resolve potential problems before they become major issues. By leveraging data, analytics and technology, an MMS enables organisations to optimise maintenance processes, reduce costs and increase asset life. Here are some key points highlighting their importance and benefits :

- **Optimising maintenance operations** : MMS provides a centralised platform for planning, executing and monitoring maintenance activities. This enables efficient resource allocation, priority management and coordination of maintenance teams.
- **Reduced unplanned downtime** : By enabling preventive and predictive maintenance, MMS helps to identify and resolve problems before they become major breakdowns. This reduces unplanned downtime and minimises production interruptions.
- **Extended equipment life** : By providing regular, preventive maintenance, MMS helps to extend the life of equipment. By identifying and correcting potential problems at an early stage, MMS reduces wear and tear on assets.
- **Maximising asset availability** : By ensuring that equipment is well maintained and available when needed, MMS maximises asset availability. This enables organisations to maintain productivity and respond effectively to market demand.

In summary, MMS plays a crucial role in optimising maintenance operations, reducing downtime, extending equipment life and maximising asset availability. The above references illustrate the positive impact of MMS in various sectors and highlight their value as strategic tools for asset management and operational performance (Sorić 2024) [5].

What is the django framework et and why use this for our web application ?



Figure 2: DJANGO

In our project to create an innovative web platform that acts as a management centre for maintenance tasks, Django proved to be a wise choice for several key reasons :

- **MVC/MVT structure adapted to our architecture** : Django follows the MVT model, which is a variant of the MVC model. This architecture is particularly well-suited to our project because it allows us to clearly separate the different responsibilities of our application.
 - The Model represents data from the CMMS, such as maintenance task details, equipment information, schedules, etc.
 - The Template is responsible for presenting the data to technicians. In our case, this means generating content adapted to augmented reality for display on their glasses.
 - The View manages the business logic of our application, including the integration of data from the CMMS with augmented reality functionalities to provide technicians with precise, interactive instructions.
- **Managing complex data with Django's ORM** : Django's ORM (Object-Relational Mapping) is one of its most powerful and popular features. It greatly simplifies data manipulation by allowing developers to interact with the database using Python objects rather than direct SQL queries. Here are some key aspects of Django's ORM and why it's beneficial for our project:
 - **Database abstraction** : Django's ORM provides a high-level abstraction of the database, meaning developers don't need to worry

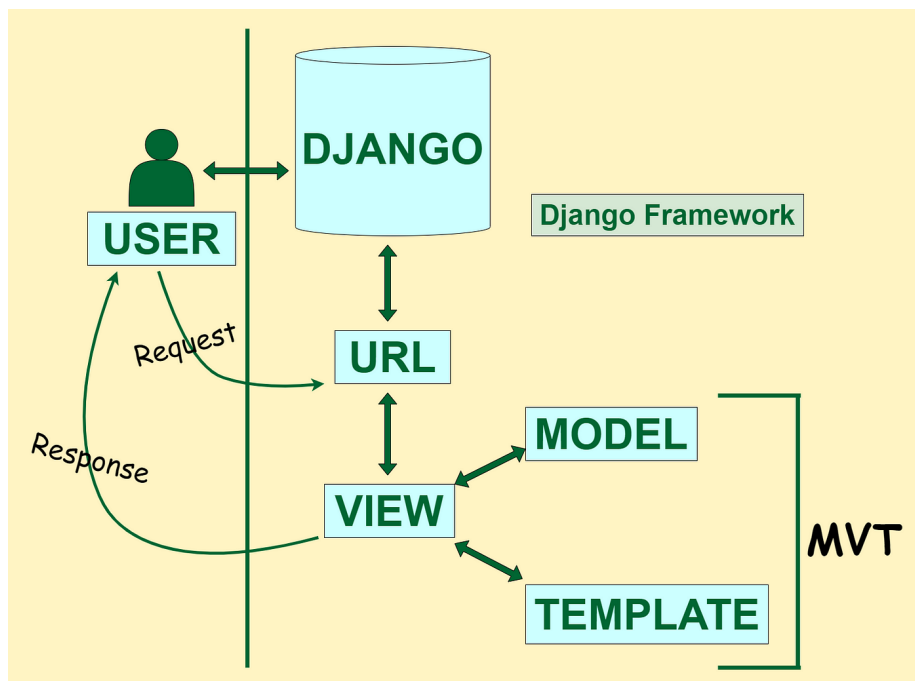


Figure 3: MVT

about the specific details of the underlying database (such as the type of database used or the SQL language).

This allows Django applications to be developed in a more portable way, as the code can be easily adapted to different types of database without having to change the business logic.

- **Using Python objects to represent data** : Database tables are represented by Python classes called “models” in Django. Each model defines the table’s fields and relationships with other models.

For example, in our project, we might have a Task model to represent the various maintenance tasks, with fields such as description, start date, end date, status, etc.

- **Easy data manipulation** : Once models are defined, CRUD (Create, Read, Update, Delete) operations can be performed using simple and intuitive methods on model objects.

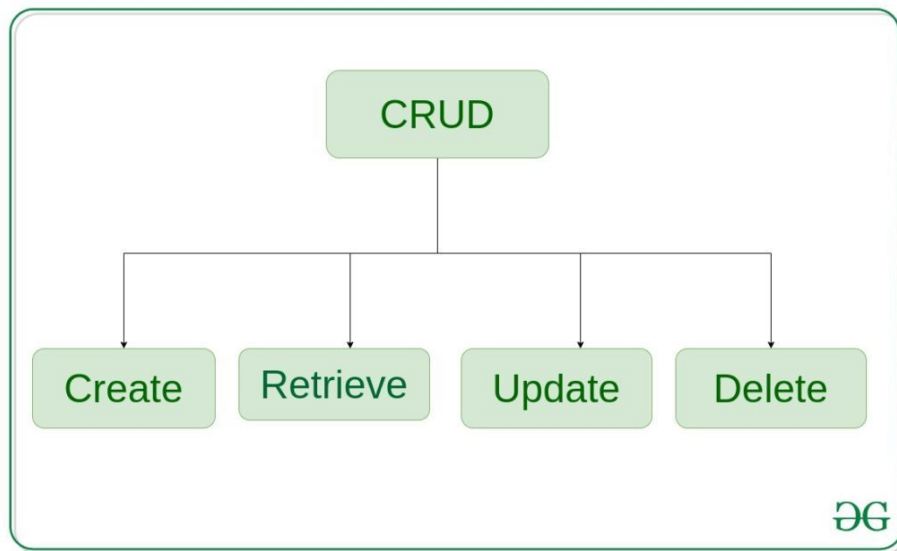


Figure 4: CRUD

For example, to create a new task in our project, we would simply create an instance of the Task class, assign it the appropriate values for its fields, and then call the `save()` method to save it in the database.

- **Transparent management of relationships between tables** : Django’s ORM makes it easy to define relationships between models, such as foreign keys and many-to-many relationships.

For example, in our project, a task could be linked to a specific piece

of equipment. This relationship can be easily defined in the Task model by adding a foreign key field that points to the Equipment model.

- **Protection against SQL injections** : Using Django’s ORM provides built-in protection against SQL injections, as queries are securely generated using query parameters, preventing SQL injection attacks.

- **Flexible presentation of AR data** : Django has a flexible template system that allows dynamic content to be generated for a variety of devices, including augmented reality glasses.

Templates can be customised to deliver instructions interactively, displaying details of maintenance tasks directly in the technicians’ field of vision, improving their productivity and accuracy.

- **Security and scalability**: Security is a major concern, especially when it comes to handling sensitive data such as that associated with industrial maintenance. Django incorporates robust security features, such as protection against SQL injections and CSRF attacks, to ensure the security of user data.

In addition, Django is known for its ability to manage large-scale web applications efficiently. Its scalability will enable our platform to grow with the addition of new features and larger volumes of data.

In short, Django offers a combination of powerful features, built-in security and flexibility that make it the ideal choice for our maintenance task management platform project incorporating augmented reality. Its MVC/MVT architecture, robust ORM and flexible templating system ensure that our solution can be implemented efficiently and scalably.

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