

Internship Report

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Abstract

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Epigraph

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Dedication

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Acknowledgments

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List of Abbreviations

- **CMMS:** Computerized Maintenance Management Systems

List of Acronyms

- **AR**: Augmented Reality
- **ORM**: Object-Relational Mapping
- **MVT**: Model-View-Template

List of Symbols

Content of the list of symbols.

Introduction

We are faced with the development of a full-stack website which requires tight integration between the backend and the frontend. The backend and frontend of our application will be developed using Django. It will be interconnected to a computerized maintenance management system (CMMS) for effective management of maintenance operations. On the other hand, the frontend, also built with Django, will be linked to augmented reality (AR), an immersive technology that enriches the user experience by providing contextual information in real time. Our project has a direct link to the work presented in this article (**Ana, Mateus, and Torres 2021**) [1] . Our goal is therefore to make a link between the CMMS and the AR, in this figure we will therefore take care of the server and the database. In this project, my role mainly focuses on frontend development.

Chapter 2

What is Django?

Django is an open-source web framework written in Python, designed to simplify the development of complex and scalable web applications. Launched in 2005, Django is maintained by an active community of developers and is widely used in the industry to create a variety of web applications, ranging from simple websites to complex web platforms.

Key features of Django:

- **Full-stack Web Framework:** Django is a full-stack web framework, providing all the necessary tools to develop both the frontend and backend of a web application, including database management, business logic, URL routing, and form handling .
- **MVT Architecture (Model-View-Template):** Unlike the MVC model, Django follows the MVT architecture where models represent application data, templates are responsible for presentation, and views contain the processing logic .

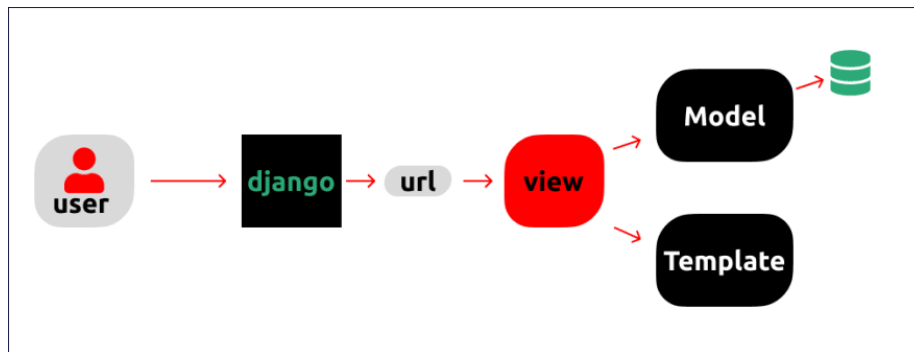


Figure 1 - Explanation MVT

- **ORM (Object-Relational Mapping):** An ORM is a programming technique that allows mapping objects from an object-oriented programming language (such as Python, Java, etc.) to data stored in a relational database . Rather than writing SQL queries directly, the ORM allows developers to interact with the database using familiar objects and methods, thus facilitating application development and maintenance. In summary, an ORM abstracts the complexity of the relational database, allowing developers to work with data in a more object-oriented way.
- **URL Routing System:** Django uses a URL routing system that maps URLs to corresponding views, providing clean and efficient route management in the application .
- **Built-in Security:** Django comes with many built-in security features, such as protection against common security vulnerabilities like SQL in-

jection attacks, cross-site scripting (XSS) attacks, and bypassing form validation.

- **Automatic Administration:** Django provides an automatically generated admin interface from the data models, allowing administrators to manage site content without needing to write specific code for it .
- **Batteries Included:** Django follows the “batteries included” principle, meaning it provides many ready-to-use features like user authentication, session management, pagination, static file management, and more .
- **Extensibility:** Django is highly extensible, allowing developers to add custom features to their application by using third-party packages or writing their own custom code .

What is CMMS (Computerized Maintenance Management Systems)?

Computerized maintenance management systems (CMMS) are sophisticated software solutions deployed by organizations to effectively streamline their maintenance operations. These systems form the backbone of maintenance management, orchestrating various tasks such as planning, organizing, tracking and managing maintenance activities across the organization.

At the heart of a CMMS is a robust and comprehensive database, which acts as a centralized repository of vital information relating to the organization’s maintenance operations. This database stores a wealth of data, including detailed equipment specifications, maintenance schedules, historical maintenance records, spare parts inventory and work order histories.

One of the key benefits of CMMS is its ability to empower maintenance technicians by providing them with instant access to relevant information needed to perform their tasks accurately. Using the CMMS interface, technicians can quickly identify equipment requiring maintenance, view detailed maintenance procedures, and determine the availability of required spare parts. This streamlined access to information not only improves the efficiency of maintenance activities, but also helps minimize downtime by ensuring timely maintenance interventions.

In addition, CMMS plays a crucial role in facilitating informed decision-making at the managerial level. By analyzing the data stored in the CMMS database, managers can gain valuable insights into the performance of their maintenance operations. They can track key performance indicators, identify trends and forecast maintenance needs, enabling them to make data-driven decisions regarding resource allocation, budgeting and strategic planning. For example, managers can calculate the financial implications of repairing machine breakdowns versus preventative maintenance measures, thereby optimizing maintenance budgets and improving operational efficiency.

In summary, CMMS is a powerful tool for effectively managing a company’s

maintenance resources. By centralizing maintenance-related information, streamlining processes and providing valuable insights, CMMS enables organizations to optimize their maintenance operations, minimize downtime, reduce maintenance costs and, in turn, ultimately drive overall organizational performance and market competitiveness. But although it is very effective and useful for businesses it nevertheless remains very complex, as this article explains (Mather 2002) [2]

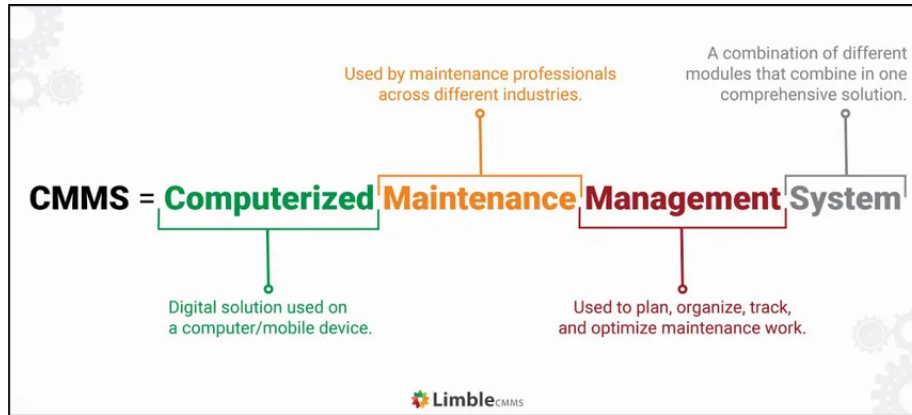


Figure 2 - Explanation CMMS

What is Augmented Reality?

Augmented Reality (AR) is a revolutionary technology that overlays virtual elements such as images, videos, or 3D models onto the real world, typically through an electronic device such as a smartphone, tablet, or smart glasses. Unlike Virtual Reality (VR), which creates an entirely virtual environment, AR enhances and improves the real environment by adding digital information in real time.

Augmented reality applications can take various forms, offering a wide range of uses. They can serve as product visualization tools, allowing consumers to virtually try out products before purchasing them. Additionally, they can be used in interactive games that blend the real world and the virtual world, providing immersive and innovative gaming experiences. In the field of education, augmented reality can be used as an interactive learning tool, allowing learners to explore subjects in a more engaging and practical manner. Similarly, in the field of assistance, it can provide step-by-step guides to help users perform complex tasks, such as repairing electronic devices or navigating unfamiliar environments.

In summary, augmented reality offers significant potential to transform our interaction with the world around us, providing rich and immersive experiences in many areas, ranging from entertainment to education to commerce and industry.

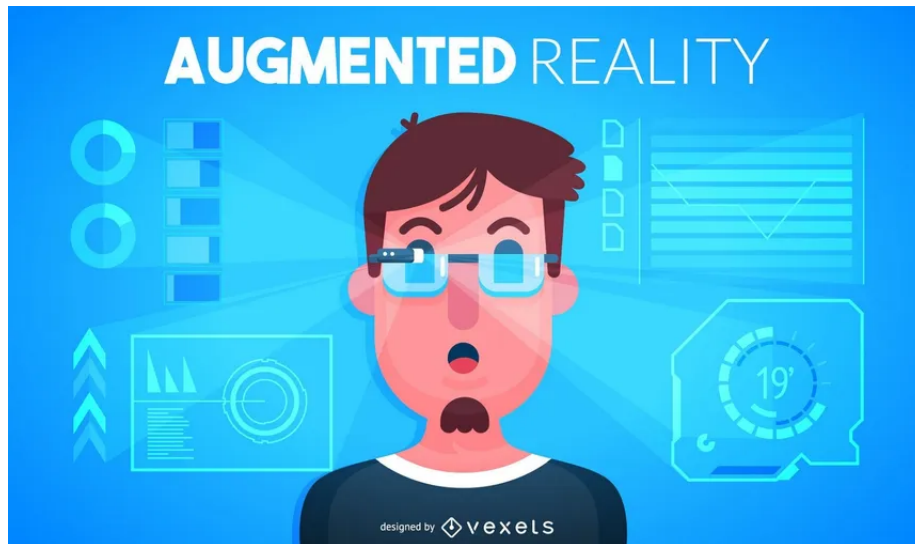


Figure 3 - AR Illustration

Integration of Augmented Reality into Maintenance

The integration of Augmented Reality (AR) into maintenance operations represents a significant advancement in optimizing industrial processes. By combining the advanced features of Computerized Maintenance Management Systems (CMMS) with the immersive power of augmented reality, companies can reduce unplanned downtime and improve overall operational efficiency. Through AR, maintenance technicians can access real-time contextual information directly within their field of vision, enabling them to perform inspections and repairs with increased accuracy. For example, using augmented reality glasses or a headset, a technician can visualize data such as electrical schematics, technical specifications, or repair instructions overlaid on the actual equipment. This approach reduces the need to consult paper manuals or digital documents on a laptop, allowing for faster and more precise interventions. Additionally, AR can provide interactive step-by-step guides for complex maintenance procedures, reducing the risk of human errors and improving the quality of repairs. By integrating augmented reality into the existing framework of maintenance management systems, companies can not only modernize their maintenance processes but also foster innovation and strengthen their competitive position in the market.

A concrete use of AR in maintenance could be the use described in this article (**Henderson and Feiner 2010**) [3]. Here, they developed a prototype that aids military mechanics in performing routine maintenance tasks inside an armored vehicle turret. The prototype uses a head-mounted display to augment a mechanic's natural view with text, labels, arrows, and animated sequences designed to facilitate understanding, localization, and task execution. A qualitative survey showed that mechanics found the augmented reality conditions intuitive and

satisfactory for the tested task sequence.

References

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