Departamento de Física y Matemáticas
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ANTEPROYECTO

Design, implementation and testing of a blockchain system to prevent fraud in the context of second-hand vehicle sales

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1 Introduction

Fraud in the second-hand car market is a globally significant issue, with numerous scams occurring annually [1]. The present document proposes the utilization of emerging blockchain technologies for the purpose of preventing any fraud related second-hand vehicle sales.

1.1 Blockchain's state of art

The first reference to blockchain technology dates back to 1991 [2]. However, the most prominent implementation of blockchain was introduced in 2008 by an individual using the pseudonym "Satoshi Nakamoto" [3]. Since then, numerous applications for this technology have emerged beyond the monetary system proposed in the original paper. These applications include:

- Blockchain in financial management [4]
- Blockchain in security and privacy [5]
- Blockchain in IoT (see section 7) [6]
- Blockchain in transportation [7]
- Blockchain in healthcare [8]
- Blockchain in education [9]

The number of applications for blockchain technology has not only grown significantly, but also the volume of academic and industry articles discussing this technology has increased, as illustrated in Figure 1. [10]

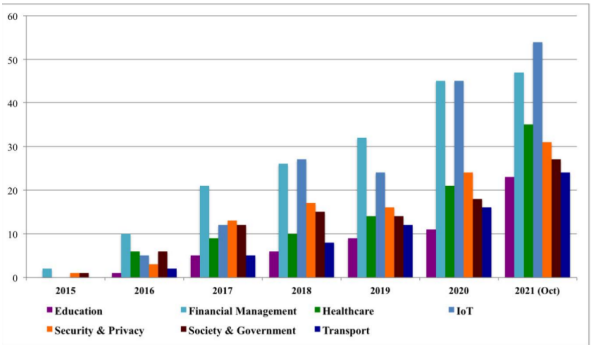

Figure 1: Blockchain articles per year

2 Objectives and application fields

The objective of this thesis is to develop a prototype of a blockchain solution that will facilitate the processing of vehicle history data in a secure and efficient manner, thereby ensuring effective data management.

The applications of this thesis are:

- Mitigating the risk of fraud in second-hand car sales
- Preventing database compromise by distributing data through multiple nodes
- Streamlining bureaucratic processes through automated information management
- Consolidating disparate data types on a single ledger

3 Work description

The preliminary phase of the process will entail the conceptualization of the blockchain, encompassing the determination of all its constituent elements and the formulation of a rationale for their inclusion. The aforementioned elements include:

- Block header
- Block content
- Consensus mechanism
- Nodes (Actors)
- P2P type of network (see section 7)
- Transactions
- etc... [11]

Once the design and functionality of the blockchain are defined, the implementation of the network deployment tool using Docker will commence. This tool will facilitate testing the blockchain and will include a corresponding testing phase to ensure its effectiveness.

Upon completion of the testing tool, the remaining aspects of the blockchain will be implemented, as previously discussed. Once the blockchain is complete, it will undergo intensive testing with the aforementioned tool.

4 Development phases

1. **Bibliographic study of blockchain and distributed systems.** Duration: 3 weeks.
2. **Blockchain designing.** Duration: 1 month.
3. **Implementation of the blockchain's testing and deployment tool.** Duration: 1 month and 2 weeks.
    - Generation of docker images. Duration: 5 days.
    - Image testing. Duration: 2 days.
    - Deployment script implementation. Duration: 1 month.
    - Tool testing and refining. Duration: 1 week.
4. **Implementation of the blockchain following the previous design.** Duration: 1 month.
    - Consensus mechanism implementation. Duration: 1 week.
    - Block implementation. Duration: 1 week.
    - Node communications and role implementation. Duration: 2 weeks.
5. **Integrating the blockchain and the testing and deployment tool.** Duration: 1 week.
6. **Code refactoring and documentation.** Duration: 1 week.
7. **Thesis writing using LaTeX.** Duration: 1 month.

A Grantt diagram representing the previously described phases can be seen in Figure 2.

5 Resources

The project will be developed using Python as the primary programming language. Additionally, the following technologies will be employed:

- Docker (see section 7)
- WSL (see section 7)
- socket libraries
- hashing libraries
- Git (see section 7)

Each of these technologies will be accompanied by their corresponding official documentation.

In this study, Visual Studio Code (VSCode) will be employed as the main code editor. To ensure adherence to best practices, linter extensions will be utilized. Additionally, a Docker extension will be leveraged to facilitate the management of container and images. Furthermore, Python debugging and highlighting tools will be incorporated to enhance the efficiency of the coding process.

The thesis will be written in LaTeX (see section 7), utilizing Overleaf as the online editor and TeXStudio as the offline editor.

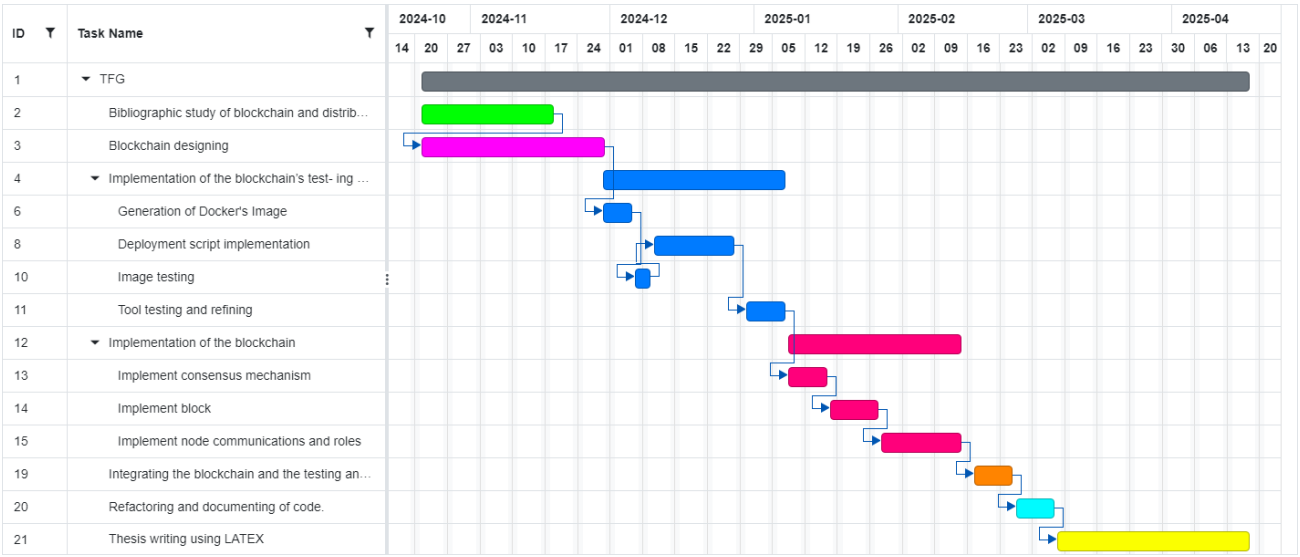

Figure 2: Grantt Diagram of development phases

6 Limitations

6.1 Scalability

The number of deployable nodes is limited by hardware constraints, hindering full scalability assessment of the blockchain.

6.2 Failure and Consistency Testing

Simulating node failures, slow networks (`e.g., 500ms` $\leq$ `latency per node-to-node message`), or partitions is limited, restricting the ability to test the blockchain's reliability and consistency under adverse conditions.

6.3 Security

Running nodes locally may not accurately simulate external threats, making it difficult to perform security tests such as DoS attacks (See section 7) or internal breaches.

7 Definitions

Internet of Things (IoT) is the network of interconnected devices that collect and exchange data through the internet.

Peer-to-Peer (P2P) is a decentralized network model in which peers share resources directly without the need for a central server.

Docker is an open-source platform for developing, deploying, and running applications in **containers**.

WSL (Windows Subsystem for Linux) is a compatibility layer that enables running a Linux distribution natively on Windows.

Git is a distributed version control system that tracks changes in source code, allowing for efficient management of project history and the ability to revert or merge modifications.

LaTeX is a typesetting system used for creating scientific and technical documents, especially those with complex formulas and structured layouts.

DoS (Denial of Service) attack is a malicious attempt to overwhelm the resources of a system, service, or network, making it inaccessible to legitimate users by consuming its bandwidth, memory, or processing capacity.

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