Blockchain use for innovative Bengee System

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Abstract: *Bengee –* *Improving e-Commerce and Electronic Auction Systems by using Blockchain and Machine learning technologies* is an innovative national Romanian research project[1] that aims to transform the online shopping experience by incorporating unique features such as subscriptions, auctions, smart contracts and artificial intelligence. This article presents the use of Blockchain for this innovative project.

Keywords: artificial intelligence, e-commerce systems, Blockchain, smart contracts

1. **Introduction**

In today's digital era, e-commerce and electronic auction systems have become integral components of our daily lives. E-commerce and e-auctions has revolutionized traditional retail by offering numerous advantages to both consumers and businesses. It enables customers to make purchases 24/7, providing unparalleled convenience and accessibility. With online shopping, individuals can save time by eliminating the need for physical travel. Furthermore, e-commerce platforms allow for easy comparison of prices, ensuring that consumers can find the best deals. The vast range of product options available online provides customers with many choices. The advantages of e-commerce, including convenience, time-saving, price comparison, extensive options, and global accessibility, have been extensively discussed in the literature (Taher, 2021).

Blockchain (Bholane, 2021) is a decentralized, immutable ledger that keeps track of transactions on numerous computers and is most popularly linked to cryptocurrencies like Bitcoin. It is a good option for dealing with trust and security issues in online transactions because of the transparency it ensures and the tamper-proofing it prohibits that come with its distributed structure. Blockchain technology will be used by BENGEE to build a more reliable and effective e-commerce ecosystem.

The capabilities of blockchain technology are further enhanced by smart contracts, which are self-executing contracts with the contents of the agreement explicitly put into code. These contracts eliminate the need for middlemen by automatically executing and enforcing agreements between parties. By automating and streamlining many areas of e-commerce and including features such as smart contracts BENGEE lowers costs, gets rid of intermediaries, and boosts overall effectiveness.

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[1] https://www.phoenix-it.ro/bengee/

The following document explains the Bengee Business logic, architecture and technologies used to develop the smart contracts and finally the conclusions about the project.

2. **Bengee**

Bengee is a Romanian commerce project, currently the web2 Bengee business logic is running in the app site[2], but looking forward to implement in the web3 using blockchain and smart contracts technology in the polygon network.

The following topics are going to explain first the business logic an then all the technologies used for for developing the web3 application that Bengee already has today running as web2, so this means that Bengee developers are adapting the same application but in the polygon blockchain.

Bussiness Logic

Bengee's core functionality revolves around subscriptions. Offerers, users who wish to sell their products, can publish an Offer with details of the product, price, and quantity. Subscribers, another user category, can browse and subscribe to Offers by paying a guarantee amount, securing their interest and contributing to the transaction funding.

Once an Offer reaches the desired threshold through multiple Subscriptions, Bengee initiates an Auction phase. Bidders, users interested in acquiring the Offer, participate in a competitive bidding process within a specified timeframe. The Auction phase injects excitement and drives up the value of the Offer through intense user engagement.

Following the Auction, Bengee enters the Delivery phase. The platform coordinates the fulfillment of the Offer based on the difference between the final bid price and the original price set by the Offerer.

Polygon (MATIC) Network

Polygon is a layer 2 scaling solution that works with the Ethereum blockchain, fees are very cheap and transactions are faster, the native token is named MATIC . The reason why Polygon is fast, is the dual strategy proof of stake that uses at the checkpoint layer and block producer, and providing decentralization. (Matic Network, 2023)

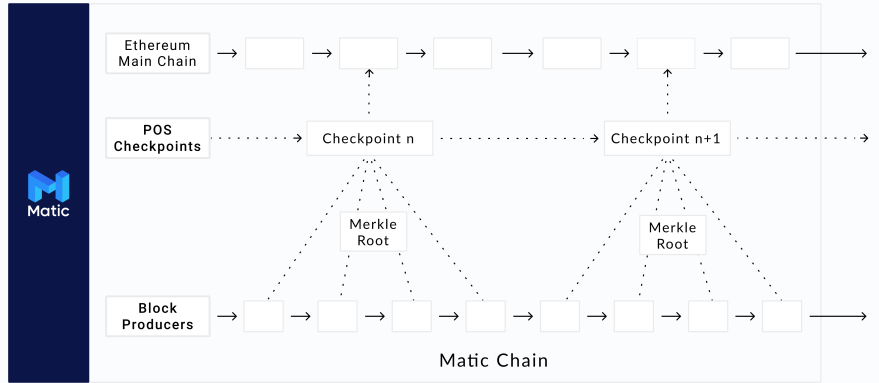
[2] https://app.bengee.ro/app/home

Image 1. Ethereum and Polygon(MATIC) network (Matic Network, 2023)

The polygon network was selected to deploy the smart contracts, because is one of the most used blockchains, there are around 37k Apps deployed in the blockchain. Since it is based on Ethereum we can trust on the maturity of the technology, so the programming language is also Solidity. Polygon is proof of stake, that means that in the future it will be compliant for the next environmental regulations that Governments are going to take with blockchain technologies (Polygon, 2023).

Volatility

To address the volatility inherent in the Polygon token, the project decided against creating auction smart contracts directly tied to the token. Instead, the team turned to stablecoins as a solution. Drawing inspiration from the article (Ante et all, 2021) the project developed its own stablecoin using the ERC-20 Interface from OpenZeppelin. By committing to always exchanging 1 Bengee Token with 1 Euro, the project ensures stability and minimizes the impact of price fluctuations.

Modules

The project comprises two main modules within its smart contract structure. The first module centers around the creation of the Bengee ERC-20 token, specifically tailored to meet the unique needs of the project. The second module is dedicated to implementing the business logic for auctions, offering a seamless and secure experience for participants. (Image 2)
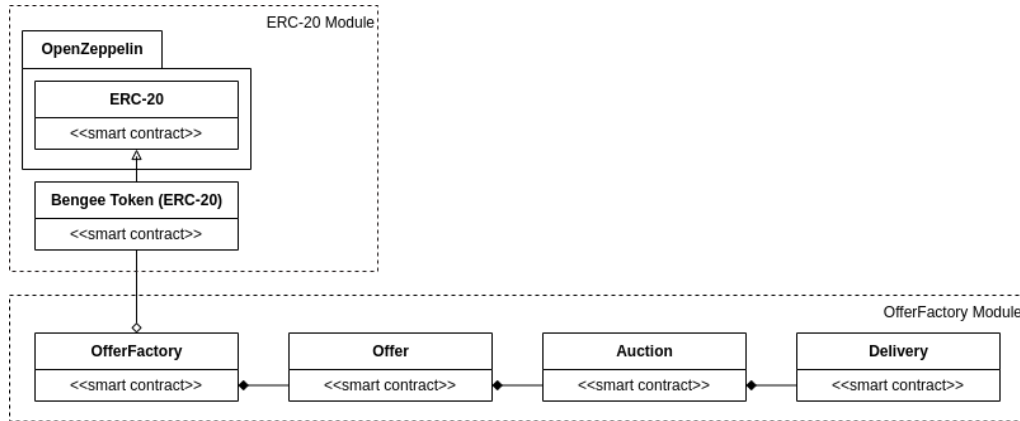
Image 2. Bengee Blockchain Modules and smart contracts

Runtime instantiation

We call an instance a deployed smart contract into the blockchain. Some of the smart contracts are going to be deployed once and others are going to be deployed every time an offer is created. Every deployment has a gas cost in the blockchain.

The **Bengee Token (ERC-20)** It's going deployed only once. **OfferFactory** It's going to be deployed once, this smart contract will create multiple Offer smart contracts. The rest **Offer, Auction, Delivery (Stage smart contracts)** are going to be instantiated sequentially, depending the state of the offer. We call these "stage smart contracts" because they represent a stage in the Bengee Business Logic, every time a stage ends, the tokens will be transferred to the next stage until Delivery instance, in the last stage the tokens are going to be delivered to the respective users. (Image 3)
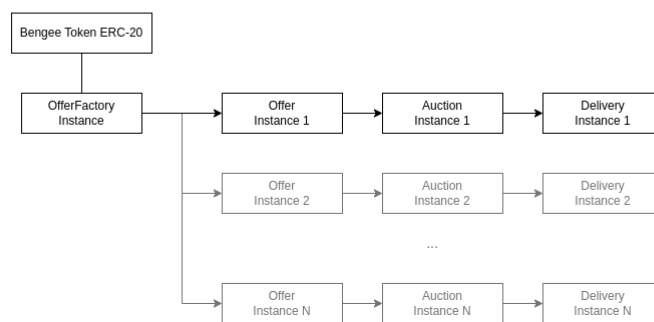

Image 3. Smart contracts instances, each smart contract representing an stage

Optimization

In an effort to optimize gas consumption, the project has explored strategies outlined in the doctoral dissertation (Brandstätter, 2020). By avoiding the creation of additional smart contracts, the team has successfully reduced gas fees. However, this optimization comes with the trade-off of decreased code legibility and challenges related to upgradability. Nonetheless, the project has already made significant progress in reducing fee costs by leveraging the Polygon network instead of the Ethereum network.

The current smart contract business logic it could be optimized even more if we handle the state of the Offer in the same smart contract, so we avoid deploying extra "stage smart contracts", but the entire code should be refactored and adapted to create single Offer instances, applying these changes the cost of the transactions should cost less. (Image 4)
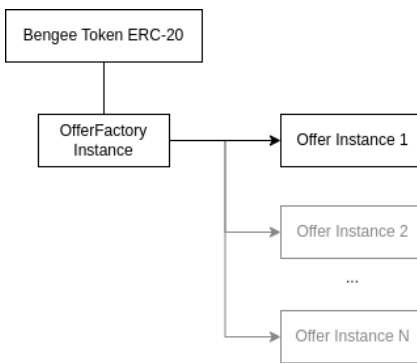

Image 4. Offer smart contract instances optimized

3. **Conclusion**

In conclusion Bengee is an innovative e-commerce that uses smart contracts polygon network, the current smart contract architecture is based in two modules the ERC-20 and the Bengee Business Logic, these smart contracts are following a technique to reduce gas consumption, so transactions are cheaper. The project's combination of Blockchain and smart contracts offers interesting options to improve electronic auction and e-commerce systems. The project seeks to boost productivity, security, and transparency by utilizing these technologies.

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