

# Auction Market using Blockchain Technology

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**Abstract**—Auction market is a very complex system which requires everyone's consensus before any modifications in the transaction system to prevent any fraud to happen. There are lots of participants, assets and transactions that has to be taken under consideration and auction market has to manage all these. For example, lots of bidders can simultaneously bid on the assets, auctioneers can close the bidding option on those assets. The key problem here is that all these difficulties are not easy to manage or control for auction market on the current centralized system. Blockchain technology try to solve all these auction transaction related problems by globally decentralizing the whole auction ecosystem. This offers the reliable, transparent and scalable solution for the auction market. Blockchain technology strictly provides all the bid and on auction related data accurately with the exact timings of bid placed, its amount and the bidder.

**Keywords**—Blockchain, Smart Contracts, Auction, Bid, Hyperledger.

## I. INTRODUCTION

Blockchain technology is so on demanding as it can add tremendous value in any kind of financial transactions. It is the system which enables the contracts between participants and members over the blockchain reliable and transparent network. The smart contract empowers the auction market to automate the bidding process by triggering the payments automatically when bid is either closed by the owner of the product or time has passed for the bidding. Every bid gets validated over the smart network of bidders and auctioneers by fulfilling consensus. A highest bidder pay only when every single thing is validated over the global network of participants. Each transparent and validated bid is considered as a block, calculates the hash value of data in that block using the hash value value of the previous block in the blockchain.

The main feature of the blockchain is that everything is visible and transparent to everyone which prevents any kind of fraud from happening. Once the entry is stored in the globally accessed ledger, its nearly impossible to alter or delete the entry from the ledger. On doing so attacker has to submit the proof of work to all the preceeding blocks in the blockchain, for the modified block to be successfully accepted by the fabric in the entire blockchain system. This is not possible in polynomial time. Mutual consensus verification protocols allow a network to agree on updates to the database collectively, with a certainty that the overall dataset remains correct at all times without the need for a central governing authority. Hence this system protects the bidders and auctioneers and do the audit bids from other members in the global network instantaneously.

This is how user-friendly blockchain technology provides a platform of easy to use, reliable and transparent transactions

for users who otherwise find all these things difficult and hard to believe in case of assets transactions.

## II. RELATED WORK

The usage of blockchain technology in online ecommerce auction market is relatively new topic. In [3], the authors has provided various use cases of blockchain technology in different areas. And it is now clear that blockchain technology can be used in much more use cases than just the cryptocurrency. The advantages of decentralization that Blockchain brings with it are explored in detail. There are many use cases of the blockchain technologies like supply chain industry, insurance, healthcare, realestate, media industry, peer-to-peer transfers, financial services, commercial applications and digital identity. The uses of Blockchain technology and smart contracts in the auction market is explored in [4]. Hyperledger Composer [2] is an open-source blockchain protocol for business to business and business to customer transactions. Hyperledger Composer differs from traditional Blockchain networks like Bitcoin [7]. As it manages the admission of participants, assets and transactions in its core. Hyperledger is build such that it assumes multiple blockchain networks that can communicate with each other rather than assuming only single blockchain network, as shown in Fig 1. Design of Hyperledger is industry oriented, which makes it suitable for use in cases like auction market. Therefore, we are choosing Hyperledger composer playground, as the fabric for our solution.

## III. BLOCKCHAIN FOR AUCTION MARKET

The world of Auction is a very tedious thing to manage, no matter how well you prepare the system to work. There are many analysis which Auction is accounted for, fails to achieve its goal. Situation such as time sensitivity, entry barriers for the ones who bid, no certainty that the amount you bid is accepted, increase in the amount of bid leads to the idea of needing more secure transactions for which we implemented the concept of blockchain where every transactions is noted down. The result of the auction wants certainty of their bids, not anonymous result.

There's where we tried to introduce Blockchain to make transactions more transparent. Every transaction is trustworthy and made available to the bidders as soon as they bid, to know if their bid is accepted or rejected for the product. The transactions mainly looks after the amount and the time of the bidders, where you cannot break the block, if tried most of the connecting block would also be destroyed. This makes the transaction secure and hence its use in Auction.

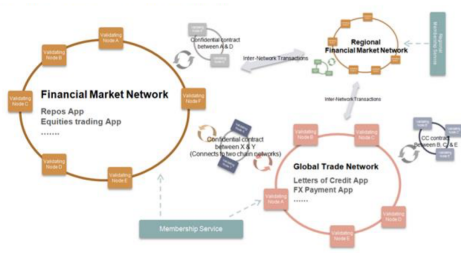


Fig. 1. Hyperledger - Multiple Blockchain Networks

#### IV. DESIGN

Blockchain is used to store 3 important aspect of the auction. 1. Product to be auctioned. 2. Auction Participants. 3. Logs of the overall transaction (Winner, Previous owner, Participants in the auction).

Three Layers of architecture is used to design the Auction System. The node server acts as a middleware between the front-end and the blockchain database. The middleware layer provides the additional security required for the blockchain and any transactions that take place has to pass through it. The blockchain will work even if some of the nodes went down. The information the broken node possess, are present in other blocks. Single block stores information for more than couple of blocks which makes the system robust.

The amount is already present in the bidder's account similar to likes of cryptocurrency. The bidder wont be allowed to bid until he has sufficient funds in the account which is verified with the blockchain database.

After the bidding has started, each auction duration will last for maximum of 5 days, and whoever is the last person to successfully bid and registered with blockchain will now be the owner of the product. The highest bidder will now become the product owner, the amount he bid for the product will be deducted from the account and transferred towards the old owners account.

The component which forms the main basis of the blockchain are

- 1) Assets - Assets will include product.
- 2) Transaction - This comprises of action such as Offer bid and Close bid.
- 3) Participants - This will include admin and bidders.

```
participant Member extends User {
  o String email
  o String firstName
  o String lastName
  o String password
  o Double balance
}

asset Product identified by pid {
  o String pid
  o String name
  o String description
  o String category
  o String listingId
  o String imageUrl
```

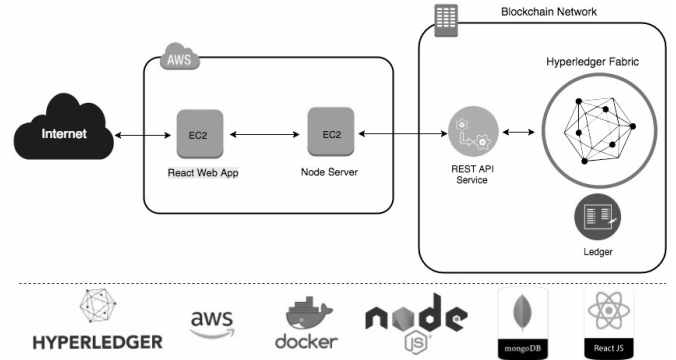


Fig. 2. Architecture Diagram

```
o ProductState state
--> Member owner
}

asset ProductListing identified by
  listingId {
    o String listingId
    o Double reservePrice
    o String name
    o String description
    o String category
    o String imageUrl
    o ListingState state
    o Offer[] offers optional
    --> Member owner
    --> Product product
  }

transaction Offer {
  o Double bidPrice
  --> ProductListing listing
  --> Member member
}

transaction CloseBidding {
  --> ProductListing listing
}
```

#### V. IMPLEMENTATION

We have used open source hyperledger fabric composer to create and manage blockchain network. We have used docker containers to create blockchain network on a local machine and implement auction market. Moreover to this we are using composer-rest-server to communicate with blockchain network.

For the user interface part we created a ReactJS based web application which communicates with NodeJS based web server. This web server communicates with composer-rest-server to manage blockchain network and exposes web services to web front-end to handle all the user requests.

Hyperledger composer has assets, participants and transactions these three types of objects. Auction market has products as assets, users as participants and bid, close auction as transaction for the blockchain network. All these information for model file, permissions and business logic is written and

combined in a .bna file which will be used to deploy to a blockchain network.

## VI. CONCLUSION

As we demonstrated in our project, the use of Blockchain in the auction industry can not only help in the advancement of the process of auction in its various aspects, but can also significantly help bring improvement to the current online auction markets in terms of increased security where chances of fraud becomes extremely low. Based on the work that we have done so far in this project, we realized that there are number of additional very important features that we can implement and add to our online auction website. There are number of features - in addition to the ones that we already added - which are relevant to our concept of decentralization that we used in this project, and we can easily add those features. Through the enforcement of identity management and by detecting, and declining shill bidding, Blockchain technology significantly reduces the possibility of auction fraud. In addition to all this, another very important noticeable aspect is that the use of a trusted Blockchain network like the Hyperledger fabric ensures that the attacker cannot add or introduce misbehaving nodes, and attempt to introduce a shill bidding to artificially increase item's price, which may unfairly hurt the real honest bidders. This further helps in increased fraud resistance. Other advantages associated with using Blockchain technology includes immutability, transparency, user compliance, and accountability to keep check.

Considering all these advantages of Blockchain technology, it is very obvious, that in near future, Blockchain technology will become an important part of the auction industry.

## VII. FUTURE ENHANCEMENTS

Our recent version of the auction market has used the blockchain functionality for bidding and auctions. We have not integrated the actual transaction here in our system. So there is a scope to implement the blockchain based transaction system using the bitcoin so that whole auction market will be transparent, reliable and scalable end-to-end at one place.

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