Blockchain Implementation in the Auctioning and Authentication of Art

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I. Problem Statement

An essential part in the art industry is the authenticity of the item being purchased. It realizes the need for the credibility of the artist through his artworks and creative outcomes. However, in the art world, a lot of artists claim to be someone else or tend to sell duplicates of famous artworks. This leads to the customer getting exploited. They invest their money thinking it's a genuine artwork, and they are not getting their money's worth this way. One way they can go about this is to get the artwork verified by an art connoisseur but this is time-consuming and sometimes, very expensive. We present here a blockchain-based approach to solve this issue, which stores the details of the artwork only after verification by centralized authorities of art and updates the history of paintings by storing it in a block every time a new purchase happens. While ensuring the privacy of the candidate up until the auction is over, blockchain offers convenience and speed by only storing the hashes of all the details, which are fixed and tamper-proof.

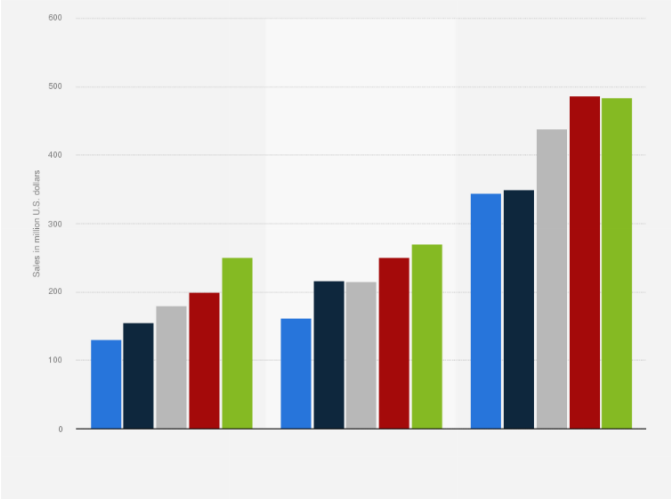


Fig. 1. Online art sales in major art houses for five different years: 2015, 2016, 2017, 2018, and 2019.

A. Motivation

In today's world, the sale of art is partly driven by blockchain sales. The art industry has generally been considered the realm of the rich, obviously, as the prices of artworks often cross into millions of dollars. Artwork bought in the 1980s gives exponential returns on their sale now. This is one of the examples of contemporary art's appreciative value. Even though sales of online art grew, the number of people buying it decreased. By making verified art readily available, art lovers can invest in art without huge capital. The demand for first-class work will continue, and those who are able to own them totally will always be permitted to do so. The use of micropayments through blockchain smart contracts to provide more investors the chance to participate in a piece of art could ultimately drive up the cost of valuable works. The demand for first-class work will continue, and those who are able to own them outright will always be permitted to do so.

Buyers could own a portion of the work in the hope that its value will increase. This is primarily aimed at paintings that are more difficult to sell to a single buyer.

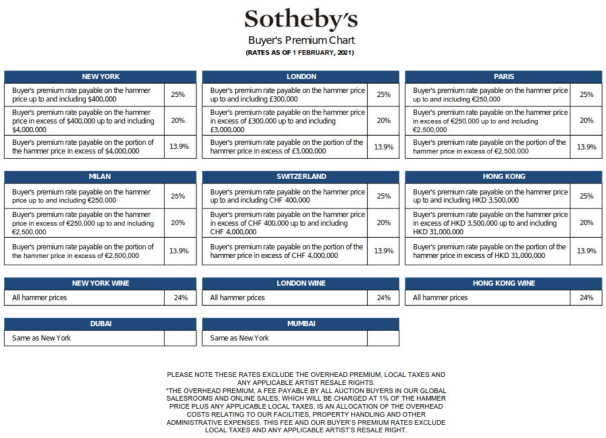
The art industry is mostly concentrated within auction houses that act as the middlemen between the artists and the buyers. There exists a possibility that the auction houses assess the value of an art piece variably. Confusion about the prices and legitimacy arises here. The concept of transparency(of transactions) in blockchain can be applied in this case.

B. Beneficiaries

The people who would benefit most from this are the customers and the artists. As auction houses are removed from the equation, the artists wouldn't have to give them a commission from the sales of their pieces. They can sell their artworks on their own. This reduces the frequency of imitations and intellectual property theft.

C. Impact of the Solution

The proposed solution will ensure that artists get their due. Most art that is displayed in museums is forged and surveys show that around 20-40% of the artwork is fake. This would reduce the probability of any institution owning fakes. Many



Sotheby's

Buyer's Premium Chart

(RATES AS OF 1 FEBRUARY, 2021)

NEW YORK	
Buyer's premium rate payable on the hammer price up to and including $400,000	25%
Buyer's premium rate payable on the hammer price in excess of $400,000 up to and including $4,000,000	20%
Buyer's premium rate payable on the portion of the hammer price in excess of $4,000,000	13.9%

LONDON	
Buyer's premium rate payable on the hammer price up to and including £300,000	25%
Buyer's premium rate payable on the hammer price in excess of £300,000 up to and including £3,000,000	20%
Buyer's premium rate payable on the portion of the hammer price in excess of £3,000,000	13.9%

PARIS	
Buyer's premium rate payable on the hammer price up to and including €250,000	25%
Buyer's premium rate payable on the hammer price in excess of €250,000 up to and including €2,500,000	20%
Buyer's premium rate payable on the portion of the hammer price in excess of €2,500,000	13.9%

MILAN	
Buyer's premium rate payable on the hammer price up to and including €250,000	25%
Buyer's premium rate payable on the hammer price in excess of €250,000 up to and including €2,500,000	20%
Buyer's premium rate payable on the portion of the hammer price in excess of €2,500,000	13.9%

SWITZERLAND	
Buyer's premium rate payable on the hammer price up to and including CHF 400,000	25%
Buyer's premium rate payable on the hammer price in excess of CHF 400,000 up to and including CHF 4,000,000	20%
Buyer's premium rate payable on the portion of the hammer price in excess of CHF 4,000,000	13.9%

HONG KONG	
Buyer's premium rate payable on the hammer price up to and including HKD 3,500,000	25%
Buyer's premium rate payable on the hammer price in excess of HKD 3,500,000 up to and including HKD 31,000,000	20%
Buyer's premium rate payable on the portion of the hammer price in excess of HKD 31,000,000	13.9%

NEW YORK WINE	
All hammer prices	24%

LONDON WINE	
All hammer prices	24%

HONG KONG WINE	
All hammer prices	24%

DUBAI	
Same as New York	

MUMBAI	
Same as New York	

PLEASE NOTE THESE RATES EXCLUDE THE OVERHEAD PREMIUM, LOCAL TAXES AND ANY APPLICABLE ARTIST RESALE RIGHTS.
*THE OVERHEAD PREMIUM, A FEE PAYABLE BY ALL AUCTION BUYERS IN OUR GLOBAL SALESROOMS AND ONLINE SALES, WHICH WILL BE CHARGED AT 1% OF THE HAMMER PRICE PLUS ANY APPLICABLE LOCAL TAXES, IS AN ALLOCATION OF THE OVERHEAD COSTS RELATING TO OUR FACILITIES, PROPERTY HANDLING AND OTHER ADMINISTRATIVE EXPENSES. THIS FEE AND OUR BUYER'S PREMIUM RATES EXCLUDE LOCAL TAXES AND ANY APPLICABLE ARTIST'S RESALE RIGHT.

Fig. 2. Charges to the buyer in various countries

articles speak about how more than half the art in the world is fake. This would give the new artists incentive to make their own artworks rather than create imitations of original pieces. The sale of imitations would affect the buyers immensely as they would not get their value for money. The creation of fakes reduces the value of the original significantly. And people who sell the fakes charge exorbitantly as the price should be in the same range as the original so that it isn't suspicious.

Many auction houses charge buyers' premiums which can be removed with this blockchain use case. The need for auction houses itself is removed basically. The buyer also won't be able to renege on their payments once the bidding is done as they are done instantaneously.

The blockchain implementation will permit only a set of artworks to be registered and anything else is evidently fake. The customer will know the history of all the hands that the artwork has passed through. The authenticity of the piece is verified and added to the database.

II. Why We Need Blockchain

The need for a blockchain in this use case is evident as we need to store the transactions happening between the buyer and the artist.

The writers here are the artists and there are multiple writers who are all known. The aim of the blockchain is to verify the identities of the artists joining the blockchain in order to ensure the legitimacy of the network. This use case requires that all artists be publicly verifiable so a permissioned blockchain is appropriate.

The transparency of the blockchain can be recorded on a blockchain and over time, the number of records will grow. Being recorded on a blockchain makes the transaction record highly dependable. These records can be made publicly accessible to allow art buyers to understand their history and value. The buyers can remain anonymous on the blockchain network as long as they have an account while conducting the transaction. The only ones not making a profit in this solution are the auction houses and they charge a lot anyway.

Fig. 3. flow of control during auctioning

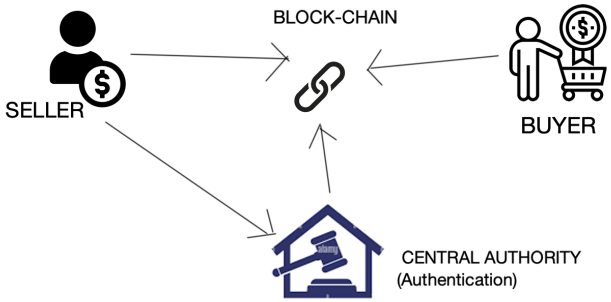


Fig. 4. flow of control when blockchain is used for auctioning and authentication

A permissioned blockchain doesn't allow everyone to join or do whatever they please with it. As soon as the artists verify their identity, they can add their registered artworks to the network. This system still requires a centralized authority to oversee the verification. It isn't wholly decentralized as people can't anonymously do as they please. This ensures that users can trust the network and trust that their artwork is registered securely in their name.

Hence, a public permissioned blockchain is implemented as we need a central authority to make sure that only legitimate art and artists are included in the blockchain.

Blockchain has been popularly tied to Bitcoin applications, although the technology at its core is a means of recording and storing financial transactions.

A. Transparency

All the transactions made can be accessed by anyone to confirm the value and history of ownership of the art. The artist's name will be public so that potential owners can verify the authenticity of the art. This enables the buyer to avoid purchasing counterfeits and make an accurate estimate of the value of the art before purchasing it.

B. Privacy of Buyer

The buyers can choose whether to remain anonymous or not while in the process of the auction. The artists, however, cannot be anonymous.

C. Decentralised Transactions

No central authority is involved in the transactions between the seller and buyer. But the spirit of decentralization is lost in the non-anonymity of the artists but in this kind of industry, it is necessary to verify the identity of the artists to ensure trust between the artists and the buyer

III. Proposed Solution

- The artist is verified by a central authority and all their artworks are entered into the system after a thorough scrutiny of their origins.
- The central authority checks the authenticity of the art piece when the piece is, for the first time, introduced into the system.
- Each art piece is entered into the system and the owner can decide whether to sell it or not. If he/she chooses to sell, the art piece is put to auction.
- All buyers can choose to remain anonymous to the other buyers and the seller but the highest bid will be made public. After a specified amount of time, the auction will be closed and the highest bidder is now the new owner of the art piece. This transaction is introduced into the blockchain and is stored indefinitely. The privacy of the buyer is only ensured during the auction. As the transaction is recorded into the blockchain, anyone who tries to buy the artwork again will know about the previous owners.
- All the transactions made will remain public and can be accessed by anyone. this will give an idea about the history and the value of the item.

IV. ARCHITECTURE

we will be using Hyper-Ledger blockchain network with the server as the center. The user and the server will have to log in separately to access their rights. There will be mainly three options accessible by the user in the app:

- option to add a new art piece into the blockchain system
- option to put an art piece to bidding
- option to bid on an art piece

The server can access the following rights:

- to accept an art piece into the system

V. SMART CONTRACT

some of the functions needed to build the network are listed below:

A. ADD ART

In this function the user will register the art piece in this system. he will have to state the artist's name, the year in which it was made, previous ownersoptional of the item and other such details. This will help the bidders to analyse and predict the worth of the art.

B. ACCEPT ART

This function can only be used by the central authority. they will go through the details given by the users who want to add a piece to the system and will verify the details and the authenticity of the artwork. on confirming the details to be correct, they will accept it into the system.

C. SELL ART

This function allows the user to sell art. He will have to set the starting bid value and the amount of time he is willing to wait till other users set their bids. The users can keep bidding at this time. At the end of this time, the one with the highest bid buys the piece from the seller.on selling the art you can choose to reveal yourself as the previous owner of the art, if you do so you will be added to the previous owner list.

D. LIST ART

This function allows interested users to see the list of art pieces that are put to auction, their details, the time left for the bidding to end, and the initial and current bidding price.

E. BID ART

On choosing which art to bid on, this function can be used to select the bidding item and how much more to bid than the current bid. you will only be able to bid within the time left to bid and other players will be able to bid after you within the time. at the end of the time, the item is sold to the one with highest bid. you will have to keep checking the bidding to know if anyone has bid after you. On winning the bid, you can choose to remain anonymous or reveal yourself as the current owner of the art. If you choose reveal yourself, then other users will be able to recognise you as the current holder of the item.

F. MY BIDDING LIST

This function allows the user to access all the biddings he is currently involved in. you can directly check the status of all your bids using this function.

G. MY ART

This function lists all the registered art pieces that you own. this information is only accessible by you, this way you can remain anonymous about owning a certain art piece.

H. SEARCH ART

This function helps the user to search for an art piece held by an user who chose to reveal himself as the owner.

VI. Analysis

A. Theoretical Analysis

The blockchain does three things:

1) Addition of new pieces into the database
2) Putting an art piece into the bidding queue
3) Bidding on an art piece available

The buying process depends on

1) Amount bid by the buyer

2) Amount bid by the other buyers
3) Gas paid by the buyer to add their transaction to the block

B. Practical Analysis

While the transaction is being processed from the buyer to the artist, the gas fee incurred will be paid by the buyer itself. The bids placed by other buyers who do not win the auction are immediately erased from the server as we want to maintain user privacy. Some buyers may try to commit fraud by placing bids and then trying to cancel them. We can place a certain amount of time after canceling to avoid this or by limiting the number of times a buyer can cancel bids.

Another way can be to place a cancellation fee so that the participant looses some amount while cancellation.

VII. Conclusion

The blockchain-based auctions help in creating a secure space for artists and buyers to buy art pieces without doubting the genuineness of the art and the artist. The blockchain also ensures that the buyer does not go back on his word as the payment has to happen instantaneously. Decentralization of these platforms would break the monopoly and would help to keep the auction houses out of the picture.

VIII. Future Work

This use case can be extended to other domains such as decorative art and antique pieces. Other features that can be added are cancellation fees so that the number of cancellations made by the buyer reduces significantly.

The project can be extended for other games such as LaLiga, ISL etc. Instead of extending the project to other games we can allow the developers/people to implement their own contracts based on some real world league. They will define the rules of their league will provide an API to get the game statistics. And the user can use our centralized distributed platform to play in all those leagues.

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