

Bloquity

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Abstract— One of the biggest challenges in buying/selling real estate, especially in a country like India, is the legal process of checking the property's title. The percentage of frauds that happen in that domain are enormous (upwards of 20%) and expensive. A person would have to hire a lawyer and wait for 1-2 months until the legal check is done. Even then there is no guarantee that the property title is clear.

Title records are decentralized, challenging-to-access aspect of the real estate buying/selling process. Even in 2017, title information remains stored at the local level and is offline. With blockchain technology, this can be changed. The blockchain could provide a central title database for the entire country to securely store and instantly access historical title records, allowing for the streamlining of title transfer in a property sale.

Keywords— real estate, blockchain, hyperledger, secure

I. INTRODUCTION

In many second and third world countries, the process of buying property or land can be very stressful. Usually, one would have to go to a bank, pay a fee, wait several

weeks, and then only will he/she be given a history of the property he/she wishes to purchase. Even after investing time and money, the property history that they provide is not credible. The United States, in particular, requires sellers and buyers to go to a third party to perform legal checks and make sure everything provided is correct and true from a legal standpoint. This is also very time consuming.

By using blockchain, the need for a middle man, either a bank or lawyer, has been removed. None of these parties will be required to perform legal checks with the use of blockchain technology. Instead, blockchain was used to keep track of data and assures all data hasn't been tampered with and is secure.

II. METHODOLOGIES

Blockchain is shorthand for a whole suite of distributed ledger technologies that can be programmed to record and track anything of value including land titles. Although we already have processes in place to track data, here are three main reasons why blockchain is so special and can help achieve our goal of securely conducting property transaction without spending the time and money involved in 3rd party land title checks.

Firstly, the way blockchain tracks and stores data. Blockchain stores information in

batches, called blocks, that are linked together in a chronological fashion to form a continuous line, metaphorically a chain of blocks. If you make a change in the information recorded in a particular block, you don't rewrite it, instead the change is stored in a new block showing that X changed to Y at a particular date and time. It's a non-destructive way to track data change over time. Let's take an examples with respect to our use case. Let's say there was a dispute between Rachel and her brother Brenden over who owns a piece of land that has been in the family for years. Because blockchain technology uses the ledger method, there is an entry in the ledger showing that Adam first owned the property in 1900. When Adam sold the property to dave in 1930, a new entry was made in the ledger, and so on. Every change of ownership of this property is represented by a new entry in the ledger, right up until Rachel bought it from her father in 2007. Rachel is the current owner and we can see that history in the ledger. Now here is where things get interesting. Unlike the age-old ledger method - originally a book, then a database file stored on a single system - blockchain was designed to be decentralized and distributed across a large network of computers. This decentralizing of information reduces the ability for data tampering, and brings us to the next factor that makes blockchain unique.

The second factor that makes blockchain unique is that it builds trust in the data. Before a block can be added to the chain, a few things have to happen. A cryptographic puzzle must be solved, thus creating the block. The computer that solve the puzzle shares the solution to all other computers on the network. This is called proof-of-work. The network will then verify this proof-of-work and if correct, the block will then be added onto the chain. The

combination of these complex math puzzles and verification by many computers ensures that we can trust each and every block on the chain.

The third reason blockchain is such a game changer - no more intermediaries. Currently while doing business with one another, we don't show the other person our financial or business records. Instead, we rely on trusted intermediaries, such as a bank or a lawyer to view our records and keep that information confidential. These intermediaries build trust between the parties and are able to verify, for example, that "yes, Rachel is the rightful owner of this land". This approach limits exposure and risk, but also adds another step to the exchange - more time and money spent. If Rachel's land title information was stored in a blockchain, she could cut out her middle man, the lawyer, who would ordinarily confirm her information with Brenden. As we now know, all blocks added to the chain have been verified and can't be tampered with. So Rachel can simple show brenden her land title information secured on the blockchain. Rachel would save considerable time and money but cutting out the middleman. This type to trusted peer-to-peer interaction with our data can revolutionize the way we access, verify and transact with one another.

III. IMPLEMENTATION

Bloquity is a prototype blockchain web application that uses hyperledger fabric for the blockchain implementation. The frontend and backend of the application are implemented using MERN stack. Bloquity also uses kafka for distributed service and load balancing. The overall architecture is based on RESTful web services.

Listed below is a brief overview of the

different tools and technologies used to achieve the implementation of Bloquity.

A. *Hyperledger Fabric*

Bloquity uses hyperledger fabric as a blockchain platform to store untampered property transaction history. We used fabric as a blockchain platform because of the below mentioned features that differentiate the framework from other blockchain frameworks available today.

- ❑ Supports **permissioned** network and the participants are known to each other which ensures **privacy and confidentiality** of transactions
- ❑ Supports smart contracts authored in general-purpose programming languages
- ❑ Leverages container technology to host smart contracts called “chaincode” that comprise the application logic of the system.
- ❑ Has a highly **modular** and **configurable** architecture
- ❑ Has a support for **pluggable consensus protocols**
- ❑ Does not require **native cryptocurrency**

B. *Hyperledger Composer*

To expedite the creation of Hyperledger Fabric blockchain application, we have used Hyperledger Composer which are essentially a set of JavaScript-based tools to build applications using fabric. Hyperledger Composer creates a business network definition that can be packaged up and exported as an archive. The exported archive file is a Business Network Archive (.bna) file, which can then be deployed on an

existing Hyperledger Fabric network. The BNA file contains executable transaction processor functions and can be considered as a smart contract written in JavaScript. We have written client applications (Bloquity backend) using Hyperledger Composer APIs to access BNA functions. Following are the components needed to generate a .bna file

- ❑ **Network model file (.cto)**. The model file contains definitions of assets, participants, and transactions.
- ❑ **JavaScript file (.js)**. This file defines the transaction functions.
- ❑ **ACL file (.acl)**. This file contains the access control rules that define the rights of the different participants in the business network.
- ❑ **Query file (.qry)**. This file defines the query that can run in a network.

As part of the .cto file we have following assets and transactions as part of the domain model.

❑ **Assets**

```
Property
asset Property identified by propertyId {
  o String propertyId
  o TransactionDetails[] transactionHistory optional
}
```

❑ **Transactions**

```
TransactionDetails
abstract transaction PropertyTransaction {
  --> Property property
}
transaction TransactionDetails extends
PropertyTransaction {
```

```

    o String buyer
    o String seller
    o String trans_date
    o String trans_amt
  }

```

Whenever there is a sale deed on the property, it is recorded as a transaction on the specified property using the business logic in the .js file which defines the transaction functions.

REST API support in Composer

Hyperledger Composer also generates REST APIs based on the business network definition using a LoopBack connector. These REST APIs can be easily consumed by client applications and integrated with non-blockchain applications.

Example Snippet for using the composer REST API's for the bloquity application that are being used in the backend server to record transactions on the property are as below:

1. To register a new property on the blockchain network, below is the request schema:

```

curl -X POST \
  http://host:port/api/org.digitalproperty.Property \
  -H 'Content-Type: application/json' \
  -H 'cache-control: no-cache' \
  -d '{
    "propertyId": "string",
    "transactionHistory": []
  }'

```

2. To register a new transaction on the specified property, following is the request schema:

```

curl -X POST \
  http://host:port/api/org.digitalproperty.TransactionDetails \
  -H 'Content-Type: application/json' \
  -H 'cache-control: no-cache' \
  -d '{
    "buyer": "string",
    "seller": "string",
    "trans_amt": "string",
    "trans_date": "string",
    "property": "string"
  }'

```

3. To retrieve existing transactions on the specified property, following is the request schema:

```

curl -X GET --header 'Accept: application/json' \
  'http://host:port/api/org.digitalproperty.Property/{PropertyId}'

```

C. WEB UI

Bloquity's User Interface is built using ReactJS which is communicating with the Node server at the backend. In React, user interfaces are described using components which are like simple functions. We call the components with user input and in return get the corresponding output. The components accept props as inputs and outputs the declared interface. The reason we chose ReactJS to construct the frontend of the website is because of the following features it provides.

- ❑ Hides its complex rendering engine implementation and exposes a simple component API.
- ❑ There are only a few public methods to override inside the component such as `componentWillMount`, `componentDidMount`, etc.
- ❑ In React, every UI is composed of components, so there is no mismatch of multiple types to worry about. Since there is only one common object, it makes it easy to nest components inside components and encourages the principle of single responsibility for each component.

We have defined variables using state and have used axios to make API calls and requests to the Node server at the backend. Then, `this.state` has been used to set the state of the variables to the data present in the response received.

We have then created `render()` methods to create JSX elements to render our data inside the component and hence display it to the user. Some of the components have also been exported to other pages, in order to be used again.

Also, the User Interface has been styled using CSS, particularly Bootstrap classes and some self made classes in order to make the website more appealing.

D. Node Server & Database

The node JS server uses the express framework to handle all the routes that it receives from the react frontend. For each API call that it receives, the server routes the call to the appropriate module where a request is made for the corresponding kafka topic that would handle the call. For example, if the user sends a request to post a property, the server would route it to the list

property module which would make a request to the kafka topic for posting a property. Kafka directs the request to the server hosting the module and then responds with the reply which follows through to the node server and then eventually back to the frontend where the user is given confirmation of the property posted. The node server also hosts the model files for how the collections are stored on the database i.e. mongoDB. The node server interacts with mongoDB via mongoose. The database stores all the user related data and the properties posted.

E. Kafka

Kafka is responsible for providing a unified, high-throughput and low-latency platform for dealing in a distributed setup with real-time data feeds. Its main USP is being able to provide a streaming architecture for data processing and load balancing of the server requests. Zookeeper is used to keep track of the cluster nodes and manages kafka topics.

F. Cloud Hosting

Both the hyperledger composer and the webApp have been hosted on the cloud with the help of Amazon Web Services. Several Amazon Elastic Cloud instances were setup to host the hyperledger server, kafka server, zookeeper, node server and the react frontend.

G. Features and functionality

The website caters to two personas, which are:

- ❑ Property Sellers: Users who own property and are looking for a

platform to sell their property to potential buyers in a secure and trustworthy way.

- ❑ Property buyers: Users looking to buy property through a secure platform, where they can see all the property history easily and in turn can be sure that the property is legit.

Bloquity provides a platform to both the above mentioned personas to carry out their respective tasks. They can use the website in the following manner:

- ❑ New users can create an account on the website by registering on the Sign Up page, while the existing users can straight away move to the Log In page and login with their credentials.
- ❑ Each user has their own profile page where they can update their profile image and maintain their personal information.
- ❑ The “Post your property” button on the homepage which will redirect him to another page. On this page the user has to upload their property images, property details and location details of the property. If all the fields turn out fine and the property owner is the legit owner of the property (which is a check done by hyperledger at the backend), the property will be successfully posted.
- ❑ A user who is a property buyer can search for the properties through the search fields provided on the homepage. The search fields primarily constitute of Zip, City and State.
- ❑ Upon clicking the search button on the homepage, the search page will pop up which includes the properties that satisfy the search criteria. These

search results can be filtered on the basis of price and number of rooms.

- ❑ Logged in users can view transaction history of the property they are interested in by clicking the “View Transaction History” button on the property details page which redirects to the Transaction History page.
- ❑ Users can choose to purchase a property by clicking the “Buy Property” button. This transaction gets recorded as a new block on hyperledger.
- ❑ The Transaction History page can also be accessed through the Homepage. can also find the transaction history for any property in the database, by making use of the search fields present on this page.

IV. RESULTS

The implementation for blockchain that bloquity has using hyperledger fabric successfully shows how property transactions can be kept decentralized, tamper free and could potentially eliminate the need for intermediaries. Bloquity has been launched successfully through AWS and anyone can start using it. Bloquity has taken the concept of land titles to the next level. By providing users with a secure and trustworthy platform, Bloquity has removed the need for a middle man or third party. Thus, saving user’s time and money effectively.

V. CONCLUSION

Blockchain can be implemented in many different ways. Some blockchains can be complete public and open to everyone to

view and access - public blockchains. Others can be closed to a specific set of authorized users, such as your company, a group of banks or government agencies. These are private blockchains. Then there are hybrid

where everyone can view all the data but only some people have access to add new data. A government of example could use a hybrid system to record the boundaries of Rachel's property and the fact that she owns it while keeping her personal information private.

It is the combination of the three factors - decentralizing of data, building plex policy questions around governance, international law, security and economics.

VI. FUTURE SCOPE

As for the future of this project, a few additions can be added to make Bloquity the ultimate website for property buyers and sellers.

This project can be monetized in many ways. For example, property owners can purchase various different packages that would allot only a certain number of postings. Another way Bloquity can be monetized is to run ads throughout the website.

VII. ACKNOWLEDGEMENT

The authors gratefully acknowledge the contributions of Professor Rakesh Ranjan and Charles W. Davidson, College of Engineering for their support and guidance.

public-private blockchains too, where those with private access can see all the data and those with public access can see only selections of the total data. Another method can be

trust in the data and allowing us to interact directly with one another and the data, that gives blockchain technology the potential to become a powerful tool in property transactions.

Much like the rise of the internet, this technology brings with it all kinds of com

VIII. REFERENCES

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Appendix

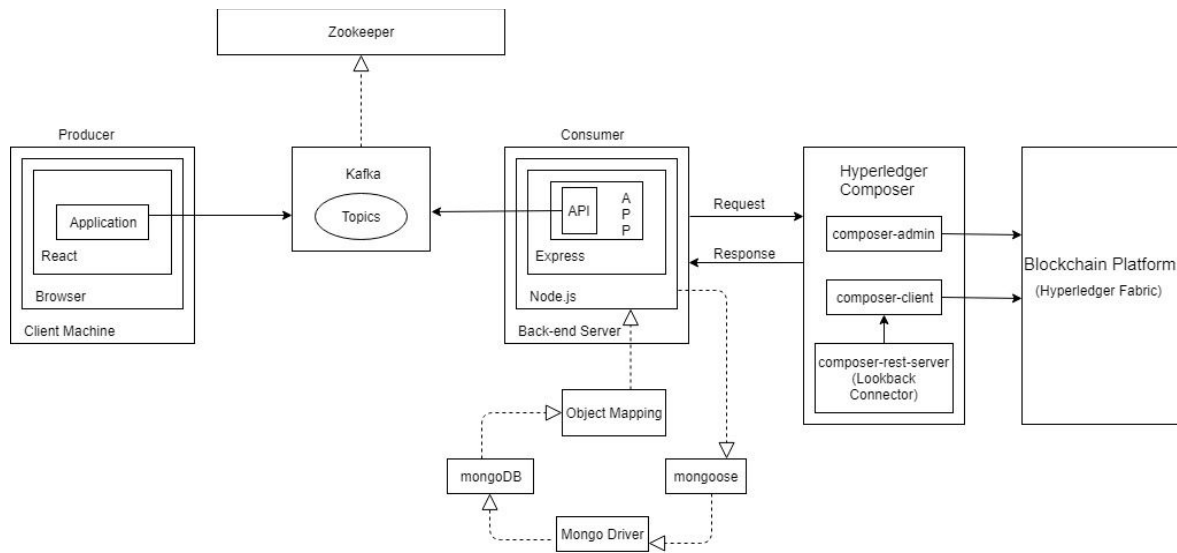


Figure 1: Bloquity Architecture

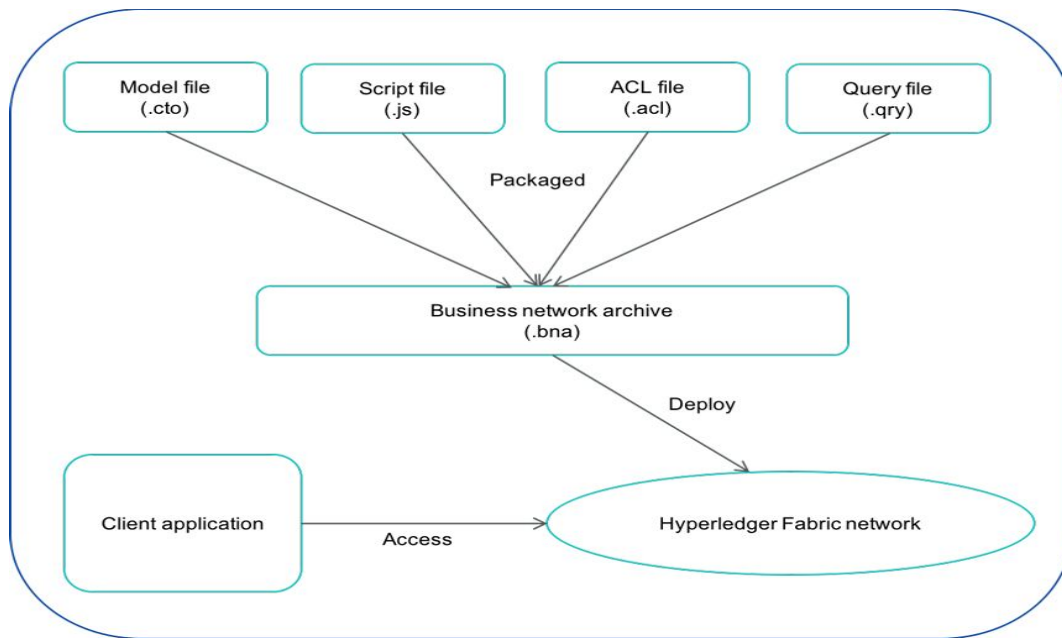


Figure 2. The components of a business network definition that can be deployed to a network and accessed by application

Screens of Bloquity

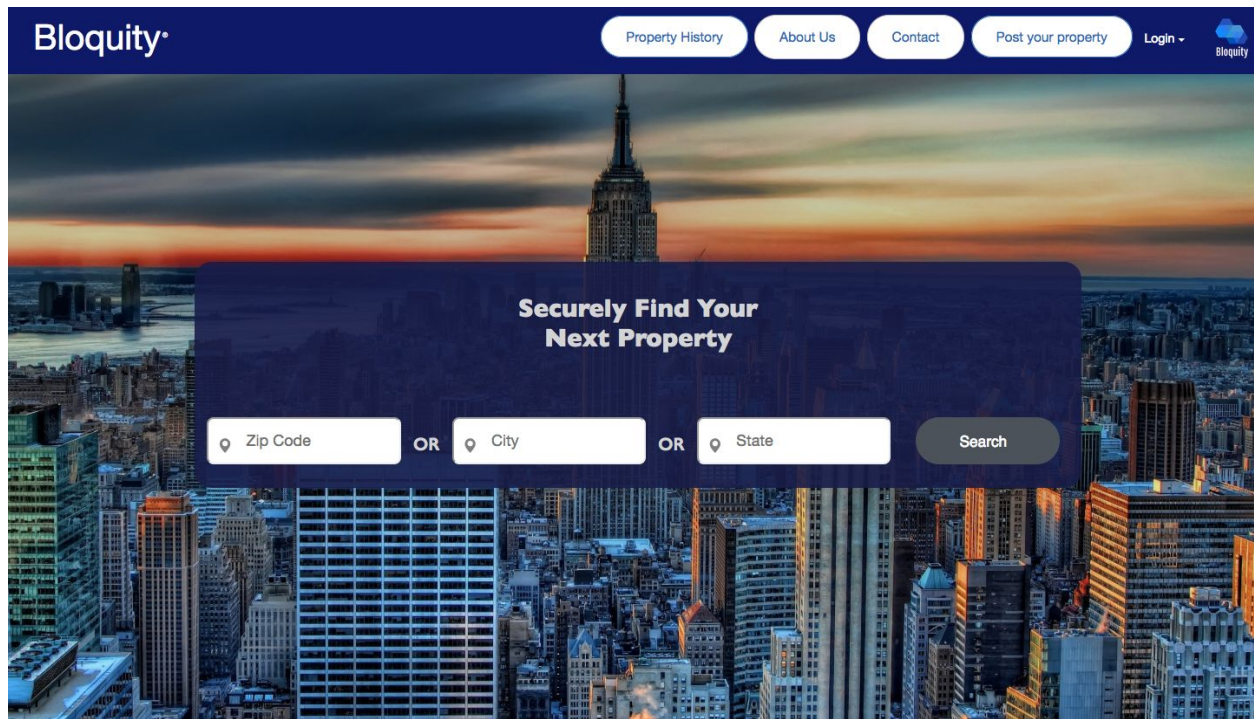


Figure 3: The above figure displays the home page for Bloquity

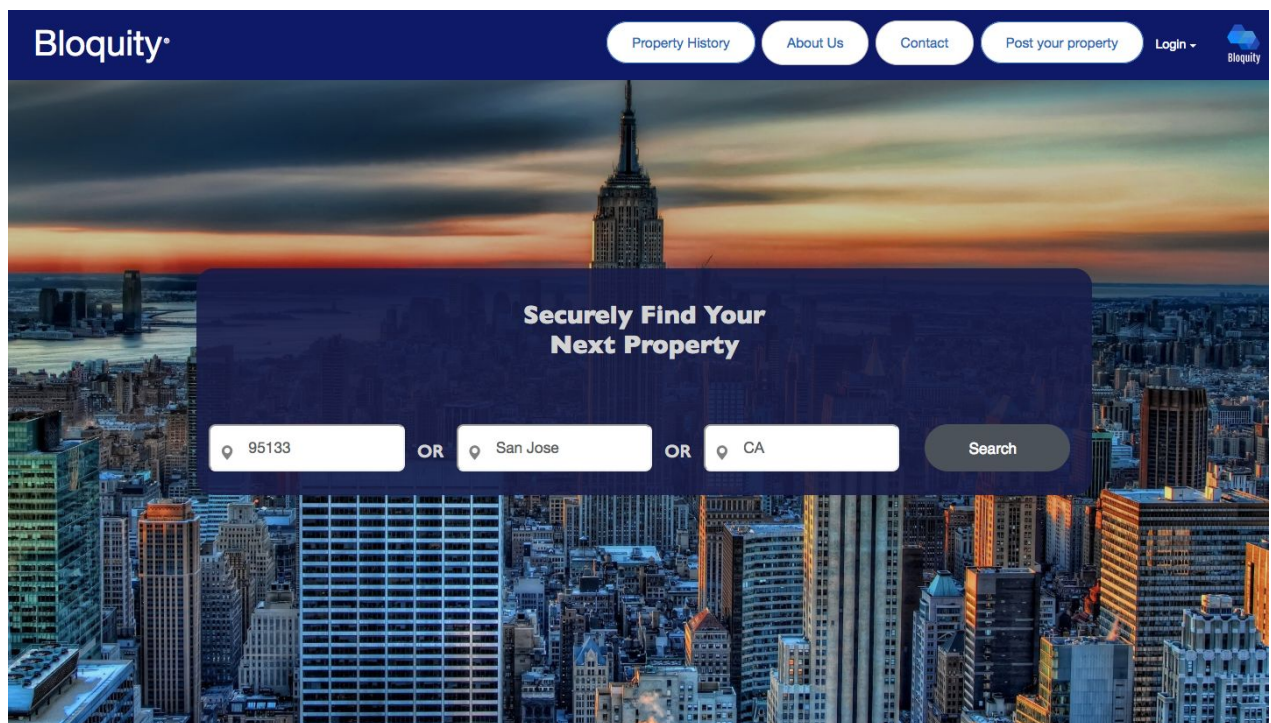


Figure 4: The above figure shows that a user can either enter zip code/city/state details in order to perform a search

Bloquity

Property History

Post your Property

U.


Bloquity

Filter Postings

\$ Price

Rooms

3 postings




Stunning single family home

House


3065 Manuel St


\$1248888 - 4 Bedrooms - 4 Bathrooms - 2153 Square Feet



Charming condo in San Jose

Figure 5: The above figure displays the search results for the search criteria as san jose






Charming condo in San Jose

Apartment

380 Auburn Way

\$800000 - 2 Bedrooms - 1 Bathrooms - 924 Square Feet



Gorgeous House in San Jose

Town Home

1656 Prime

\$1088000 - 4 Bedrooms - 4 Bathrooms - 2053 Square Feet

Figure 6: The above figure is a continuation of figure 3 (displays the search results for the search criteria as san jose)

Bloquity

Property History


About Us

Contact

Post your property

Archana Yadawa

Bloquity



Property Description: Stunning 2 year old detached single family home located on Communications Hill. Light and bright throughout this home features a modern open floorplan with desirable bedroom suite and bathroom on the first level, gourmet kitchen with granite countertops, stainless steel appliances, and marble/tile backsplash.

Details


Property Manager: Kruti Thukral

Address of Property: 3065 Manuel St , San Jose , CA , 95136


Price of Property: \$1248888

Property Size: 2153 Square Feet

Property Type: House



Bedrooms: 4



Bathrooms: 4

Buy Property

View Transaction History

Figure 7: The above figure shows images, details, and a short description of the selected property. The user can either directly buy the property by clicking the “Buy Property” button if satisfied with everything, or select the “View Transaction History” button to view all previous transaction records for the selected property. The user can also go back and view other properties if the current property is not favorable.

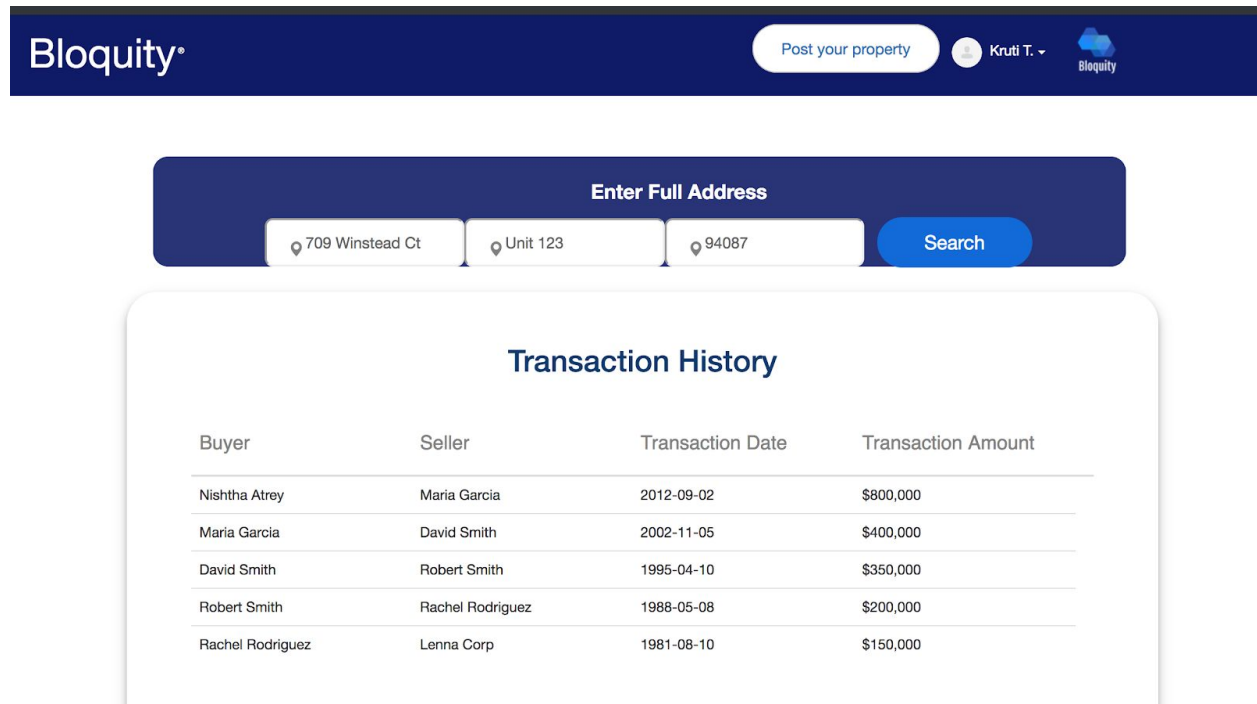


Figure 8: The above figure shows the untampered property transaction history of a particular property

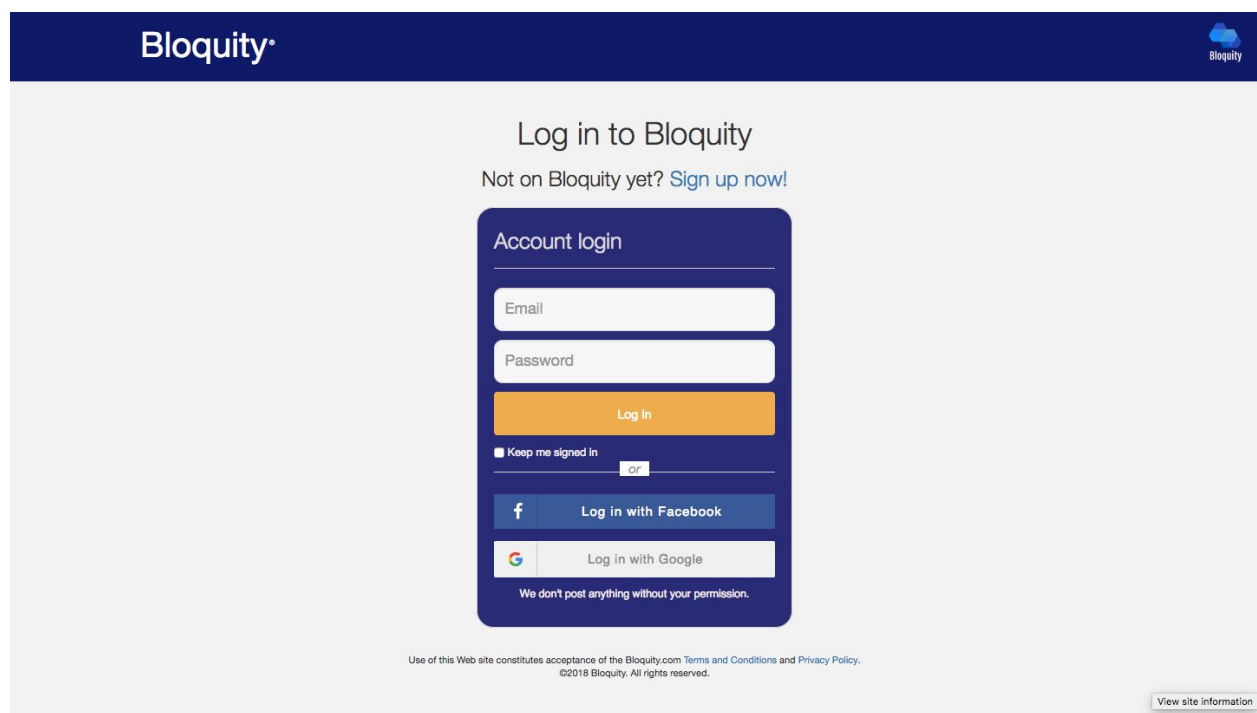
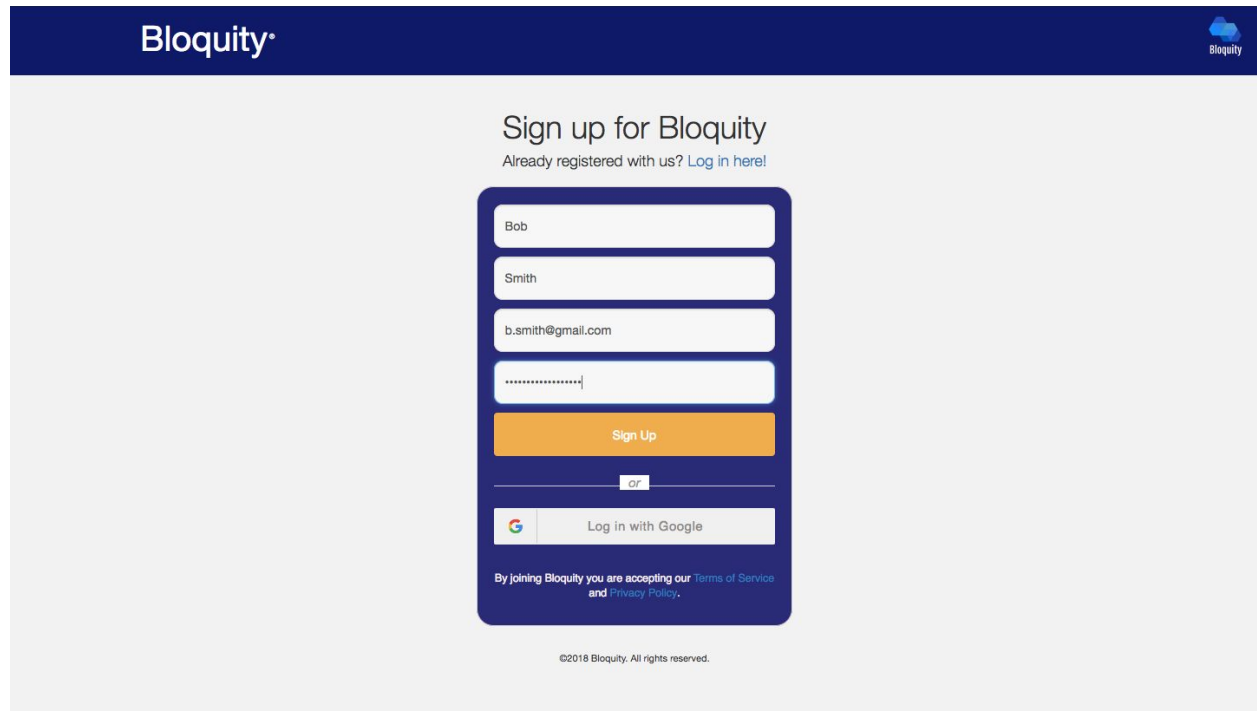
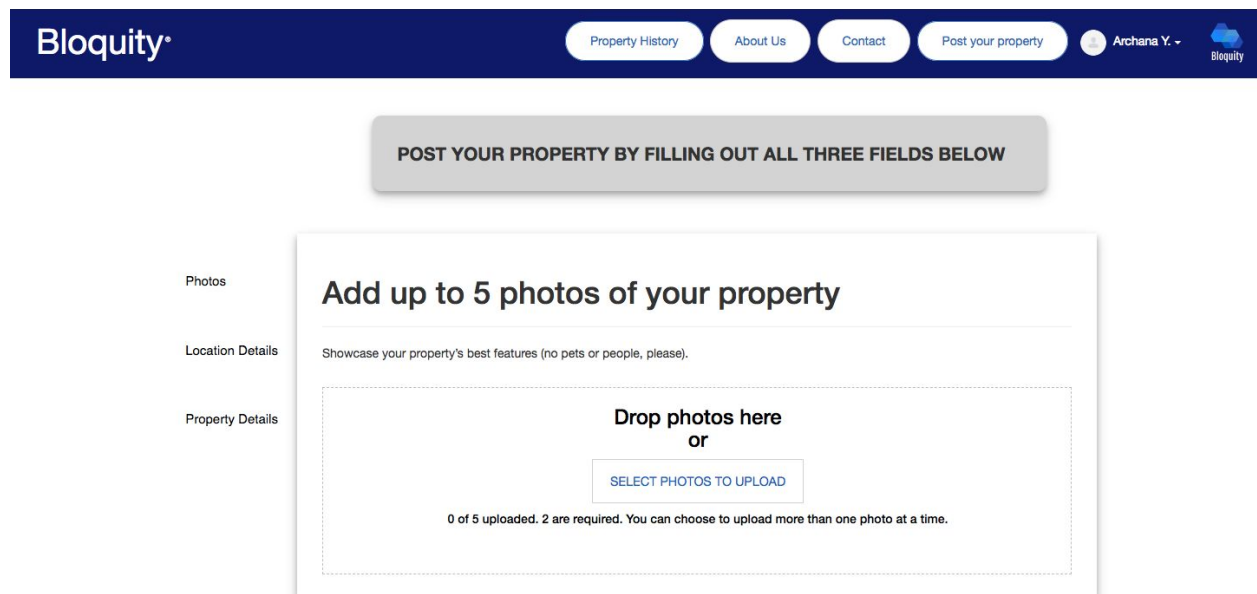


Figure 9: The above figure displays the login page for the user. This page will appear with the user clicks the “Buy Property” button.



The image shows the 'Sign up for Bloquity' page. At the top is a dark blue header with the 'Bloquity' logo on the left and a small cloud icon with the word 'Bloquity' on the right. The main content area is light gray. In the center, there's a dark blue rounded rectangle containing the sign-up form. The form has four input fields: a first name field with 'Bob', a last name field with 'Smith', an email field with 'b.smith@gmail.com', and a password field with masked characters. Below these is an orange 'Sign Up' button. Underneath the button is a white 'or' separator. Below that is a 'Log in with Google' button featuring the Google logo. At the bottom of the form, there's a line of text: 'By joining Bloquity you are accepting our [Terms of Service](#) and [Privacy Policy](#).' Below the form, centered, is the copyright notice '©2018 Bloquity. All rights reserved.'

Figure 10: The above figure displays the sign up page for a user to create a Bloquity account.



The image shows the 'Post your property' page. At the top is a dark blue header with the 'Bloquity' logo on the left. On the right, there are several navigation buttons: 'Property History', 'About Us', 'Contact', 'Post your property', a user profile icon for 'Archana Y.', and a small cloud icon with the word 'Bloquity'. Below the header, there's a gray button that says 'POST YOUR PROPERTY BY FILLING OUT ALL THREE FIELDS BELOW'. The main content area is white. On the left, there's a sidebar with three sections: 'Photos', 'Location Details', and 'Property Details'. The 'Photos' section is active. The main content area has a heading 'Add up to 5 photos of your property'. Below the heading is a text prompt: 'Showcase your property's best features (no pets or people, please)'. Below that is a large dashed box containing the text 'Drop photos here or' and a button that says 'SELECT PHOTOS TO UPLOAD'. At the bottom of the dashed box, there's a status message: '0 of 5 uploaded. 2 are required. You can choose to upload more than one photo at a time.'

Figure 11: The above figure shows the post your property page. A user can post any property for sale by filling out all three sections (Photos, Location Details, and Property Details). The above figure shows the photos sections.

Property History

About Us

Contact

Post your property

Archana Y. ▾

Bloquity

POST YOUR PROPERTY BY FILLING OUT ALL THREE FIELDS BELOW

✓

Photos

Location Details

Property Details

Enter Your Location Details

Country

Street Address

Unit, Suite, Building, Etc. (Optional)

City

State

Zip Code

Figure 12: The above figure shows the locations details section of the post your property page. The blue checkmark besides the photos section indicates the section has been successfully filled out.

Property History

About Us

Contact

Post your property

Archana Y. ▾

Bloquity

POST YOUR PROPERTY BY FILLING OUT ALL THREE FIELDS BELOW

✓

Photos

✓

Location Details

Property Details

Enter Your Location Details

United States

444 Apple Way

Unit, Suite, Building, Etc. (Optional)

San Jose

CA

95133

Figure 13: The above figure shows the fields required for the location details section. Once all the required information has been filled out, a blue checkmark will appear on the side of the location details tab, as represented in the figure above.

✓ Photos

✓ Location Details

Property Details

Enter Your Property Details

Nice House With Great View

Buy this house

- ✓ Apartment
- Barn
- Bed and Breakfast
- Bungalow
- Chateau / Country House
- Condo
- Corporate Apartment
- Estate
- Hotel
- House
- Mobile Home
- Studio
- Town Home
- Villa
- Yacht

Figure 14: The above figure displays the property details page and shows the sections required for that section.

Property Type
House

Bedrooms
2

Bathrooms
2

Sqft of Lot
1500

Year Built
2010

Price of Property (\$)
999000

Parking Spots
2

Figure 15: The above figure shows a continuation of the fields that are required for the property details page.

Bloquity

Property History

About Us

Contact

Post your property

Archana Y.

Bloquity

POST YOUR PROPERTY BY FILLING OUT ALL THREE FIELDS BELOW

✓ Photos

✓ Location Details

✓ Property Details

Add Property

Enter Your Property Details

Nice House With Great View

Buy this house

Property Type
House

Figure 16: The above figure shows all the three sections have check marks therefore, users can add their property by pressing the “Add Property” button.