loqul - REAL ESTATE RENTAL MARKETPLACE FOR CRYPTOCURRENCY PAYMENTS PROJECT OVERVIEW

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Abstract

This paper details the design and process of loqul, a real estate rental protocol and marketplace on the Cardano Blockchain. Loqul is built from the bottom up, focusing on ease of document filing and low-cost secure transactions, building on the latest decentralized identity systems and the Cardano Blockchain network as a secure & stable blockchain solution.

Introduction

Motivation

Blockchain technology is here to stay but while many are aware of the breakthrough applications, adoption in solving real world problems is still limited. Our team has come together to bring life to viable and practical services that allow you to rent properties in the real world through cryptocurrency payments and blockchain identities.

At its core, Loqul is a real estate protocol and marketplace that connects homeowners, renters, and tenants in a transparent marketplace. Our MVP will focus on rentals as a lower friction entry into the market. Rental services will allow us to begin building credit scores for our clients who will then be able to transition to buying homes through us. The Loqul roadmap has a long term vision to expand its product suite into many other services that will become possible with the growth of the network effects of our marketplace.

Infrastructure

Loqul is building its infrastructure on Cardano, a proof of stake blockchain network created by a group of academics and researchers; They built a blockchain base with a functional programming language, Haskell, focused on stability and security of the entire financial ecosystem. IOG, the company developing Cardano and its layer 2 solutions, provides tools and programs for building blockchain infrastructure and connecting to enterprise tools. By working with other projects within Cardano we are able to improve our value proposition by allowing other layer two solutions to improve our client's experience.

Cardano has gone through great efforts to work with governments and companies to create enterprise level applications with genuine real world utility. Their rigorous mathematical foundations, utility, and unique choice to be built in a functional programming language, makes them the perfect choice to build our marketplace. Both IOG and the development community are vibrant in technical prowess. They have provided the longest runtime without a network outage or accidental fork compared to Ethereum while also maintaining the most decentralized infrastructure compared to Fantom or Solana. Cardano is also the greenest blockchain system to date.

MVP

Loqul will start off as a property rental marketplace that unites owners and renters that want to transact using cryptocurrency. Users will go to Loqul.io, where they can list their properties for rent, or window shop and see what places are available. There will be a unique bidding system where renters can bid on a property based on how long they want to stay and how much they

want to pay. Renters will also be able to filter for properties based on availability during a certain time period, like on AirBnb. This will reduce the turnover between losing a tenant and getting a new one, since the property will still show as available for renters filtering based on the appropriate time periods.

Renters will build a credit score by making full on time monthly payments tracked by smart contract logic built into the rental agreements. These users will be a funnel into our mortgage system, where we will partner with lending providers to provide loans to renters who have proven themselves trustworthy over their past agreements.

Revenue from the MVP will come in the form of application fees, and stake pool offering.

Initial client onboarding

Background checks for tenants will be done through background check agencies such as TransUnion. The cost of the background check will count as a credit towards the renter's first month's rent. If they do not complete a rental agreement, the cost will stay as income for Loqul. For landlords, we only have to verify the driver's license as well as confirm the ownership of the property through the Miami Property search site. This is proof enough to start a rental agreement between two private parties. This process will transition to being done on Cardano's Atala ID system as soon as the SDK becomes available. The Atala ID system is partnered with Acuant, who provides data and document verification software to Equifax and Experian, in order to process documentation.

Renters

There is over $2,000,000,000,000 in liquidity currently trapped in cryptocurrencies. Real world use cases are severely limited. For the most part, all they can do is stake, swap from one coin to another, or buy NFT's, where their liquidity will remain locked.

There exists a subset of crypto holders whose majority net worth is trapped on these blockchains (let us refer to these people as hodl gang from now on), where liquidating fiat currency comes with the pain of capital gains taxes. Crypto rentals allows them to avert these taxes, essentially providing them a substantial discount on their rental payments.

Hodl gangers will jump at the opportunity to finally have real world use cases for their currencies. This can be attested to by the contents of this article: Airbnb Users Want to Pay in Crypto - TheStreet

Property owners

Property owners can be partitioned into two subsets: those who already invest in and own crypto, and those who don't. We already have a network of property owners who own crypto and would

like to be part of our marketplace once it is up and running. The incentive for them is immediately clear, they see crypto as the future and believe they will gain a larger return on their rentals by taking crypto as payment and joining hodl gangers.

The more interesting question is how do we align incentives such that non-crypto investing property owners see reason to accept crypto as a form of payment. This is where the innovation of Loqul takes over and addresses current pain points in the process of getting your properties filled as quickly and cost efficiently as possible.

In its current state, the process of filling rental properties with tenants usually requires hiring an agent, or speaking with a property manager, and paying them your first month's rent or 10% of a year's worth of income. This process requires hands-on labor by the agent, and can take ten days or more.

By listing on Loqul, we can slash those fees down to 0%, and even accelerate the speed at which rentals are filled with the assistance of our marketplace network and bidding system. This eliminates the need for the labor provided by the agent. So now instead of paying 10% and waiting ten days, the owners are paying 0% and waiting the time allotted in the rental auction listing, drastically lower than the current process.

There will only be a value-added fee applied in the case that the rental property goes for more than the initial asking price listed by the owner. If a property is listed for $2000, and it gets rented out for $2200, Loqul will get $100, or 50% of the value added by our marketplace. The pricing model is subject to change based on results, but will always substantially undercut the costs of having an agent or property manager do the work for you.

If the owners have their hesitations about crypto price fluctuations, this is easily addressed by having the option to accept stablecoin like Djed or USDC. Link to Djed Whitepaper: https://iohk.io/en/research/library/papers/djeda-formally-verified-crypto-backed-pegged-algorithmic-stablecoin/.

In the future, Loqul wants to streamline property acquisition processes by doing in house documentation filing and providing the necessary infrastructure to create a one stop shop experience. This involves combining the functionality of stable coin transactions and implementing smart contracts that enable sales and auctions of properties. The goal is to create a property marketplace similar to sites like zillow and multiple listing service (MLS) with added functionality allowing the user to easily complete the transaction directly through the platform.

Business Revenue Model

Onboarding Fees

Renters will be required to do a background check to be able to partake in the marketplace. The fee will count towards rental credit on the first month's rent. This incentivises our customers to follow through with getting a rental contract on our site. If they do not complete a transaction, then the fee will stay as income for Loqul.

Monetization

Landlord

Landlords have various options to market their properties. They can hire real estate agents who will charge one month rent upfront or a percentage of yearly rent depending on the contract. They might even pass this "broker fee" straight to the future tenant (as is fairly common in NYC). If not, landlords can also use websites like apartments.com or Zillow which could charge to list or take a percentage of rent, or charge to link the application functionality, etc. If a landlord wants to avoid all of this, they must depend on their own marketing skills to find tenants and that means paying for digital or physical ads that take time, expertise, and money. Turnover and empty rental residences are a critical pain point for landlords.

The Landlord will not be charged to list on our site. This is to reduce friction and maximize incentives for property owners to join the marketplace. Our platform can help attract tenants such that we may only take a fee if our platform allows you to make more than you listed it for. A property will be listed for a floor price and if it sells for that starting price, there will be no fees. However, if the bids go above the initial asking price, then Loqul will get 50% of the added value provided by the bidding system. This way, Loqul only takes a part of the profits if the marketplace bidding provided an added value to said owner.

EXAMPLE:

Landlord is looking for a tenant to fill their last open apartment in a 6-apartment building, where the standard rent for a one-bedroom apartment is approximately $1,500. The landlord posts it on our marketplace establishing the floor price ($1,500), with all the benefits and features the apartment/property has. The landlord then selects an expiration date and lets the auction style marketplace work its magic. As users start bidding for the apartment the market forces may raise the price. If the price increases from the floor price ($1,500) the landlord and Loqul share in the monthly profits through the smart contract system (50% / 50% on premium from price floor).

This causes no disruption to the tenant and the landlord is essentially getting more for its rental residence thanks to the value created by the marketplace.

RENT PER MONTH	$ 1,500.00

% Increase	0%	1%	2%	3%	5%	8%
Tenant Pays	$1,500.00	$1,515.00	$1,530.00	$1,545.00	$1,575.00	$1,620.00
$ Landlord Receives	$1,500.00	$1,507.43	$1,514.70	$1,521.83	$1,535.63	$1,555.20
$ Loqul Receives	$0.00	$7.58	$15.30	$23.18	$39.38	$64.80
	These are dollars paid per month					

% Increase	0%	1%	2%	3%	5%	8%
Loqul yearly income	$0.00	$90.90	$183.60	$278.10	$472.50	$777.60

Other plans for monetization from the landlord include sponsored listings and a Rent It Now option.

The sponsored listings will show up first when searching through the marketplace and will be attracting a broader search span. This is a very similar style to Zillow's sponsored listings. The advertisement algorithm will be priced per impression, and will track click rates to rank ads success rates. This way, poor performing ads will be weeded out, and feedback can be given to the owners so that they can redesign their ads and not waste their marketing budgets on lower quality content.

The Rent It Now option will be available for landlords when listing, like eBay's Buy It Now feature. If users do not want to be part of the bidding or want to secure their rental residence, they can do so by paying the Buy It Now at a premium where we will share the profits just as before.

Tenant

The tenant will need to be onboarded to participate in the marketplace. Once onboarded the future tenant can bid on listings while knowing that every bid will lock up the security deposit in their wallet. This will minimize market manipulation and get rid of bad actors who do not really want to sign the contract. The onboarding deposit counts as a credit towards the initial security deposit when the renter signs the rental contract.

General

Both tenants and landlords can send and receive payments through our platform using various exchange listed cryptocurrencies. For the convenience, security, and smart contract setup of using our platform we will charge a fee on the conversion of the payments. The standard operating currency will be Cardano (ADA) and any other Cardano native tokens compatible with Cardano wallets.

Stakepool Operation

As our ADA reserves and customer base increase, we will be able to run a sizable stakepool operation that can yield up to 10% compounding APY, this will allow us to collect compounding passive income as we raise funds and help the network grow.

Payment Processing & Partnerships

Ada Domains

Inspired by decentralized naming projects on other blockchains, such as ENS, ADA Domains brings the user a better and cheaper solution by utilizing native tokens on Cardano. Owning an easy to remember domain NFT (non-fungible token), like hello.ada for example, will allow anyone to send blockchain payments straight to your domain instead of your wallet address. You will be able to later claim these funds to your actual address without having to worry if you typed it correctly. Blockchain domains will also enable you to store personalized data directly on Cardano with the help of other decentralized file storage systems like IPFS. For example you can save your contact information or a personal landing page to be displayed by a browser.

Every domain will be one of a kind and yours forever without any renewal fees. Since we know how many NFT enthusiasts are out there, we will also provide a marketplace where you'll be able to trade domains with other people. We would like to integrate ada domains into our platform for more reliable payments and improved user experience.

Ada Handles

Also inspired by naming projects such as ENS, Ada Handles is our partner, working with them will allow our customers to create and use their handles with their wallets and integrate with smart contracts on our site. Within these handles people can build identity and store addresses that have the identity tokens necessary for KYC. ADA Handles works the same exact way as ADA Domains but adds more capabilities such as GraphQL queries and subdomains for the use of payments under certain DAOs. The reason this is valuable to us is that our landlords can organize and track the payments done throughout their properties by being able to see what subdomains have specific balances and info.

Djed - The first formally verified stablecoin protocol

Djed is the first formally verified stablecoin protocol. The use of formal methods in the programming process have greatly contributed to the design and stability properties of Djed. Using formal techniques, the properties are proven by mathematical theorems:

- Peg upper and lower bound maintenance: the price will not go above or beyond the set price. In the normal reserve ratio range, purchases and sales are not restricted, and users have no incentive to trade stablecoins outside the peg range in a secondary market.
- Peg robustness during market crashes: up to a set limit that depends on the reserve ratio, the peg is maintained even when the price of the base coin falls sharply.
- No insolvency: no bank is involved, so there is no bank contract to go bankrupt.
- No bank runs: all users are treated fairly and paid accordingly, so there's probably no incentive for users to race to redeem their stablecoins.
- Monotonically increasing equity per reserve coin: under some conditions, the reserve surplus per reserve coin is guaranteed to increase as users interact with the contract. Under these conditions, reserve coin holders are guaranteed to profit.
- No reserve draining: under some conditions, it is impossible for a malicious user to execute a sequence of actions that would steal reserves from the bank.
- Bounded dilution: there is a limit to how many reserve coin holders and their profit can be diluted due to the issuance of more reserve coins.

Djed Versions - There are two versions of Djed:

- Minimal Djed: this version is designed to be as simple, intuitive, and straightforward as possible, without compromising stability.
- Extended Djed: this more complex version provides some additional stability benefits. The main differences are the use of a continuous pricing model and dynamic fees to further incentivize the maintenance of the reserve ratio at an optimal level.

Other forms of payment are able to be done as long as our Decentralized Exchange partners are able to provide the swap volume for our customers. Stable coins such as USDC, Tether, and Ardana are also available for use.

The Djed stablecoin will be the default transaction currency on the marketplace. Renters and owners will be allowed to transact in other currencies if they choose to do so. If two parties wish to transact in separate currencies, a swap fee will be applied to cover the backend expenses of converting from one currency to another. This functionality will likely come later in development, with the MVP focusing on Djed and ADA transactions. Each company will be able to receive funds as soon as all of the transactions are confirmed. We do not want to have the finances of properties dependent on the sustainability and performance of other protocols. Djed is used by COTI, an IOG partner.

Other assets that are backed by the stable coin are protected from sudden price changes in the crypto market, while still benefiting from all of the underlying technology of the main protocol. This token will allow us to make transfers between property buyers and sellers without suffering significant risks from market changes. This also allows other common investors that are accustomed to working with pegged and fiat currencies to have a more familiar transaction method / option.

Tenant USD Payments

We are currently working on facilitating USD fiat payments through stripe on our site. The payment is very simple, each payment has a custom identifier, the crypto address of the landlord. As soon as the payment is received we will send the landlord the necessary payments and the tenant will receive the NFT as payment confirmation on the wallet that they have registered.` By making this a feature we are able to gather all tenants regardless of their crypto portfolio size. Our value proposition here is directed to the ease of payment on the tenant side and the fact that the landlord can receive crypto as payment through our services.

Stakeholders & Collaborators

These will be managed by the identity system as required, most of the stakeholders and collaborators will have minimal influence on the issuing of the documentation or certification

unless otherwise specified. Stakeholders and collaborators will be compensated with stock options for the time being.

Competition

Propy

Propy is a service that looks to sell and trade properties with NFTs as well. Their target market is agents while ours is renters, buyers, and sellers who want to transact in cryptocurrency. The middleman is broken in the real estate transaction process. By focusing our efforts on building a peer to peer real estate marketplace, we cut them out and create an environment where landlords can receive higher yields. Loqul processes will be faster, cheaper, and safer than using a real estate agent. This is thanks to the network effects of our marketplace and reduced risk of fraud through Atala ID and publicly auditable blockchain transactions. We are one of the only peer to peer real estate marketplaces on blockchain as of now, and while our competitors focus on agents, we focus on creating more value for our landlords. We are also the only ones building on the Cardano network.

Rentberry

Like Propy, Rentberry targets agents and is not peer to peer. They are built on Ethereum, a blockchain where gas fees are incredibly high with no guarantee the transaction goes through, and over $163,000,000 lost to stakepool operators. The move fast and break things approach of Ethereum does not provide the stability and reliability that is necessary to create a trustworthy financial product or service for something as important as real estate transactions. It may be due to this fact that Rentberry currently only accepts payments in fiat using Stripe.

Rentible

Rentible is another blockchain marketplace that appears to be peer to peer. They are also built on Ethereum just like Rentberry. Rentible plans on accepting crypto payments and has their own token called RNB that must be used to pay any fees on the site. By forcing users to buy RNB, they create more friction in the customer journey to completing a transaction. They also charge many fees that we will not be charging, such as a listing fee, smart contract deposit fee, and leasing smart contract fee. These fees create even more friction in the customer journey, which is why the Loqul revenue structure attempts to keep fees to a minimum. This is especially important in the beginning to grow our marketplace. The true value and revenue of Loqul will come from the network effects of having a marketplace with thousands, and eventually millions

of users. Rentible is currently based in Hungary, a market we won't be touching for quite some time.

Liv.rent

Liv.rent is based in Canada, is not built on blockchain, and they only accept Bitcoin or fiat. They charge a flat fee per month for property owners to list on their site, and also charge a payout fee when a transaction is completed. Like mentioned earlier, charging to list creates resistance for onboarding property owners, and undermines the immense value that comes from creating a massive network marketplace. Similar to our plans of having a proprietary credit score, they have a "Trust score" based on an in house algorithm. They claim the algorithm uses things like their LinkedIn profile, pay stubs, financial statements, and references to create a more reliable metric of their integrity as a renter. We can use their trust score as a reference when building our own version, and reverse engineer the components and weights based on a guide they have on how to improve your Trust score.

Bungalow

Bungalow is a residential real estate platform that provides renters with a convenient, flexible, and communal living solution. It utilizes existing housing supply by signing long-term master leases with homeowners, and rents out those homes by room, at a premium rate to generate revenues. Bungalow offers private bedrooms with housemates in furnished homes across seven major cities. Each home comes furnished and includes wifi, utilities, housekeeping, and monthly community events for members.

Regulation

Rental Contract Regulation

Private contract agreements and terms similar to the ones on the Florida standards are ok and other terms are not regulated by the state or city since it is a peer-to-peer contract.

Documentation Filing

The documentation filing will be done guided by the following sections in contract lifecycle management guidelines:

1. **Requests** - The start of every contract involves the actual request. This is the phase where involved parties gather all the relevant information and data they

need in order to create a contract that works for both sides. The request stage is arguably one of the most important stages of the contract lifecycle and can take some time depending on who is involved.

2. **Authoring** - This is the stage where the contract actually gets written. Both parties put their terms into writing and 'solidify' their clauses and relevant information relating to their contractual obligations.
3. **Negotiations** - The negotiation stages are where both parties continue to negotiate specific contract parameters – this is the stage that directly precedes final approval. Negotiations can be very quick or prolonged – it entirely depends on the method of negotiation, the involved parties, the scale of the contract, how many people are involved, etc. The use of contract lifecycle management software can drastically reduce the amount of time spent in the negotiation phase.
4. **Approval** - Once both sides have agreed on the various terms, clauses, and dates relating to the particular contract, it can now be approved. Department heads, executives, and 'higher-ups' may need to get involved at this phase of the contract to ensure everything is as it needs to be. Once the contract gets approval from the relevant departments and/or personnel, the contract can then be signed.
5. **Signature** - In the signature phase, the contract is signed by whoever needs to sign it in order to become official (who signs the contract is unique to each business). If contract lifecycle management software is used, the signature stage can be done electronically via the internet which drastically reduces the amount of time this stage takes.
6. **Obligation** - Each involved party and personnel will have their own set of responsibilities and obligations pertaining to the specific contract.
7. **Compliance** - Compliance means the involved parties and personnel all keep to their various obligations. Without a proper system or contract lifecycle management software, compliance can be difficult to keep track of and can result in legal ramifications, late fees, bottlenecks, and other business hazards.
8. **Renewal** - After a document expires (or when it is nearing expiration) a contract must be renewed and renegotiated. Contract lifecycle management software makes it easy for businesses to keep track of expiry dates and upcoming renewals.

Future Customer Onboarding & Identity Management

Decentralized Identity IAMX

We are currently working on a partnership with IAMX, a decentralized identity company building on the Cardano Ecosystem. Offering secure identity scanning and biometric markers for

security, IAMX is offering to work with on for our tenant onboarding process to process background checks and access to other services for proofs of payment for our credit score.

Atala Prism

In the future, we will be using Atala Prism for our identity system management tool. Atala allows individuals to create and register their identities on the blockchain. This tool was created by IOG to bring governance with a higher level of trust in order to offer better services on the blockchain. Atala offers our customers a streamlined experience with automated, hassle-free user journeys, instantly onboards and authenticates our customers with reusable, cost and time-reducing KYC (know your customer) and AML (Anti Money Laundering) credentials. We comply with regulatory requirements (including GDPR) via built-in data and privacy mechanisms.

Key Components

- Mobile App - Offer end users a customizable app for receiving, storing, and sharing digital credentials.
- Management Console - Easily issue or verify digital credentials with the user-friendly, decentralized management platform.
- Browser Wallet - Use a web-based browser extension for managing DIDs, accessing the Management Console and authorizing credential issuance.
- SDKs and APIs - Streamline your processes by integrating a digital identity and credential issuance and verification functionality into your applications and workflow.
- Enrollment Tool - Coming Soon
- Capture biometric data as part of the onboarding process using a lightweight mobile app.
- SmartCard - Coming Soon
- Expand your ecosystem using a low-cost smart card for storing and sharing digital credentials.

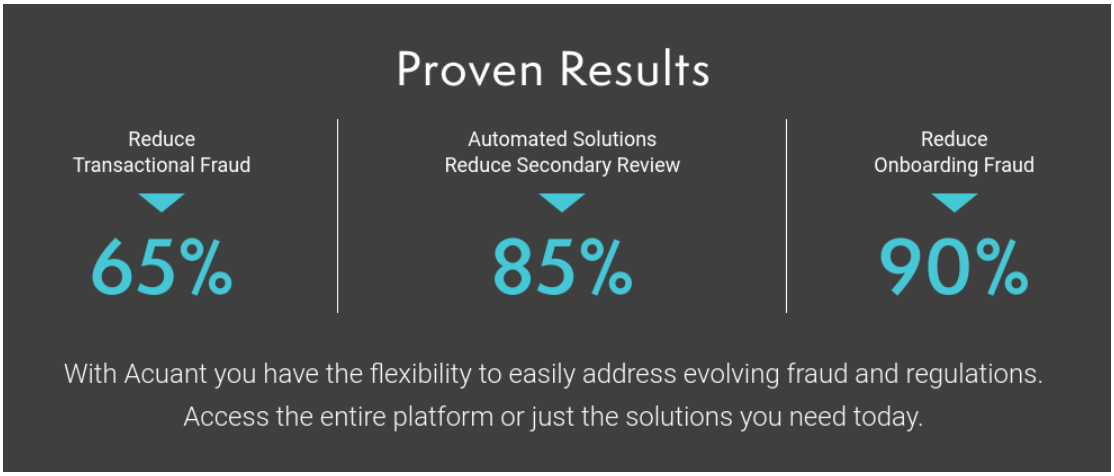


Figure shows the proven statistics of Acuant

Landing Page IAMX Reservations

In order to measure the engagement of our site we will be recording the amount of IAMX IDs that register their interest to participate in our marketplace. We will have one registration for tenants and one for landlords, and possibly refinancing in the future. Each one has different sections where we show prospect clients the features and the amount of documentation and sections that are done before the listing of the property can happen (for landlords), what is required before bid or purchase of a property (for tenants).

The balance of the wallet and other identity tokens will be used in order to place offers or bids on our site. This ensures that only vetted parties are able to participate on our marketplace and landlords can rest assured that they know who they are dealing with.

Initial Property Registration Order

The registration order will be done from easiest to hardest in the survey and arbitration process, we will register the properties that the usual real estate companies do not want to deal with, low asking price and thus lower commission fees to be earned. This will add more properties to our marketplace much more easily. Apartments, condos, and town-houses come first. The newer the property the better it is for us due to the arbitration and inspection. New developments will also be taken into consideration as we finalize the marketplace with the registrations. The purpose is to onboard as many customers as possible with as little arbitration as possible to show the community how well the system works and how well we are able to use overlapping resources.

Tenant Identity

Onboarding our tenants will be similar to how current property managers onboard customers to their rental agreements. Using a private company to do a national background check will give us the proper information to then send a validation NFT to the person's wallet. This validation NFT can be used by the user in order to start participating on our marketplace as a tenant. All of this information will be sent to the Atala Credentials when the SDK is available but since we are starting with a small amount of signups we can handle the onboarding and the NFTs ourselves without Atala.

Landlord Identity

In order to verify landlords we only have to make sure that they are the actual property owners by cross referencing their identity with their registration on the county's public property record database. The database allows us to pull data automatically in order to fill out the rental contract.

You can be both a landlord and a tenant on our site if you have the proper NFT validations but you cannot bid or rent out your own listings.

Marketplace Listings

Minting Policies for Rental Agreements & Monthly Payments

Rental Agreements will be the ones that are sold on the marketplace, after you buy the agreement you are essentially purchasing the right to be able to pay monthly for the property. On another page of our site we will scan your wallet for the contract agreement and you can purchase an NFT receipt that represents each month that you pay for. You can pay in advance as well by purchasing more NFTs that are labeled with the epochs.

A minting policy is the set of rules that govern the minting and burning of assets scoped under that policy. The point of a minting policy is to specify the conditions under which tokens are minted (or burned). For example, the rules might specify who has control over the asset supply through minting and burning.

Our system works using a Single-Issuer Policy meaning that only the issuer's signature has the capacity to mint and burn new tokens. This type of policy can be implemented without Plutus smart contracts due to the embedded properties of Cardano assets.

Example of minting policy:

{

```
 "type": "all",
 "scripts": [
  { "slot": 38082894, "type": "before" },
  {
   "keyHash": "c74140d3c5946dc5fdb4cf97f0c9fed6f138969005d81d3ba12b714c",
   "type": "sig"
  }
 ]
}
```


Minting Transactions

To introduce new quantities of new tokens on the ledger (minting) or to remove existing tokens (burning), each transaction features a mint field. The transactions where the mint field is not empty are known as minting transactions. The use of this field needs to be tightly controlled to ensure that the minting and burning of tokens occurs according to the token's minting policy. Apart from the mint field, minting transactions must also carry the minting policies for the tokens they are minting, so that these tokens can be checked during validation.

The outcome of processing a minting transaction is that the ledger will contain the assets included in the mint field, which is included in the balancing of the transaction: if the field is positive, then the outputs of the transaction must contain more assets than the inputs provide; if it is negative then they must contain fewer.

It is important to highlight that a single transaction might mint tokens associated with multiple and distinct minting policies. For example, (Policy1, SomeTokens) or (Policy2, SomeOtherTokens). Also, a transaction might simultaneously mint some tokens and burn others.

These are the transactions that will be used in the Loqul protocol. The transaction of the property will mint the new title using the deed as a field and burn the old title. The data will still remain but the old title will not be valid.

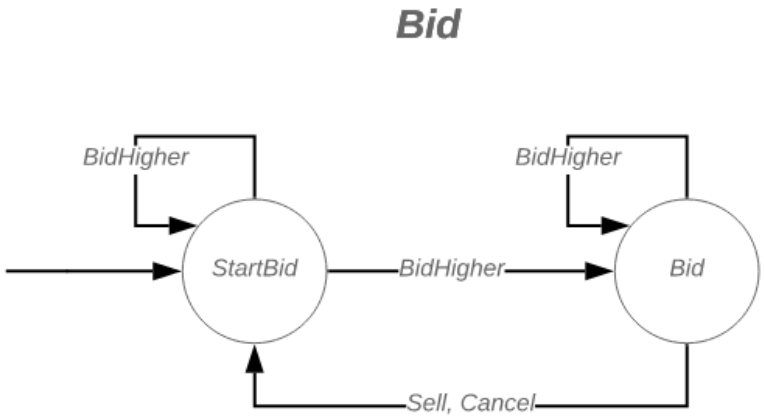
Creating Rental Listing

To post a current property on our marketplace that is currently registered in our system, you need your loqul verified NFT to issue a post on our marketplace. The property that is posted on the marketplace will show the last sales price as well as the current sales price for buy it now or bid, the reserve will be set but not visible unless otherwise specified by the property owner. The property will now be listed and the tenant, who is already certified with IAMX will be able to buy the property rental contract immediately. Rental Listings will be processed right after the landlord goes through the onboarding process for the rental side.

Rental Contract

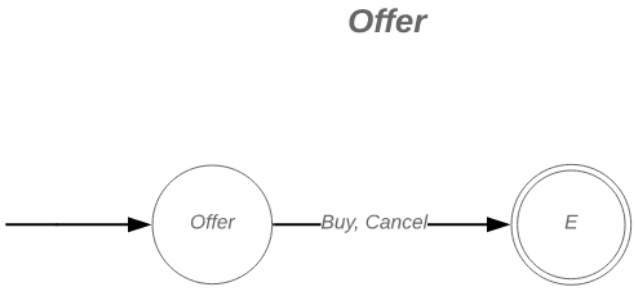
Bid Contract

Potential renters will bid on rental contracts based on desired duration of the rental agreement as well as the pricing they are willing to pay. The bidding interface communicates with a smart contract that will automatically generate and sign the documentation required to legalize the rental agreement when the bid closes. The customer signs beforehand and knows that they are committed to pay the price and time bid on the contract. Monthly receipts of payment will be minted as NFT's and will function as a form of credit score building on the Loqul platform.



Offer Contract

Standard Offer listings are also available, where the owner of the property places a flat offer for their rental property. Future tenants can look through the offer and pay for the offer with their initial deposit.



Credit Score Building

Most mortgage agencies and banks reference past rental agreements as an important deciding factor whether to provide potential borrowers a loan or not. Loqul will employ a similar strategy, a function will calculate renter credit scores based on history of on time payments. The entire process will be handled by smart contract logic that will be able to read the attributes of the NFT receipt to check for quantity of payment as well as timeliness. We will use this score internally to send to the lending provider in order to grant mortgage loans to our customers. Once sufficient client data and history is amassed, Loqul will charge an oracle fee to provide credit score data to other blockchain companies. Credit Scores will be calculated from the monthly payments made to the landlords. This credit score is based on effectively staying committed to the rental contract.

Bed and Breakfast Contract

Is there a demand for our service? Yes!

1) https://www.thestreet.com/investing/airbnb-could-offer-crypto-payments-soon

a)

2) https://www.nasdaq.com/articles/airbnb-users-ask-for-crypto-rentals-in-2022-shares-down-5

The Bed and Breakfast smart contract allows homeowners to accept crypto for short term rentals identical to the AirBnB model. This simple contract is given to loqul homeowners. With this smart contract you are able to list your property on our site at no cost and receive crypto payments. This is interesting because we can prove that the next stage is paying subleases and rent in crypto.

Treasury and Token governance

All of the revenue generated by loqul will be sent to a treasury system where token holders will be able to vote for funds used similar to the Cardano Catalyst fund. We want to use the treasury to help developers, small property owners, and property management groups to expand their rental portfolio. We would like to use the funds for helping other add new properties to the loqul marketplace as well as building sustainable housing and other projects along the line that help feedback the system.

Financing Smart Contract

Staking Financials

Most of the liquidity that will be kept in our pool will be staked on our own stake pools as well as within other stake pools that are operating at our desired parameters. Stake pools are like miners in Cardano in which the only barrier to entry is a significant amount of coins. Since our liquidity allows for unallocated funds these funds will be staked in order to generate some interest.

Stake pool Calculator: https://jscalc.io/calc/hRreLLiiFQaMWc3A

Why Staking on Cardano and not on other POS protocols?

Delegator Coins Lost By Proof of Stake Pool Operators	
Cardano v.03 Goguen	$0
Ethereum 2.0 POS	$163 Million* and counting

External Financing Protocols

There are some protocols on the Cardano protocol, they offer collateralized financing for loans and they have their own credit score for each loan. The contracts are very simple and driven through the state machine. Protocols such as Paribus/Meld are able to estimate the values of NFTs and use them as collateral for the loans held on an escrow contract. We can partner with the protocol provider in order to create either a derivative NFT or a simple loan done to our company in order to cover the purchase of the property. In the case of a foreclosure the debt account does not default but is transferred to us as the guarantor, we transfer the title to us through our first lien position and we keep paying the monthly payments while we foreclose and prepare the property for sale on our marketplace. Paribus/Meld is a prospect protocol that we would like to work on. This way we are able to finance properties without having to leverage ourselves and also without having to maintain an even larger stash of cash in order to pay the loan provider immediately.

Other mortgage pools can be opened and used as alternatives to lending providers on our end but we would like to work with current lending providers who already work on the Cardano ecosystem.

https://www.meld.com/

Technology Infrastructure

Compatible Wallets & Features

We will be implementing wallets such as Gero wallet on our sites were customers can have:

- Yield Farming
- Borrowing & Lending
- Cross-Chain Swapping
- Multi-Chain support
- Synthetic Assets Support
- Future contracts
- Access to securities

This will allow our users to do their payments and access far more on our platform than previously expected. Other forms of payment such as Dollars are also going to be used in the future for tenants that want to pay in dollars, Coinbase currently has a payments solution that we will be looking into in the future as well but we will partner with an exchange to get the dollar transactions to work on our smart contracts.

Decentralized Storage Solutions

Decentralized and backed up storage capabilities such as IPFS and server backups will be used to ensure that information is maintained in the net for the foreseeable future. The documents that will be on the network will be hosted on IPFS due to data center outage protection at any point in time. Because the transactions are rare the cost of updating each individual file will gradually decrease as we expand the nodes that are used in the network.

When you add a file to IPFS, your file is split into smaller chunks, cryptographically hashed, and given a unique fingerprint called a content identifier (CID). This CID acts as a permanent record of your file as it exists at that point in time. When other nodes look up your file, they ask their peer nodes who's storing the content referenced by the file's CID. When they view or download your file, they cache a copy — and become another provider of your content until their cache is cleared.

A node can pin content in order to keep (and provide) it forever, or discard content it hasn't used in a while to save space. This means each node in the network stores only content it is interested in, plus some indexing information that helps figure out which node is storing what. If you add a new version of your file to IPFS, its cryptographic hash is different, and so it gets a new CID. This means files stored on IPFS are resistant to tampering and censorship — any changes to a file don't overwrite the original, and common chunks across files can be reused in order to minimize storage costs.

However, this doesn't mean you need to remember a long string of CIDs — IPFS can find the latest version of your file using the IPNS decentralized naming system, and DNSLink can be used to map CIDs to human-readable DNS names.

Other services for decentralized file storage are available, arweave is the next project that we will partner with in order to secure our storage solutions.

Decentralized Computation and Seamless Low Fee Transactions using Hydra

As Cardano continues to update their protocol we hope that the chain is able to achieve a great amount of traction after the Plutus Application Backend is released. This will allow us to build decentralized applications with contracts directly going to the chain. The speed of our contracts will be maintained by using Hydra nodes. This technology allows us to speed up the processing speed of our own smart contracts, even though the minting policies on our token do not require a smart contract to validate we still need to implement them for the transactions of the assets.

Our hydra validators will be run in house and are expected to be more than efficient for the time being. Hans' server computer is currently more than capable of handling the load for the next 2 years at 98,000 transactions per quarter which is the total amount of real estate sold in Q2 2021.

The chain is supposed to be upgraded by mid 2022 in order to support a 35X improvement on the base 250 TPS in order to handle the traffic of the Decentralized exchanges and the DApps that will be coming in. Because of this the transaction fees will stay static but we will not have to worry about that since the Hydra node allows us to not pay processing fees as long as our node is up and running. Due to this protocol there is no downed service risk, only higher fees.

Stake Pool Operators

Our operators are prepared in house for the moment stemming from a current project called Magi Computing. Our operator array is composed of 1 main node and 2 relay nodes as backups. All operators will have a backup battery system and by Q2 will have a 5g device for concurrent full uptime on the network.

Additional Services for External Partners

Oracle Services

Because our marketplace will be collecting sales and leasing data we will be able to provide data oracle services to other projects that build on the ecosystem.

Polygonal Mapping and Analysis

Hexagonal indexing is an analysis tool that is used in order to compute the values of homes more effectively using custom functions, they take into account distances and details of the location of the properties. This indexing tool will be held on the IPFS database as well and will aid the abstractor programs when selling the property once again. Since the system is queryable at any moment and editable with permission from the owner any updates can be done on the fly without having to interrupt the future transaction of the property.

Hexagonal and other polygonal functions will be used as a visualizer for analysis and future predictions on real estate trend tracking. This system will also allow us to automatically assign

Parametric Land Register

In order to help with the deed creation and additional procedures such as plot extensions and property merging we want to integrate both a mapping system for remote due diligence processes as well as a parametric mapping system for plot indexing. Plots can be extended if and only if the

same owner owns the lands adjacent to each other. Plots can also be divided into individual pieces for sale or other purposes. This is why we will integrate a tool for parametric land registration.

This system also helps the abtractor program to verify and address any problems with the deed when the property is registered to our database. Other visualizations can be integrated in order to create a live telemetry of home values traffic in the area.

Figure 2 showing labeling of areas on our mapping API.

This system will also aid the government in cases of Eminent domain, where private property can be purchased at market value for the construction of public roads and other state assets.

Benefits of the technology implemented

Cardano is strictly purely functional meaning that it is mostly a mathematical language and it strictly encourages functional programming. The company behind Cardano is IOHK, a peer review-based research and development company that has recently been at the leap of innovation in the blockchain ecosystem for the last 4 years. The company and it's scientists have published most of their work here: https://iohk.io/en/research/library/ and have been posting monthly updates on their blockchain technologies and improvements over the past few years. Cardano is currently the project with the highest amount of comments on GitHub as well as the only

company that supports and promotes direct involvement with companies and governments that want to use their technology.

Since our system runs in a decentralized environment the risk of downtime is near to impossible which secures any future maintenance and need for further large infrastructure down the road.

Being a purely mathematical system gives programmers the capacity to create logit that is directly related to the mathematical expressions outside of the code which has been a challenge for many programmers that lack extensive mathematical knowledge but it is a gap that is now closing. The functional nature of cardano allows for an order of magnitude productivity on the development stage compared to other protocols. Security as well as interoperability with current services such as acuant is one of the reasons why they appeal so well to the enterprise model, which they have supported from the beginning.

Having deterministic costs are another feature of Cardano in the way that we are able to know if a transaction will go through and how much the fee will be in a specific slot. If the transaction is still executed and it fails there are no fees charged to the wallet. This is safe compared to other protocols like Ethereum where the gas fees are not predicated and where the contracts can get stuck and empty your gas balance.

Development Staff and Overview

IPFS content addressing enables you to store large files off-chain and put immutable, permanent links in transactions — timestamping and securing content without having to put the data itself on-chain.

Our first program will be running on the Cardano testnet and will be connected with Atala Prism. An identity protocol that uses an SDK to create, sign, and issue verifiable credentials to create and publish decentralized identifiers (DIDs). [3]

This identity system will allow users to participate in our decentralized network without the need to worry about identity and other assets.

The Blackfrost API will be used heavily in our site in order to access the data from the Cardano blockchain in a standardized way.

Plutus allows all programming to be done from a single Haskell library. This lets users build secure applications, forge new assets, and create smart contracts in a predictable, deterministic environment with the highest level of assurance. Furthemore, developers don’t have to run a full Cardano node to test their work.

Jann Müller then takes us through the Plutus Application Platform, where assets can be built and launched. He also demonstrates how tokens can be transferred using a smart contract. With Plutus you can:

- Forge new tokens in a lightweight environment
- Build smart contracts
- Support basic multi-signature scripts

Query information of a specific asset

Let's look at this last example and query information of a specific native token on Cardano. You need to provide the string concatenation of the policy_id and hex-encoded asset_name.

```
curl -H 'project_id: 1234567890'
https://cardano-mainnet.blockfrost.io/api/v0/assets/d894897411707efa7
55a76deb66d26dfd50593f2e70863e1661e98a07370616365636f696e73

{
 "policy_id":
"d894897411707efa755a76deb66d26dfd50593f2e70863e1661e98a0",
 "asset_name": "7370616365636f696e73",
 "fingerprint": "asset1pmmzqf2akudknt05ealtvcvsy7n6wnc9dd03mf",
 "quantity": "50000000",
 "initial_mint_tx_hash":
"3cce12c77b9d11d70575320c4f2834b26debb065308fbe43954018fbeb90010d",
 "onchain_metadata": null,
 "metadata": null
}
```

Roadmap

Name	Deliverable	Expectation	Key Performance Indicator
1. Website and Documentation (Q1)	A website with our documentation & different sections.	Website will showcase our roadmap and our sign up page.	Visiors, registrations, engagement with the community on discord, and customer feedback.
2. Loqul Stake Pool Operator (Q1)	Loqul will operate and fund its own stakepool to raise funds from the community white we launch.	Community members can stake on our stake pool and support us while getting rewards.	5% rewards on our stake pool operator and 100% performance index.
3. User Onboarding (Q1)	Users that have registered their interest can start to get onboarded on our site and receive their identity tokens after some background checks.	Users will be able to express their interest in the platform	Number of registrations on the site and marketplace traffic.
4. Decentralized Identity (Q1)	Decentralized Identity system for KYC	Using a decentralized Identity system for KYC.	Credentials and required IDs can be created and linked on the loqul site.
5. Buy & Sell Contract Listing (Q2)	The first Buy & Sell listing for a full cash transaction.	All transactions go through and we are able to process the property transfers internally.	You can place an auction-bid or buy-now commitment. Funds are locked in place.
6. Payment Rails Partnerships (Q3)	Allow customers to sign up for other partnered services.	Users will be creating ada domains in order to initiate most secure transactions.	100 ada domains created or 30% of our new users are creating ada domains.
7. Sponsored Listings (Q3)	Allow property owners to pay for a sponsored listing and stand out from other listings.	Customers can set their daily budgets and set their bids for an ad campaign.	All sponsored listing spots are taken. Register 10 sponsored listings.
8. Loqul Private SPO (Q3)	Loqul will operate and fund its own stakepool to cover risk of defaulted loans.	Stake pool is operational on Complex Computing node	Stake pool operators maintain 100% uptime and highest index of performance.
9. Financing + Lending Provider Partnership (Q3)	Home financing will be provided, if the owner fails the predetermined contract agreement the house goes to foreclosure.	Our customers buy a home using Loqul financing and are living in it.	Financial Contract completes and payments can be made through chosen terms.
10. Refinancing (Q4)	Home owners can refinance with us, register their homes, and pay lower interest rates.	Financing will be available to all buyers.	Loan vs Payment burn rate telemetry.

Team

Daniel Angel Manzi
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Chief Executive Officer
HBS CORe ‘20
BBA in Real Estate ‘21
MRED+U ‘22

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ONE Sotheby’s Int’l
KPMG

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Chief Technology Officer
BBA in Business Analytics ‘20
BS in Mathematics -
Computational ‘23

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BS in Mathematics
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BBA in Business Analytics ‘22
MBA ‘22

Prior Experience:
JP Morgan
Berkeley Research Group
FIU Students Board of Advisors

Randolph Vaughan Russell
Chief Mathematician
BS in Mathematical Sciences ‘22

Prior Experience:
Customs Broker & Manager

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