A Technical Seminar Report

On

LAND REGISTRATIONS USINGBLOCKCHAINTECHNOLOGY

Submitted By

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Department of Computer Science and Engineering

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This is to certify that the seminar report titled "**LAND REGISTRATIONS USINGBLOCKCHAIN TECHNOLOGY**" is being submitted by DANDYALA SAI SRUJAN bearing roll number **16891A0576** in IV B. Tech / I Semester Computer Science and Technology is the record Bona fide work carried out by him.

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ABSTRACT

Blockchain technology has created a huge buzz across the world. Alike the original internet, the blockchain is a fast-disruptive technology becoming a key instrument in recent years, that will not only touch base with all the people, but it will connect with all the businesses as well. Blockchain makes the data more secure with absolutely no chance of forgery as the information provided is same across multiple computers/ servers publicly. To make it even simpler, the blockchain is a series of computers that are provided with a record of an event or transaction in a ledger that is open to the public. The records are fully encrypted; the ledgers virtually hack-proof. Since all these computers display the same thing, they ensure & provide information that the recorded event or transaction is valid. The beauty of the blockchain is that it allows multiple parties to interact with, say, a financial transaction, with no middleman. Blockchain can be used to record, encrypt and secure the data for eternity. The blockchain can be used in real estate, as a fresh way for contracts– Smart contracts. Smart Contracts are self-executing contracts with terms of the agreement between buyer and seller directly written into lines of code.

So, which these Smart contracts can be used to enable real estate contracts, property records to be completed All this process could be completed without any human intervention. The facilitation of property transactions will be met with decreased fraudulent activity, improved transaction transparency and efficiency, and strengthened confidence in identity. Additionally, it will speed up land registration, be a simpler process, and provide for an open approach to data. However, the application and use of smart contracts enabled blockchain technology in enterprises require an in-depth understandability which helps the current adoption of this technology. A blockchain driven database is replicated on multiple computers across many authorizations. Additions are made by these same computers, which need share neither an affiliation nor any limited quantity of trust for the updates to remain secure. By which these blockchains are incredibly well equipped to coordinate the activities of mutually mistrusting peers who want to collaborate in an environment with a predefined set of rule

LIST OF FIGURES

LIST OF ABBREVIATIONS

Acronym	Abbreviation
BTC	Bitcoin
eID	Electronic IDentification
eIDAS	Electronic IDentification, Authentication and trust Services
EU	European Union
GB	Gigabytes
GDP	Gross Domestic Product
GOVT.	Government
ID	Identity
IT	Information Technology
IOU	(Abbreviated from the phrase "I owe you"),an informal document acknowledging debt.
LHV	LHV is an Estonian financial group providing customers with banking services
NASDAQ	National Association of Securities Dealers Automated Quotations exchange
NRI	Non-Residential Indians
SHA	Secure Hash Algorithm

CHAPTER-1
INTRODUCTION

Blockchains' are one of the most talked about technologies in recent years, especially within the IT community and the financial services industry. The influential bank Goldman Sachs stated the following in December 2015 regarding blockchain technology: "Silicon Valley and Wall Street are betting that the underlying technology behind [the Bitcoin hype cycle], the Blockchain, can change well everything."

One application of the technology involves creating verification records for digital files, e.g. documents or transactions. These verification records are the uniquely identifiable 'fingerprints' of the actual files. The verification records are grouped into a "block". The block is then added to a chain of blocks such that it bears a verification record of the block that preceded it. This creates a chain of "fingerprints" all the way back to block number one. Therefore, it is impossible to alter information stored in older blocks without changing the subsequent blocks, because changing the block would change its fingerprint and invalidate the chain.

Current IT architectures most often create security by making systems inaccessible behind firewalls and with special network connections. For example, there are just a few actors, such as real estate agents, banks and several governmental authorities, who can connect their systems to databases at Sweden govt. (Swedish land survey). Blockchain technology makes it possible to make verification records accessible without jeopardizing the security of the original documents.

In practice, confidence in the original transactions and documents improves when several actors have access to the blockchain's verification records. When the verification records are open and demonstrably difficult to manipulate, there is less reason to question them, and trust and confidence in them grow significantly. The blockchain's ability to create a secure shared history, and in doing so create trust, is why it has been called" The Trust Machine" by the Economist. There is a parallel with the right of access to public records in Sweden. Openness and transparency of public documents and decisions creates trust in government agencies and in the welfare society. Anybody can request documents according to the principle of right of access. The blockchain allows many people — sometimes anyone — to check the verification records. Therefore, everyone can trust that the person who has the original document, and who can recreate the verification records, is telling the truth.

CHAPTER-2
PROBLEM EXISTING

2.1 LAND REGISTRY TODAY

The main issues to be addressed in the current process we can highlight these problems:

1.Sweden govt. is only involved in a few steps at the end of the real estate transactions. Because of this most of the process is not transparent, in other words, visible to the public or other stakeholders. The system is slow at registering real estate transactions. The time between the signing a legally binding purchasing contract and when Sweden govt. receives the bill of sale and make the approval of the title is often three to six months.

2.The issues above have resulted in sellers, buyers, banks and real estate agents being forced to create their own complex processes for agreements, since they must make sure that things can't go wrong, and because the value of the transactions is large. This creates inefficiency.

3. Manual/paper-driven process: The process is not digitized, it's a manual process and there are so many possibilities that the records could be altered or tempered.

4. Long process: The process is slow it could take months to register a land with too much bribery involved.

5. Access of the record: The land property undergoes several mutations over generations that are not always captured on public records. The records are stored in some government office, accessing to them will be a time consuming and cost incentive as it involves frequent visits and bribes.

6. Establishment of ownership: There are so many cases pending in Indian courts to deal with land-related disputes, most of which revolve around establishing ownership.

7. Land encroachment: Unutilized Land and the abandoned house in India are more vulnerable to encroachment. Land particularly of older people without primary support or of NRIs are prone to become soft targets and legal way of eviction is also time-consuming as well as a hectic process.

8. Land double registration: There are cases about the two or more registrations of the same land to the different people that they realized after several years (10-12 years), it generally happened in the 90s.

9. Technical errors: There were instances of technical error due to which the central server connectivity was halted and almost 500-600 land registrations were stopped.

10. E-registration: It has simplified the process for providing evidence of titles and facilitating transactions and the process online but there is again server error due to which people can't register online and helpdesk will be flooded by the customers.

11. Brokers: The broker system is not good, it cost too much to the buyer of land because they pay for land and the heavy broker fee. Also, there is some fake broker who miss sells the property to consumer (forged papers).

12. Transparency: There are three stages in document registration - execution, presentation, and registration. People don't face many problems in the first phase - execution, but they face practical difficulties during the second phase - presentation of documents because of fewer documents and not proper registration (that happened in the 90s) and also the official is not present in every step hence it is not transparent.

13. Corruption: There is too much corruption in land registration while doing the registry, like in the property stamp, making the process fast etc.

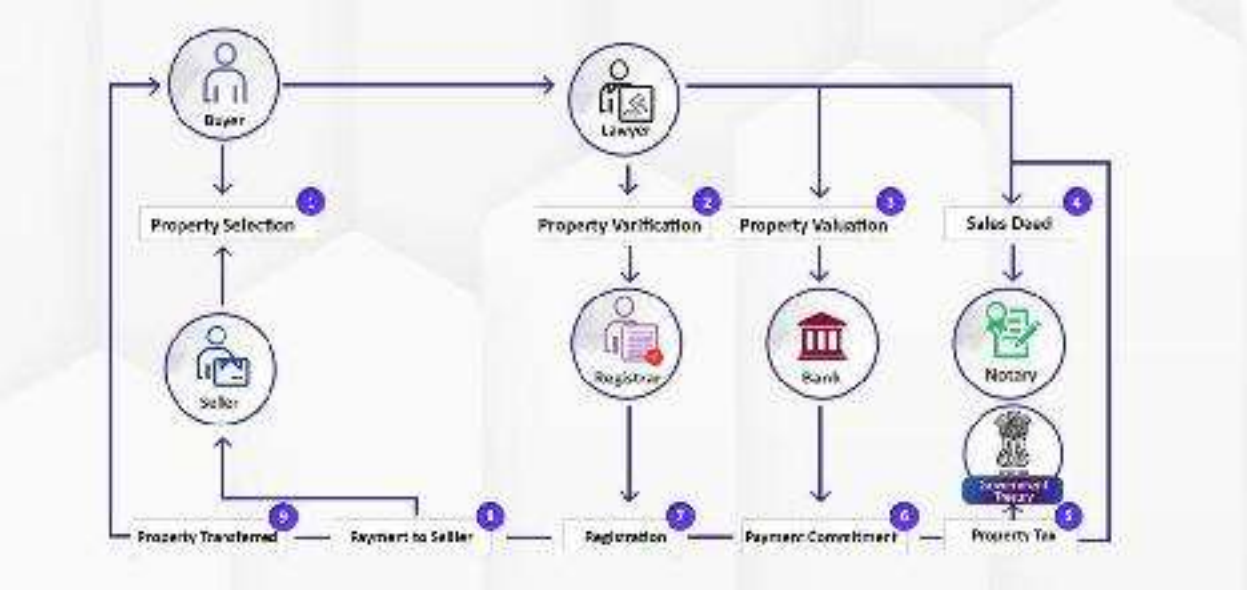

Fig. 2.1 Existing Land Registration Process

2.2 REAL ESTATE TRANSACTIONS BY PRIVATE PERSONS VIA REALESTATE AGENT TODAY

1.A property owner wants to sell her property.

2.The property owner, i.e. the Seller, contacts a real estate agent and draws up an agreement formanaging the sale of the property.

3.The agent contacts Lantmäteriet2.2 and orders an excerpt from the real estate registry databasein order to check the information about the property, i.e. that the seller is in fact the owner and can sell the property.

4.The agent puts the property up for sale and markets the property to potential buyers.

5.The Buyer goes to a bank, the Buyer's bank, and asks for a loan commitment. The bank checksthe Buyer's credit rating, often in a digital registry. The Buyer's bank approves the loan commitment.

6.The property is put out on display to the market and eventually offers are made.

7.The Buyer that makes the highest offer makes an initial inquiry about credit options for thespecific residence with the Buyer's bank.

8.The Buyer'sbank inspects the property and evaluates the credit options for the Buyer. Theproperty and the Buyer may be inspected again in the respective databases.

9.The Bank approves the purchase price and the amount of the loan for Buyer, which is oftencommunicated over the phone.

10.Prior to signing the purchasing contract, the agent again checks on the seller and the propertywith Lantmäteriet. The agent also often checks that the Buyer has a loan commitment from the bank.

11.A purchasing contract is drawn up between the Buyer and the Seller together with the agent,often at the agent's office. Often four copies of the contract are created, one for the seller, one for the Buyer, one for the agent and one for the Buyer's bank.

12.The contract is sent by the Buyerto the Buyer's bank, often by regular mail.

13.The bank sends credit documents to the Buyer, often via regular mail.

14.The Buyer signs the loan documents and also writes a note to the bank to pay a down paymentinto the agent's escrow account.

15.The Buyer sends the signed loan agreement to the Buyer's bank via regular mail.

16.The Buyer’s bank receives the loan documents and pays the down payment to the Agent.

17.The property may be inspected by the Buyer.

18.The agreement becomes binding if there were conditions in the form of inspection.

19.The agent pays the down payment to the Seller, while deducting the agent’s fees.

20.After this step, the main thing remaining is to actually sign the bill of sale, transfer thepossession of the property and make the final payment. This is often done roughly 3 months after signing the purchasing contracts.

21.Closing: The agent checks on the property and the Seller in the database of Lantmäteriet againto ensure that there aren’t any problems that would prevent the sale of the property.

22.The Buyer and Seller sign the bill of sale at the agent’s office. The Buyer signs for the mortgageand any other mortgage deeds on the property.

23.The purchase price is paid by the Buyer’s bank to the Seller’s bank. Often this payment is madevia a direct deposit where the Seller’s bank and the Buyer’s bank confirm that the transfer has been made.

24.The Buyer, Seller, as well as the agent, each save a copy of the contract, as well as a copy forthe Buyer’s bank, and the Buyer may now move into the property.

25.The Buyer’s bank goes into the mortgage deed system of Lantmäteriet and requests themortgage deed on the property from the registry.

26.The Seller’s bank releases the mortgage deed to the Buyer’s bank

27.The agent sends thebill of sale to the Buyer’s bank.

28.The Buyer’s bank sends the title registry application along with the bill of sale and anyapplication for a new mortgage (i.e. an increase in the mortgage beyond the existing mortgage deeds) to Lantmäteriet.

29.Registering the property title: Lantmäteriet grants The Buyer a Property title, and the title isregistered in the land registry.

30.A new mortgage is granted, and the Buyer’s bank is registered as themortgage deed holder inthe mortgage deed system.

31.Lantmäteriet decides on any service charges and stamp duty (based on the purchase price or theassessed value of the property).

2.3 SUMMARY OF THE CURRENT SITUATION:

What we see above is that the Lantmäteriet is involved relatively late in the process. Not until item 28 does Lantmäteriet make any active decisions or receive any of the submitted documents. Prior to that, it is primarily the agent who checks the land registry to check the ownership of the property. There are several disadvantages with this system. Lantmäteriet is the actor with the highest credibility, and if Lantmäteriet is involved earlier, the confidence and transparency in the process increases.

The second thing that can be noticed is that the process takes a long time. There are likely advantages with the process because the buyer and seller of a residence will often want to have time to sell the previous residence and find a new one. It also takes significant time to prepare all the information. The agent needs to check on the owner and the property several times. The bank may check credit and real estate information several times. Information that is already listed in the purchasing contract is written again into the bill of sale.

A third thing we notice is that there are still a lot of documents that are signed on paper and sent via regular mail. Checking these documents and the identity of the people who signed them must be done manually. Today, agents, buyers and sellers can be sitting for two hours signing several hundred pages of documents when signing a purchasing contract, since all the documents and often all the pages in several documents need a signature or initials written by hand. This takes time and it's easy to make mistakes. The amount of documentation and information that must be saved also leads to mistakes. In 2015, Lantmäteriet granted 91% of all applications and 94% of all e-applications. Therefore, it is relatively common that papers need to be filled in a second time because they are incomplete or there are mistakes. All these records must be stored by law for ten years, which requires physical space and increased security, e.g. in the agent's offices and at the banks. Searching for information in old records is also time consuming.

CHAPTER-3

SOLUTION AND IMPLEMENTATION

3.1 BLOCKCHAIN AS A SOLUTION

A very valid question that has come up after the first project is. “Why do we have to learn this? Can’t we just use the technology we already know?”

The answer to this question is that we cannot use traditional technology and continue to digitize real estate transactions. We can stay where we are, but in Sweden a further digitization of the process may not make substantial difference. No one has demonstrated a trustworthy solution for creating, enacting, verifying, storing and securing digital contracts. Until such a solution presents itself, the blockchain and the technologies described below seem to be a solution with great benefits and maybe no alternatives. Three properties of digital solutions have been very difficult, or even impossible, before the blockchain. These are described below.

3.1.1. DIGITAL UNITS IMPOSSIBLE TO COPY:

If we look at a central bank that is about to issue money to the market in the form of cash, i.e. physical bills, we can easily identify some of the concerns that they would have. It is obvious that one property is of outmost importance; the bills must be very difficult to copy. If everyone could take a home printer and make thousands of copies of their bills, they will soon be worthless. The same would be true for digital cash. If a central bank would like to issue money in digital form, it is still crucial that it cannot be copied. However, such a property of the digital world hasn’t existed until recently. Bitcoin was the first to solve this ‘double spending’ problem. A lot of central banks, and commercial banks, have during the past year communicated that they are looking at the opportunity to issue digital cash on the blockchain, or with distributed ledger technology. None of them has done so, and none has said they are looking at doing it with any

The practical consequence of solving this problem is that Bitcoin gives us, for the first time, a way for one Internet user to transfer a unique piece of digital property to another Internet user, such that the transfer is guaranteed to be safe and secure, everyone knows that the transfer has taken place, and nobody can challenge the legitimacy of the transfer. The consequences of this breakthrough are hard to overstate. other technology. As far as we know, the blockchain is the only solution being investigated by this growing group of central banks and commercial banks. Perhaps

the main reason for this is the possibility to create transferrable digital units, which are impossible to copy. If you want to create a digital IOU and be sure that there are no copies of this IOU, and that its properties are securely preserved, the blockchain is the only known solution.

3.1.2. DIGITAL FILES THAT CAN'T BE MANIPULATED:

While digitization has come far in many respects there is another property, except for being possible to copy, that traditional IT has not solved yet. It is very difficult to know if a digital file, photo, contract etc. has been manipulated. As an example, the Swedish law states that any changes in the bookkeeping of a company must be registered with a notification of who made the change, why was it made, and when was it made. The problem with this rule is that it is impossible to audit. A savvy IT person can the make changes in the registry of the bookkeeping that cannot be detected. There is no practical way for a manager or the organization, an accountant or the tax authority to know who made these changes and when they were made, or to notice at all that any change has been made.

With the blockchain it is now possible to make sure that a digital file, register, patent, video etc. is still the same as it was when it was first registered in the blockchain. The hashing technology and the blockchain is the only known technology that can do this. If we want to digitally represent binding contracts it is of paramount importance that they be impossible, or at least very hard, to manipulate. The blockchain is the most trustworthy solution for this.

Modern technologies have made it possible to monitor all updates, for example in a cloud environment, so a person who wants to manipulate the data Base to be able to manipulate the external environment as well, which makes is more complicated but possible.

3.1.3. DIGITAL PROCESSES THAT CAN'T BEMANIPULATED:

A third problem the blockchain has solved is securing a process. The most discussed example of such a process is trade finance, where a sequence of actors must confirm what they are doing at various stages in the agreement. They must take responsibility for the goods being shipped and confirm the process for actors throughout the chain of transportation. Securing a process is also valuable in a contract such as a purchasing contract of real estate. It is important for all parties involved to be confident that all other parties are signing the contract in an acceptable order. This also makes it possible to proceed even if some of the actors are not physically present.

This may also be of help in securing processes related to objects connected to 'the Internet of Things'. It is very important to prevent or detect any manipulation of the processes these products are involved in, before they do any damage.

3.2 OVERVIEW OF TECHNOLOGY AND USE CASES

The new possibilities can be understood through the example of Bitcoin and of more general use cases for the world. The first widespread use case was for value storage and transfer where Bitcoin made the new technological opportunities evident. In a more general interpretation this is understood as the creation of digital assets and digital identities, whether they are to be traded or not. The second use case is a register where hashes of any digital entity can be recorded and verified. This is possible in Bitcoin and in most other blockchains. A more generic interpretation of this use case is distributed ledgers. One application is the Estonian system built on technology by Guard time.

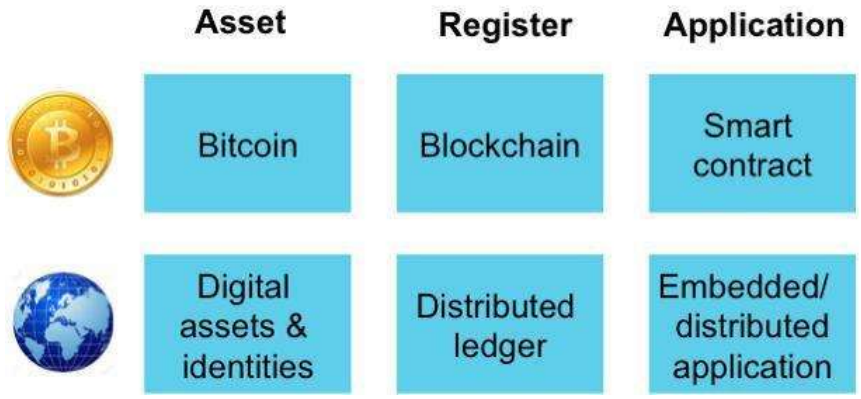

Fig. 3.1 Comparing Bitcoin Blockchain With Blockchain Platform

The third use case is the smart contract, first described by Nick Szabo before Bitcoin was released into the world. Ethereum, another major blockchain player, has focused on becoming a platform for creating and executing smart contracts. In Ethereum there is an interpretation of these as distributed applications. They could as well be embedded applications since the application is embedded in the blockchain. While the technology developed by Chroma Way for this project can handle all three use cases, the strength and the core of the technology is the contract engine and associated toolset

3.3 THE TECHNOLOGY BEHIND BLOCKCHAINS

A central part of what is currently called blockchain technology is the ability to create unique verification records of digital files. For example, photos, transaction lists, registers, agreements, video films, patents, etc. Essentially, this includes everything that can be stored as a digital file. Using an advanced “fingerprint algorithm” any digital file can receive a unique code. This is technically called a cryptographic hash. An example of an algorithm that creates cryptographic hashes is SHA256. This algorithm takes all the ones and zeros that describe a digital document and recalculates them in a repeatable but irreversible way.

An illustration of how an algorithm like SHA256 works is: take every third digit in the file, multiply the number by 7, and divide the total by every fourth number in the file. Combine every number not used in the previous calculation to the number you have, etc. In the end, a series of digits and/or letters is created, in other words, a hash. If the same digital documents and the same encryption algorithms are used, the result will be the same hash. However, it is not possible to understand what the file looked like that created the hash — it includes just a few characters, for example, 32 numbers and letters. In the same way that a fingerprint is unique, the hash is unique for a digital file. But if you look at a fingerprint, you do not know what the person looks like, and in the same way a person looking at the hash does not know what the digital file looks like. A purchasing contract for a real estate transaction that is scanned and becomes digital is an example.

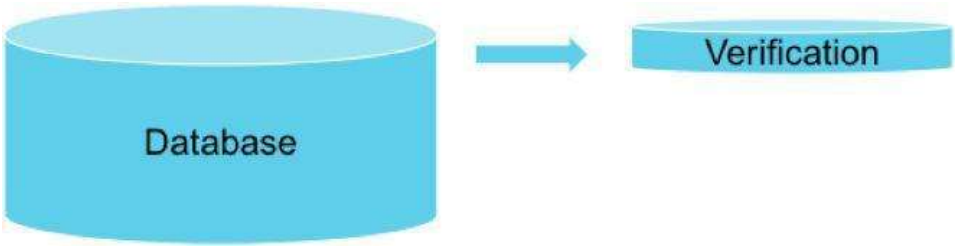

Fig. 3.2 Verification Added to Database

The hash that is created from the document is unique. For example, if a bank receives a purchasing contract sent via email, the bank can see that the document is correct. The bank takes the document and run the algorithm SHA256 on the file. The bank can then compare the hash with the hash that is on the list of verification records, if it is available to the bank. The bank can then trust that the document really is the original purchasing contract. If someone sends an incorrect contract, the hash will not match. Even though email has a low level of security, the bank can feel confident about the authenticity of the document.

It is the verification records — the hashes — which are saved in the blockchain.
We can imagine that an individual government agency or organization may see an advantage in can imagine that an individual government agency or organization may see an advantage in creating their own database of verification records. Different parts of the organization then can check the authenticity of documents and files by cross referencing the list of verification records. The owners of the agreements, documents, images, patents, etc. also benefit from having the list of verification records distributed to more stakeholders. A high level of redundancy reduces the danger of a single list of verification records disappearing. When multiple people have access to the verification file, the trust in that file grows. Everyone can therefore be confident that their document is considered authentic because multiple people have access to the verification records.

3.3.1 THE BLOCKCHAIN IS A WAY OF SAVING THE LIST OF VERIFICATION RECORDS

Of course, there are large numbers of documents and large amounts of data that can benefit from having an external verification service. Therefore, one of the challenges is to be able to manage the large number of verification records/hashes, the blockchain is a way to save the hashes as a group in a list. Many hashes are saved as a group, i.e. a block. Each block with verification records is then distributed to the persons who have access to the blockchain, sometimes even publicly to anyone and everyone. The person who is in charge of approving which of the transactions should be saved and distributed in a blockchain can do this more easily by grouping the hashes in a block. The alternative is to approve each hash one by one. In other words, it is not necessary to make blocks with many transactions, but the technology has the benefit of disseminating many verification records at the same time. In addition, something called a Merkle tree can be used to convert multiple hashes into one and therefore to save space in the block.

Blockchains are divided into different groups. The two main groups are open blockchains and private blockchains. In a private blockchain, there is one or a limited number of actors who approve the hashes that are to be saved in the blockchain, using digital signatures. For example, it could be a group of governmental agencies. In an open blockchain, practically Anybody can approve the block according to predetermined rules.

Fig. 3.3 Merkle Tree Structure in Blockchain

The largest open blockchain is the one that builds up the digital currency or cryptocurrency, Bitcoin. If the system and participants in an open blockchain accept the block, they start building on the next one. The blockchain is called a blockchain because each block is linked back to the previous block. Each subsequent block gets a hash, i.e. verification, of the previous block, which makes it difficult to cheat by creating another version of what happened. For example, it is not possible to enter a new verification into an old block without changing the subsequent blocks. If a lot of people have saved the blockchain, they can see that changes have been made and that the manipulated blockchain is not correct.

3.3.2 WHO REGISTERS THE BLOCK?

The blockchain and its verification records can be accessible to a large group of actors. The persons who approve which verification records will be added to the block, however, in practice are most often limited. In an open system, such as Bitcoin, the system is limited in that enormous

numbers of fast processors and energy are required to win the right to approve the verifications in a block. In a restricted system with a private blockchain, for example, the system that NASDAQ launched as a trial for trading of unlisted stocks, NASDAQ themselves are the ones who approve the transaction lists and who gets to add transactions. In the case of NASDAQ, this is natural because this is the way they are working in their existing systems. On their exchanges, only persons with access to the trading system and who are connected to their exchanges can trade. Correspondingly, there are only a few actors who have direct links to the databases of Lantmäteriet.

Blockchains can be a mix of private and public, and in these cases several actors can approve transactions but not just anybody. In the future, we can imagine that private organizations and groups of IT companies, banks, central banks and other agencies will have blockchains that they monitor and regulate. While approval of the block is limited, access to the verification lists can be open, to all Swedish residents for example.

3.3.3 THE POWER TO APPROVE THE BLOCKS

The advantage of having multiple actors who can approve the block is that the system is more transparent. The difficulty is to ensure that those people who contribute to the system by checking and approving transactions are doing it in the best interest of everyone, and they need some incentive to do this. In a government agency or at a bank or at a consortium, this isn't a major problem. The value of the service must naturally justify the investment due to greater security, increased transparency, efficiency, and revenues from the people who use the service, etc.

In Bitcoin's blockchain, the incentive is determined by who provides the greatest security for the system. Those who contribute with the most energy and processing power also increase the system security the most. These are called miners - these are the persons and organizations that uncover codes that are needed to approve new blocks in the blockchain. By giving the power to approve the block to those who are contributing most to the security and speed of the system, the system ensures itself of a high level of security and processing power.

Anyone who wants to take over the system needs to exceed the power of the other people who are maintaining the system. At the moment their processing power in terms of hashing is far greater than the 1000 largest supercomputers in the world combined, and the processing power is increasing steadily as well. In practice, those people who are maintaining the system are not

particularly interested in the power over the list of verification records since it doesn't do anything other than save the verifications and transactions but not the original documents. There are thousands of copies of the verification list so it cannot be changed without everybody noticing it. What those people who approve the block receive instead is a small payment from the verification records that are entered into the system.

3.3.4. INTRODUCTION OF A DIGITAL CURRENCY

When Bitcoin was launched and the first block was created, it was practically free to add verification records. Still today it costs very little to register a verification record in Bitcoin's blockchain. Payment for the registration of the verification records is also important at the same time. If it had been free, the system would have had a harder time handling overloading of verifications. The problem with spam in the form of email depends in part on the fact that it is free to send.

In order to create an incentive for miners who would approve the block with verification records and ensure the security of the system, a digital currency, sometimes called a cryptocurrency, is awarded to them. The miners who dig up and approve blocks with verification records are paid by the system in the form of Bitcoin, which are digital codes that stay in the system. This system is programmed in such a way that Bitcoin is only created when a new block is created, and these are awarded to the person who identified the block and approved the verification records. Even private blockchains work in several cases with digital currencies as a part of the system. The hashes are actually entered as comment fields beside a digital currency or cryptocurrency.

3.3.5 THE LOTTERY DETERMINES WHO PROVIDES THE APPROVAL

In the case of Bitcoin, an open lottery determines which computer or "miner" wins Bitcoin as well as the registration fee for the verification records and therefore approves the next block. The system generates a number that all computers that want to can try to guess[11]. The person who has many computers and uses a lot of processing power and energy can guess many times and therefore has the greatest chance of guessing the series of digits correctly first. It is a little bit like a lottery. The person who purchases a lot of lottery tickets has a greater chance of winning. In the case of Bitcoin, the person who purchases many processors and use a lot of energy has the greatest chance of winning. In order to take over the system, you need to have as much processing power as possible so that you are sure to win the lottery many times in a row. Only then can the system be manipulated and controlled in a way that other people who are part of the system do not accept.

3.3.6 CRYPTOCURRENCIES REMAIN IN THE SYSTEM

An important point with cryptocurrencies in the blockchain is that these remain in the system. Cryptocurrencies can be transferred to another person as a code that can provide access to the cryptocurrency in the system. However, the cryptocurrency cannot leave the system. In other words, the person who owns a cryptocurrency owns an encryption code to an amount of an encrypted currency in a blockchain. If the cryptocurrency is transferred, someone else has access to the code that controls the currency. The word "chain" is therefore particularly relevant for of cryptocurrencies. They are transferred like a chain from one owner to another, but the chain remains linked together.

3.3.7 DO CRYPTOCURRENCIES HAVE A VALUE?

The idea of creating digital money is naturally something that has attracted many more or less serious actors. The use of money for society is usually described with 3 functions:

1. As a medium for payments:

Money makes it easier to trade. It is expensive and cumbersome to trade with cows and coffee beans. Money makes it cheaper and more efficient to trade.

2. A standard for accounting:

Money makes it easier to compare and control businesses and people. We can see how much a company is worth, how much a person earns when there is a standard for reporting amounts that everyone understands. Tax agencies, investors and others benefit greatly from this.

3. A way to store value:

Money makes it possible for people to save what they earn and spend or give it away later. The value can be transferred to another point in time. We can also spend earlier and get indebted i.e. get the value first and earn the money later.

If we look at Bitcoin, as an example, a demonstrated use has been as a medium for payments. Even if the currency's value relative to the US dollar, for example, fluctuated a lot in the initial years, this is a minor problem for the person who wants to transfer money cheaply. One of the challenges that Bitcoin currently faces is that the system in its current form cannot handle large numbers of transactions. The global number of transactions of money and various financial assets is billions per second. This is not possible to handle for Bitcoin today. The system is secure, but it cannot handle frequent trades.

Now the cost of transactions has increased, which makes Bitcoin as a means of payment less attractive, at least for smaller transactions. On the other hand, the value as a store of value has become more evident. In general, we can say that all money is currently based on trust. As money has transitioned from raw materials to today's zeros and ones in the banking system, the amount of money in circulation has increased to dizzying amounts and at dizzying speeds. We are not able to answer in this report whether cryptocurrencies have a future or not. The subject cryptocurrencies are related and interesting but the process for real estate transactions and embedded contracts/ smart contracts that is described in this report and shown in the technical demo does not need to use any cryptocurrency.

3.4 SMART CONTRACTS/ EMBEDDED CONTRACTS

As described above, colored coins are designed to allow a digital code in a blockchain to represent an asset. An even more interesting coding possibility is that we can add additional information that is stored in the blockchain that regulates, for example, data authorization and storage. In addition to separating the verification record from the traditional database structure, we can also separate parts of the application layer. Similar to hashes/verification records, only the person who owns or has programmed the coding and the rules for authorization and storage can interpret how the application works.

The system of adding logic and properties that are normally part of the application layer in an IT architecture has been called “smart contracts”. However, there are many different interpretations of what is meant by the term “smart” in this context. Therefore, we also use the term “embedded contracts” to highlight the feature that we are after. The logic is registered in, embedded, in the blockchain. The cryptocurrency/system Ethereum was built with a focus on creating smart contracts/embedded contracts in the blockchain. Apart from Bitcoin, Ethereum is one of the current blockchains that is talked about most. Ethereum permits arbitrary code to be executed in Ethereum’s blockchain as long as you pay for the number of cycles that is required to run the program.

The technical demo that is currently being built as part of this project uses ChromaWay’s open source technology and programming structure Esplix, which creates smart contracts/embedded contracts in a blockchain. Open source is an important part of ensuring confidence in the code. Everyone can inspect the code and detect potential weaknesses. In practice, a chain of messages is saved into a private blockchain, which can execute the transactions between the parties more quickly. When the contract is finished, it can be summarized into a hash that can be added to other blockchains like Bitcoin’s blockchain as an extra back up. Everyone involved can also save all or part of the blockchain, which covers the personal transactions in the system. Both buyers, sellers, banks and real estate agents can therefore verify the history of a transaction.

An additional benefit of this procedure is that the solution is even easier to transfer to an alternative blockchain. Let’s assume that a few government agencies jointly build a blockchain that they control. The solution we have built in the testbed can be easily secured, even in this blockchain.

A solution with Colored Coins is somewhat more hazardous and difficult to transfer since the code is written on top of a specific cryptocurrency.

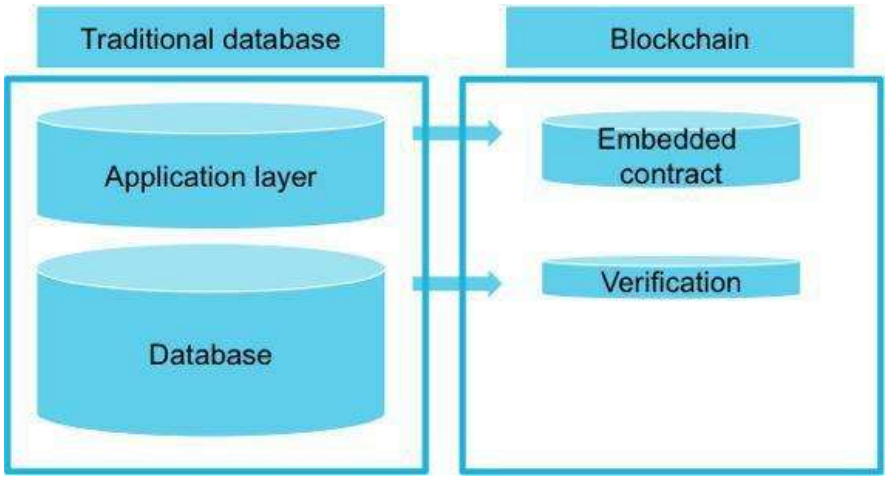

Fig.3.4 Data Base v/s Blockchain

3.4.1 SAFEGUARDING IDENTITIES

A central part of the practical application of blockchains is the identification of what the digital codes will represent in the physical world. As described above, it is LHV Bank, Lantmäteriet or someone else behind a solution that is the organization that determines what the digital codes represent and who is authorized to transfer or act in a contract.

In other words, Lantmäteriet guarantees which digital representation a specific property has. Another central part is the identification of the actors who will have rights to act in the system. For this, a secure ID solution is required. This solution also needs to be easily accessible to the actors involved.

If we look to the future, we see a world where mobile phones play an increasingly important part in the ID solutions being developed. Telia is a company headquartered in Sweden that is well positioned to create such a solution for the future. Telia already have an ID solution that can be used in mobile phones and can register people with or without a personal identification number (The Swedish equivalent of a social security number). In addition, Telia's solution is currently used by agencies within the healthcare system in many county councils.

3.5 PROPERTY TRANSACTIONS OR PURCHASING SMALL HOUSES BY PRIVATE PERSONS VIA REAL ESTATE AGENTS IN THE FUTURE USING BLOCKCHAIN

The example above illustrates the current process for real estate transactions. With the example below, we want to illustrate what this would look like in the future.

1.A property owner wants to sell a property.

New Solution: The property owner can check their ownership and whether there are any obstaclesto the sale by themselves using the app from Lantmäteriet ("My property account") and by verifying their identity via their mobile phone.

2.The property owner, the Seller, contacts, a real estate agent and draws up an agreement for a realestate sale.

New solution: The property owner, the Seller, contacts a real estate agent and commissions theagent to sell the property via the app. The agent accepts the offer to manage the sale of the property. In practice, the agent can also guide an individual through these steps in the app.

3.The agent contacts Lantmäteriet and orders an excerpt from the property database in order tocheck the information about the property, i.e. that the seller is in fact the owner and can sell the property.

4.The agent puts the property up for sale and markets the property to potential buyers.

5.The Buyer contacts a bank (digitally), the Buyer'sbank, and asks for a loan commitment. Thebank checks the Buyer's credit rating, often in a digital registry such as UC. The Buyer's bank approves the loan commitment.

6.The property is put out on display to the market and eventually offers are made.

7.The Buyer who makes the highest offer makes an initial inquiry about credit options for thespecific residence with the Buyer's bank.

New solution: In the future, this step is superfluous because the agent can see the informationdirectly in the app and any applications for changes in the land registry are communicated immediately.

8.The Buyer's bank inspects the property and evaluates the credit options for the Buyer. Theproperty and the Buyer may be inspected again in the respective databases.

New solution: In the future, the property does not need to be questioned again because the latestinformation is always available and can otherwise be checked directly in the app.

9.The Bank approves the purchase price and the amount of the loan for the Buyer, which is oftencommunicated over the phone.

New solution: The Buyer's bank can provide preliminary approval of the loan so that the agentand the Seller can be confident that the Buyer has the ability to pay.

10.Prior to signing the purchasing contract, the agent again checks the Seller and the property withLantmäteriet. The agent also often checks that the Buyer actually has a loan commitment with the bank

New solution:The Buyer's bank is given access to the property via the app and the bank cancheckthe property there. Information about the condition of the property, inspection report etc. can be included in the app or linked to the app.

11.Often four copies of the contract are created, one for the Seller, one for the Buyer, one for theagent and one for the Buyer's bank.

New solution: The necessary information is registered in the app, e.g. date of possession andpurchase price in digital fields, which reduce the risk of the contract being incorrectly formulated. Signatures are provided in the app using Telia ID or another ID solution. Everyone involved can retain a copy of the agreement and the verification record in the blockchain in their mobile phone or computer for extra security. The contract cannot be lost or falsified. If anyone wants to print out a paper copy, it is easy, but it is then just a copy that is only valid for the time when it is taken out. The contract is also shared with Lantmäteriet, which registers the pending property title at no cost until the final verification record for the transfer (bill of sale) is distributed. The information about the purchase price and the property can be made public, which provides security for the Buyer and Seller and is important information for entities like Sweden's national statistics bureau and central bank.

12.The contract is sent by the Buyer to the Buyer's bank, often by regular mail

New solution: The Buyer's bank can see the signed contract in the app and does not need to send it.

13.The bank sends credit documents to the Buyer, often via regular mail.

New solution: The credit documents can be attached to the app and signed directly when thepurchasing contract is written up. ChromaWay's technical solution makes it possible to make the credit documents accessible only to the Buyer and the Buyer's bank. If the Buyer does not want to display how much is being borrowed to other parties, access to the credit documents can be encrypted or sent outside of the app.

14.The Buyer signs the loan documents and writes a payment order to the bank to pay a downpayment into the agent's escrow account.

New solution: The Buyer can sign the loan documents as well as the payment order for the downpayment directly with signatures in the app.

15.The Buyer sends the loan agreement to the Buyer's bank via regular mail. The Buyer's bankreceives the loan documents and pays the down payment to the Agent.

New solution: The loan documents do not need to be sent via regular mail because the bank getsa digitally signed copy of them directly when the purchasing contract is written.

16.The Buyer's bank receives the loan documents and pays the down payment to the Agent.**New solution:** The bank can pay the down payment to the agent directly at the time of signing thecontract, because the Buyer signs the payment order digitally.

17.If there is a condition that has to be met like an inspection of the property by the buyer, theproperty may be inspected by the Buyer.

18.The agreement becomes binding if there were conditions in the form of in- spection.

19.The agent pays the down payment to the Seller, while deducting the agent's fees.

20.After this step, the main thing remaining is to actually sign the bill of sale, transfer thepossession of the property and make the final payment. This is of-ten done roughly 3 months after signing the purchasing contracts. During this time the mortgage deed transfers can be prepared and signed following the process for mortgage deeds described in that section of the report.

21.Closing: The agent rechecks the property and the Seller in the database of Lantmäteriet to ensurethat there aren't any problems that would prevent the sale the property.

New solution: With the new solution, this is not needed. The pending property title is already granted. If no changes have been made, this is displayed, and the next stage can be processed without further changes or checks of the contract or real estate.

22.The Buyer and Seller sign the bill of sale at the agent's office. The Buyer signs for the mortgagedeed on the property.

New solution: In the new solution, this is done with digital signatures and digital identification.The risk of incorrect formulations in the bill of sale is minimized since the necessary information is already there and any new information

is entered digitally and verified automatically.

23.The purchase price is paid by the Buyer's bank to the Seller's bank. Often this payment

is made via a direct deposit where the Seller's bank and the Buyer's bank confirm that the transfer has been made.

24.The Buyer, Seller, as well as the agent each save a copy of the contract and write one for theBuyer's bank, and the Buyer may now take possession of the property.

New solution: With the future solution, the contract is already available in the app. If anyonewants a physical copy of the contract, they can print it out. The copy also has a verification code that is registered in the blockchain.

25.The Buyer's bank goes into the database of Lantmäteriet and takes overmort-gage deed in themortgage deed registry of Lantmäteriet.

New solution: With the mortgage deed application everyone involved in the mortgage deedtransfer has already signed this contract. If and only if all requirements are fulfilled for the land title to be transferred to the owner will the mortgage deeds be transferred to the buyer's bank.

26.The agent sends the Bill of sale to the Buyer's bank.

New solution: The bill of sale and documentation for the mortgage on the property is alreadyaccessible to the bank via the app.

27.The Buyer's bank sends the application for the property title along and a new mortgage (i.e.

increase in the mortgage beyond the existing mortgage deeds) to Lantmäteriet.

New solution: This information is already accessible and distributed to Lantmäteriet in steps 11and 22, and in the mortgage deed application.

28.Registering the property title: Lantmäteriet grants The Buyer a Property title, and it is registeredin the land registry.

New solution: The pending property title is already granted and the process of verifying theagreement can proceed more quickly through automated decisions because the risk of incorrect formulations in the bill of sale is reduced when this is done using digital fields.

29.The Buyer’s bank is granted a new mortgage deed, which is registered in themortgage deedsystem.

30.Lantmäteriet decides on any service charges and stamp duty.

31.Lantmäteriet is paid via an automatic payment account for the title and the mortgage.

32.Lantmäteriet notifies the Buyer’s bank, i.e. the title applicant, by regular mail that the title hasbeen granted.

New solution: Lantmäteriet’srecord of the property title and the mortgage is shared via the appand all parties can see that the title has been granted.

33.The Buyer’s bank notifies the Buyer that the title has been granted and the transaction isperformed via regular mail.

New solution: This step is not needed. Information about the property title goes directly to theBuyer, Seller, agent, Buyer’s bank and the Seller’s bank via the app.

3.6 SUMMARY OF POSSIBILITIES WITH THE NEW TECHNOLOGY

The future process example includes several improvements. The time between when the purchasing contract is written and when the pending property title is registered with Lantmäteriet can be reduced from 4 months to a few days. Eventually, this could take place more or less in real time. The Buyer is granted the pending property title, and the property cannot be sold a second time by the seller.

The information that is needed for the bill of sale is already registered in the system for the most part. Therefore, in practice, the buyer and seller sign the same information upon taking occupancy. The risk that the property title will not be granted is sharply reduced since the system can ensure that the information that is required by law is included in the system and is required by the system before the parties are able to provide their signatures.

In factLantmäteriet may actually automate the land title registration. If no other transactions or changes have been made in the property Lantmäteriet can execute the registration automatically since the manual checks that are necessary, have already been made. Lantmäteriet wants it to be easy for citizens and stakeholders to do things correctly, and this is considerably easier in a digital system.

Digital signatures provide a significantly greater level of assurance that the correct people will be filling out the correct documents. Since digital signatures are provided with the same

application at several instances, the risk of errors and fraud is reduced. The process involves multiple contact points and multiple signatures by the parties involved. This increases confidence in the system since it is more difficult to manipulate the system over a long period of time. In addition, the purely manual portion of sending paper by mail is streamlined and made more secure. All the parties can save the digital files and verification records of the entire chain of events digitally. Paper copies can be printed out if desired, but the process saves a lot of documentation.

3.7 AN OVERVIEW OF THE IT ARCHITECTURE

In an initial stage, the database of Lantmäteriet remains intact. Updates to the land registry are retrieved from the blockchain and are then also checked by Lantmäteriet. Registration in the blockchain is digital and based on the legal requirements, which minimizes errors in the information. The blockchain for the transactions is open source and is checked by Lantmäteriet, and other nodes running the blockchain. The chain of authorization, signing with a Telia ID, etc. can be edited in the administration interface, but any changes will be visible to all parties to prevent fraudulent changed of the contract/application. The blockchain saves the verification records of documents such as the bill of sale and the purchasing contract, all signatures etc. Storing the original documents and their verification records can be performed by an external party, but can also be stored digitally by each party in the agreement, the bank, buyer, seller, agent, etc. The documents and verification records are then stored in multiple locations, which creates redundancy. The verification records are also summarized in an external blockchain and/or transparent to the public, which means that all of the parties can feel secure that they can recreate and demonstrate the chain of events on their own, in the event that the other parties suffer a breach of data or similar event.

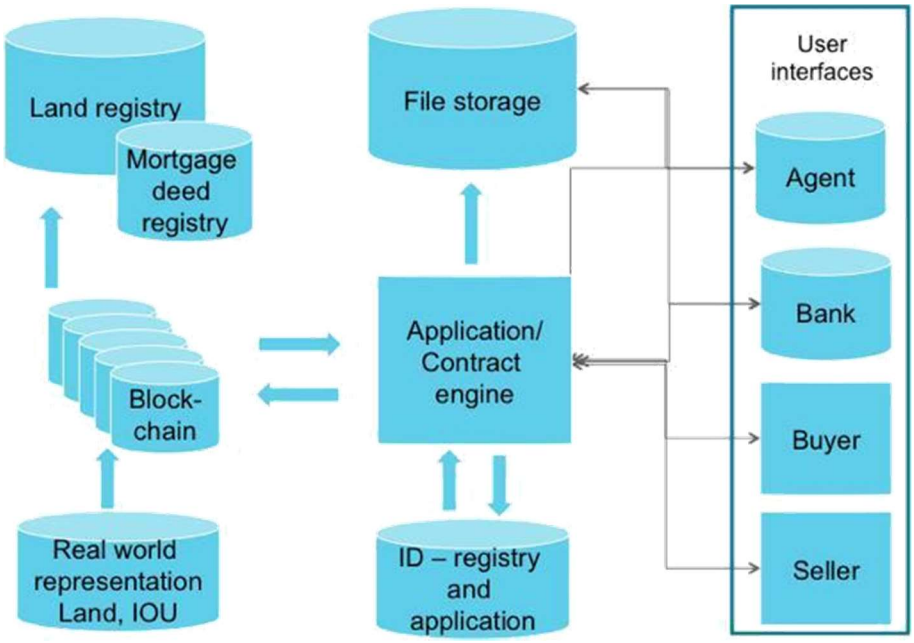

Fig.3.5 Architecture of Proposed System

3.7.1 TECHNICAL OVERVIEW

There are seven parts of a blockchain solution that can be considered to be standard, at least in the case of private blockchains. These components are described below.

3.7.2 USER INTERFACES

The user interfaces are designed for different users. There are three main categories of user interfaces.

3.7.3 END-USERS - TYPICALLY THE BUYER AND SELLER OF REAL ESTATE

These users are expected to use their mobile and a dedicated app for the solution. The real-estate agent can assist them in setting this up. These users will see the state of the contract and when they are in turn to take action. They will also be able to store the details of the contract as they see fit.

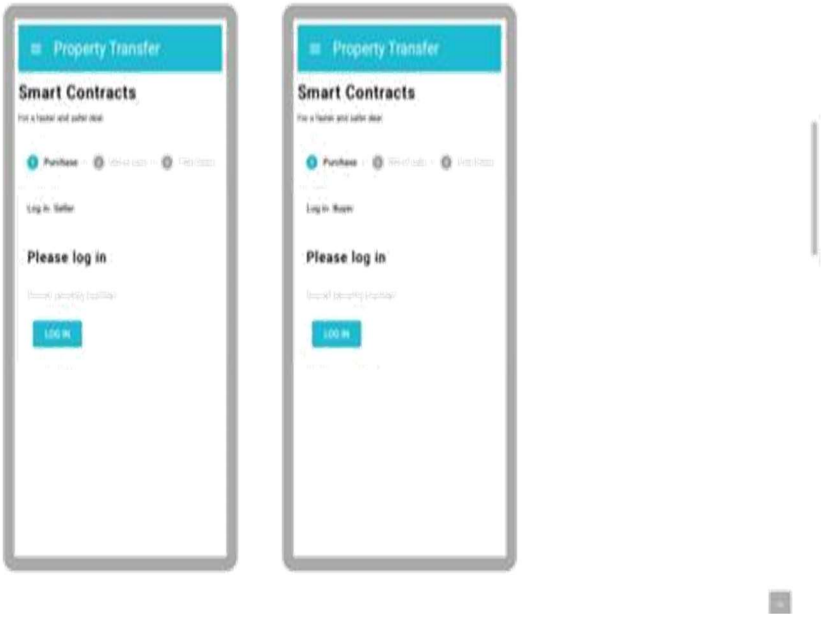

Fig.3.6 User Interface of the Application

3.7.4 PROFESSIONAL USERS – TYPICALLY BANKS, AGENTS, LANTMÄTERIET

These users will be able to see the contract in a professional interface, and the application will ideally be integrated with their own systems and processes. These users will act as professionals and employees of an organization and in most cases represent the organization and not themselves. Their user interface will be adapted to their needs.

3.7.5 CONTRACT ADMINISTRATORS – TYPICALLY LANTMÄTERIET AND THE ARCHITECTS OF THE SOLUTION

These users will administer the contract for the other users. The setup of the contract can be revised and changed quite easily at this point in time. In a launched solution the software/application edition in use has to be fixed and changes overseen by all partners running the blockchain.

The administration interface looks like this:

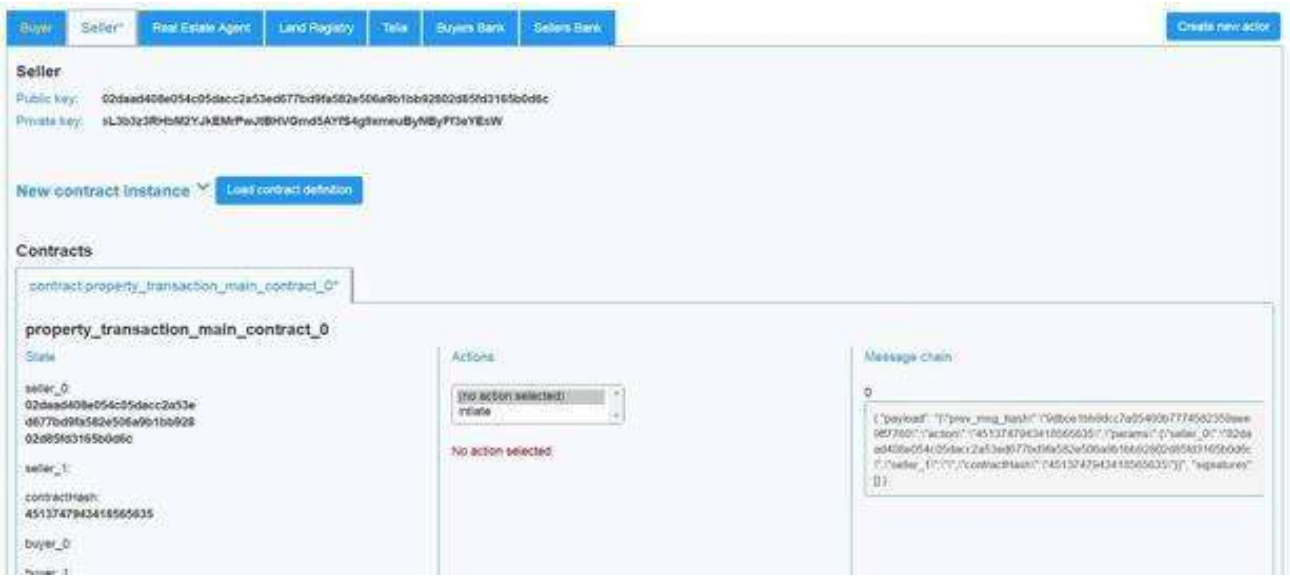

Fig.3.7 User Interface of the Wallet

The administration user interface has four important section

1.The top bar: Here the different actors are seen. The manager of the contract adds the actors; inthe case of the real estate transaction it is usually the real estate agent. In the case of mortgage deeds it is usually the buyer's bank.

2.The left column: To the left the fixed properties of the contract are seen these are typicallycontract date, real estate identity number, the public keys of the actors involved in the contract, the price, the date of transfer etc.

3.The middle: In the middle there is selection of possible actions and below the different fields toenter or sign. Like the price entered. This is where the actions which progress the contract appear.

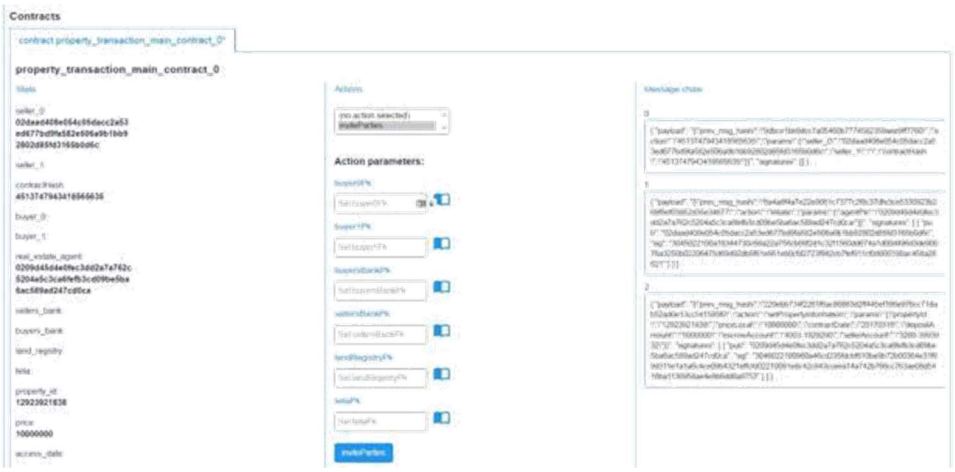

Fig.3.8 User Interface of Smart Contract

4.The right column: To the right are all the messages which are posted to the blockchain. Exactlythese messages can also be seen with other messages from other contracts in the blockchain. In this overview there has been two more steps taken and the messages to the right have become three. More information around the contract is now fixed in the left column.

3.7.6 THE FILE STORAGE

Each actor can make the file storage of contracts by herself. In almost all cases the blockchain will not contain all information, but instead contract verifications, hashes. The original files have to be stored separately. This can be made in the cloud or at the choice of the bank, agent etc. In a public blockchain the data storage must be kept small so that the entire data set doesn't become too large and slow to transfer over the network/ internet. After eight years of operation the Bitcoin blockchain is a more than 100 GB. In our case, low network overhead and the low cost of storage means that realistic restrictions are much less burdensome than those of the Bitcoin network.

The data that will be stored on the blockchain is primarily the content of the contracts, the data required for consensus among the participants, and other information like the closing price, the day of actual transfer of the property, and the public keys of the participants. It is possible that eventually the full purchasing contract and bill of sale will be stored in the blockchain as well. File storage may not be handled jointly but can be arranged according to the needs of different actors. The data storage will save a lot of work for real estate agents, banks, Lantmäteriet and the buyer and seller since they won't have to maintain a physical archive.

3.8 THE BLOCKCHAIN

The blockchain is the part where the transparent transactions are recorded and stored. This is equivalent to the distributed ledger. The nodes decide what is going to be committed to the blockchain. There may also be nodes that are not part of the validation process but simply store the record. In a public blockchains such as Bitcoin and Ethereum, anyone is allowed to be a node and keep a copy of the ledger. They can be a node which verifies and accept transactions and information that is going to be stored in the blocks. or they can simply keep a record of what is committed to the blockchain by the others. In practice those who want to be nodes which verify transactions need substantial processing power to have the chance to be part of the system. In our case the blockchain is permissioned which means that only trusted partners are allowed to validate transactions and blocks.

3.9 LAND REGISTRY, MORTGAGE DEED REGISTRY

The current database for the land registry contains a lot of information about the real estate. This data can be understood as metadata. Information can be obligations or rights for the property in relation to others, such as the right to use water or roads for another property. All this data will not be stored in the blockchain in the proposed solution, but may be in the future, or may be verified in the blockchain and stored elsewhere.

To access this data agents, banks etc. still need to contact Lantmäteriet through existing systems. The transactional data will be retrieved from the blockchain to the land registry.

The registry of mortgage deeds will, for legal reasons, be similar. The difference here is that the blockchain will store all relevant data. There is no metadata, which is only found in the mortgage deed registry. It will therefore be possible to use the blockchain as the actual mortgage deed registry over time without major changes in technology or processes, at least if physical mortgage deeds are transferred into digital.

3.10 APPLICATION/CONTRACT ENGINE

The application or contract engine is a key element of the solution. The most well-known blockchain solution for applications is Ethereum. In Ethereum the contracts are called distributed applications. The applications are run on the blockchain by all nodes, they are distributed.

In the proposed solution the contracts are not run on the blockchain – they are confirmed in the blockchain, we can say their verifications are embedded in the blockchain, but the entire application is not run by the blockchain network. The contract is like a middleware running on the end-user's hardware. Some people believe this is a larger risk, but with the blockchain any changes in the contract can be observed. Manipulations are easy to identify and there is no central point of failure for the system.

3.11 THE ID AND AUTHORIZATION

The actors who are going to authorize the different steps in the process have to be identified. This is one of the major challenges for digital solutions. In the case of Bitcoin, possession of the correct private key is sufficient authorization to spend the associated bitcoin. The problem with this is that the storage of the key becomes crucial. Most consumers are not capable of securely storing their private key in the long term. If the private key is lost or stolen all Bitcoins can be lost. Making an ID-solution and securing the adoption of the ID-solution may be the most difficult problem for the solution to be used in a widespread way globally. The ID-solution has to be adapted to the country, law, process, and culture. The eIDAS project in the EU is an example of an effort to standardize eIDs across a wide area.

While the ID solution is a major concern, the blockchain is also an enabler of ID-solutions. It is rather simple to add levels of security of an ID solution with the blockchain. For example, if a public authority or a person wants higher security in the form of a copy of a driving license it is easy to make a copy and add that to the contract in the blockchain. The flexibility of the ID-solution is easy to adjust with the blockchain.

3.12 THE REAL-WORLD REPRESENTATION

In the case of cryptocurrencies there is no need for a real-world interpretation of the digital units. It's an open market, which decides if the digital units have a value, and apart from that value it has little meaning. In the case of a colored coin an issuer decides if the colored coins represent Euros (as in the case with LHV Bank) or any other financial asset. The real-world interpretation may, however, be other things than financial assets and land. Many people who have heard of this project have thought that we are trying to implement a solution for digital transfer of land, similar to Bitcoin transfers. This is not the case. Digitally representing all of the packages of land in Sweden so that they can be traded directly on the blockchain without involvement of Lantmäteriet, agents or banks is not the ambition of this project. And there are no such plans for the future either.

Rather, this implementation focuses on digitally representing the processes by which property is transferred between parties. The contracts represent the identities of individuals, organizations, and property such that it is possible to authoritatively connect the representation in the contract with its real-world correspondent. It is necessary to have an organization, in this case Lantmäteriet, to assign the representation of the property so that it can be identified in the blockchain. Any contracts related to a particular property can therefore easily searched and tracked by a unique ID. Other information such as promissory notes can also be represented in the blockchain. It may not be Lantmäteriet who assigns the real-world representations of all digital identities in the contract. It can be another public authority, a consortium of banks etc.

CHAPTER-4
RESULTS AND OUTCOME

4.1 THE CHARACTERISTICS

The result is a secure process for real estate transactions and mortgage deeds with the following characteristics:

1.All involved actors will have a digital file representing the agreement of ownership of the realestate, mortgage deeds and the transaction process. These files can be stored in the cloud, locally, or some other method of the actor's choosing.

2.The authenticity of the process, the signatures, the file confirming ownership, mortgage deedsetc. will be secured with a blockchain. The Swedish Lantmäteriet will store the blockchain with the proofs, but the blockchain will also be stored and validated by other actors. It will therefore be easy for authorized third parties to verify information. These third parties would usually be actors who are part of the process: banks, buyers, sellers, real estate agents etc.

3.The records and files that should be public according to Swedish law will be public and thosewhich should be confidential will stay confidential.

4.There will be no bearer instrument stored on the blockchain in the current implementation. Thisprecludes the risk of such authoritative documents being lost, stolen, or tampered with. Bearer instruments could be implemented in the future, but it should be noted that doing so entails risks and legislative uncertainties that require further investigation.

5.The only way to steal a property is through entering a new real estate transaction process withstolen or forged identification. The security of the ID-solution can be improved according to the requirements of the system in question. More stringent identification procedures (photos of physical ID-cards, biometric identification, multi signatures, etc.) can be easily implemented.

6.The current process is designed to involve Lantmäteriet, real estate agents, buyers, sellers, andbanks. These are the parties involved in most real estate transactions in Sweden. The process can be redesigned to involve other actors such as notaries, insurance companies and local public authorities.

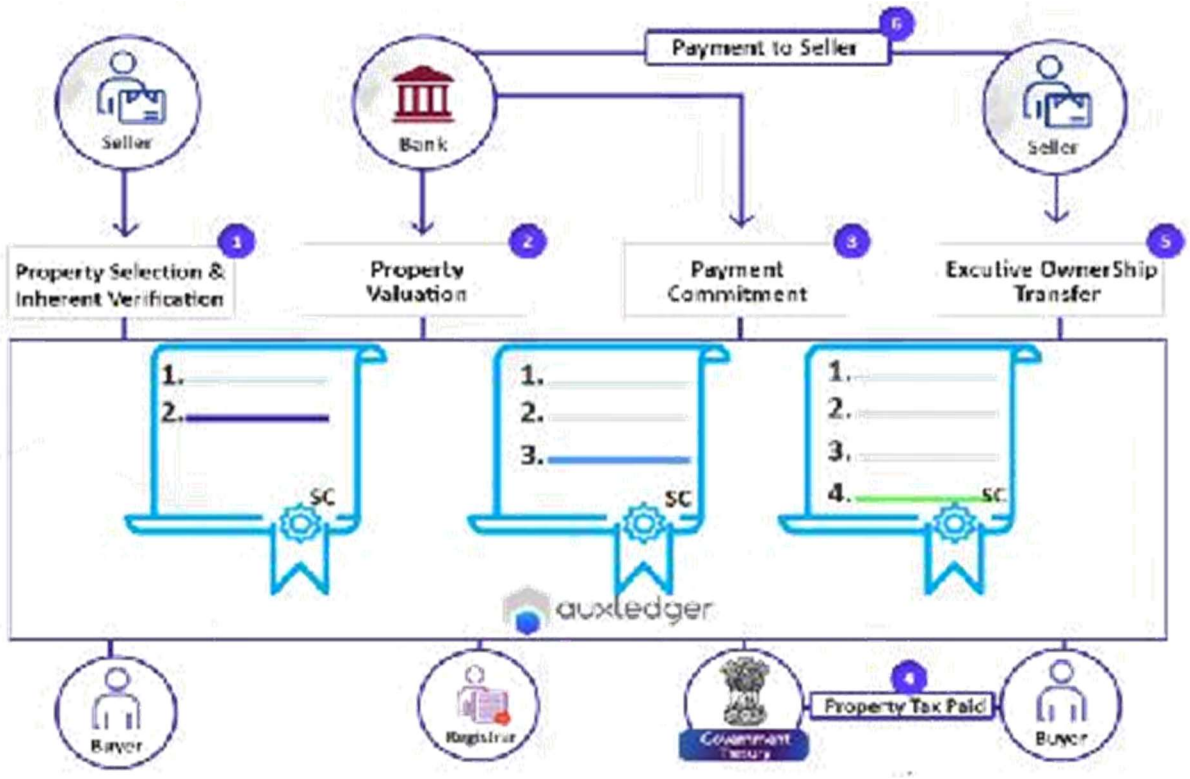

Fig. 4.1 Final Proposed System Workflow with Blockchain

4.2 ADVANTAGES

1. Security: Blockchain could reduce the risk of manual errors while creating more secureprocesses for transferring ownership of documents and the records can never be manipulated in the blockchain.

2. Double land registration: There will be no case of double land registration because buyer will know everything about the land that is all the different registrations of the same land.

3. Less corruption: The process will be very fast compared to the current process and there will be fewer cases of bribery since the whole system will be digitized. Most of the corruption happens in the stamp duty and since the process is online, there will be a full history of the stamp duty in the different registrations of the land. Also, we could implement a software that will calculate the stamp fee automatically.

4. Ownership: Most of the cases in Indian courts are about ownership of the land because people don't have easy access to documents or they lost it or due to corruption but because of blockchain the owner has all the records of land and can access the information at any time when he wants, this will prevent these cases and no one can alter the records in blockchain.

5. Transparency: The major profit of blockchain is transparency, you have the full history of your land, all the registrations are proper (without any manipulation) and all the records are official blockchain. Hence, it’s transparent.

6. No technical error: Land registration also gets delayed due to technical errors since the system is centralized and error in central server halts about 500-600 land registration, blockchain will provide a secure decentralized platform hence there will be no risk of technical error.

7. Decentralization: This is one of the major advantages of blockchain. The system will be decentralized, it will make government work easy. The only work of government is to ensure the smooth flow of the system.

8. No land encroachment: These cases will stop after the implementation of the blockchain, one cannot snatch anything from someone since it is in the blockchain and the owner will have full proof of his house.

9. Brokers: Though blockchain cannot remove the broker's system in the land registration, the fees a broker will charge are definitely reduced by blockchain, but a broker is still required (who is a must need in some cases). It will also help the real broker and secure the customers from fake ones.

CHAPTER-5

CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION

The value of the described solution will be substantial for countries like Sweden. For countries without a trustworthy real estate ownership record and land registry, a similar project may be the easiest, most cost efficient and fastest way to increase GDP in themedium term. It will serve as a foundation for better investments in land, enable the development of a mortgage market and a credit market in general, and become an institution for trust inone of the most fundamental parts of an economy: land and real estate.The solution provides value by improving processes associated with land registration and real estate transactions. The following is a brief list of some of these improvements:

Eliminating the need for physical archives of contracts and files. Increased resilience and redundancy of the transactional data in the land registry and the mortgage deed registry. Greater security for users of the system, in part because validation of the purchasing contracts and ownership can be done independently from Lantmäteriet.

Faster and more transparent transactions. Official registration and confirmation of pending ownership around four months earlier than in the current process, which allows more information and data of transactions to be available, increase liquidity of real estate since it can be sold by the soon to be owner, and more. Making it possible to receive automatic confirmation of final land title at the date of transaction. Significantly improved mortgage deed handling and making payments of loans dependent on secure transfer of mortgage deed. Elimination of the possibility of selling a property more than once. And Making it more difficult to steal a property.

The development of an IT solution using blockchain technology for real estate transactions is a long-term project that is best implemented in stages. The first stage was a proof of concept. This second project has been the building of a testbed with working technology. The solution has not yet been subjected to scaling, optimization, and integration development. The continued project:

5.2 FUTURE SCOPE

5.2.1 TECHNICAL ENVIRONMENT

A list of requirements in terms of the IT environment with servers, storage, nodes that verify the blockchain, local storage in the mobile phone, in the cloud, etc. These can then be drawn out, designed and tested to ensure the proper IT architecture, and to further check the processes and security of the solution.

5.2.3 TECHNOLOGY AND PROCESS INTEGRATION

The project will also need to integrate with existing systems and processes, primarily banks and real estate agents, and the Land Registry in order to ensure that the service works with the partners involved in the process. Further process improvements can then be identified too.

5.2.4 MORE PARTNERS AND PARTNER PROJECTS

The international interest in the project has been impressive. The project team has met and discussed the solution with public authorities from more than 10 countries already, aside from several large conferences and presentations, including the Land and Poverty conference arranged by the World Bank in March 2017. A lot of companies, primarily banks, have also been very interested. This has resulted in more than 100 meetings with representatives from organizations from around the world. Media coverage has been very widespread. The project would benefit from more partners and other teams working on similar projects to stimulate development and learning. The project team sees a good value in getting more partners and other projects up and running.

5.2.5 LEGAL CONDITIONS AND LOBBYING

Further lobbying, investigation and innovative solutions to allow for a digital process with digital signatures is a key element to secure the realization of the value of the project.

5.2.6 OWNERSHIP AND GOVERNANCE

The operation of a blockchain is a joint responsibility. The appropriate governance and incentives for operation has to be set up. The ambition is to make the solution open source to a large extent. Still, ownership of the software and hardware, and a framework for potential external partners for cloud solutions, storage, network etc. has to be outlined. There are many possibilities to develop new solutions and services with the use of the data and platform developed. Conditions for this has to be discussed, and the process for decision on changes investigated.

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