Vehicle Information As A Service (VIAAS)
Democratizing vehicle information through a decentralized blockchain network for the automotive and transportation industry

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Abstract

Technology is advancing at warp speed across all domains and is becoming increasingly commoditized. This is especially true in a Covid-altered, war-affected, and geopolitically restructured global economy. In the effort to make the world well-connected and more sustainable, we are also witnessing continued innovation, especially in the automotive mobility and transportation industry. In the last few decades, there has been a huge proliferation of information about vehicles and the ecosystems that they create. With multiple systems storing information across various stakeholders including those from manufacturing, services companies and industry organizations, there isn't a decentralized, unified approach to get access to vehicular information.

Building a blockchain based-decentralized **V**ehicle **I**nformation **A**s **A** **S**ervice (VIAAS) is a first step towards achieving a transparent, egalitarian, trusted and a ubiquitous vehicle ecosystem information repository. In this technical brief, we explore how VIAAS powered by a decentralized blockchain can democratize vehicle information and make it efficiently available to all stakeholders: spanning commercial businesses, consumers, and other automotive market players across the industry.

1. Introduction

The automotive industry has transformed the world over the last century. Mobility and transportation have revolutionized the way humans interact and function daily in our society. With the advent of new innovations such as autonomous driving, electric vehicles and connected mobility, there is also a need to manage vehicle information that is associated to each model in a simple decentralized infrastructure.

While the world today runs on planes, trains, automobiles, and ships, the largest and most widely used mode of transportation includes cars, trucks, and two/three wheelers that operate on roads or terranean infrastructure. There are so many multiple networks and associations where information on vehicles is available and duplicated but there is no decentralized approach to get access to vehicle information from any place or system. In effect, access to accurate and relevant vehicle information is a challenge. Building a blockchain based-decentralized **V**ehicle **I**nformation **A**s **A** **S**ervice (VIAAS) can serve as a platform for efficient transacting and functioning of the vehicle economy. There is also immense commercial and ESG

(Environmental, Social and Governance) value in democratizing this VIAAS (vehicle ecosystem information). In that way information can be accessible to the consumer as well as various other stakeholders in the automotive value chain.
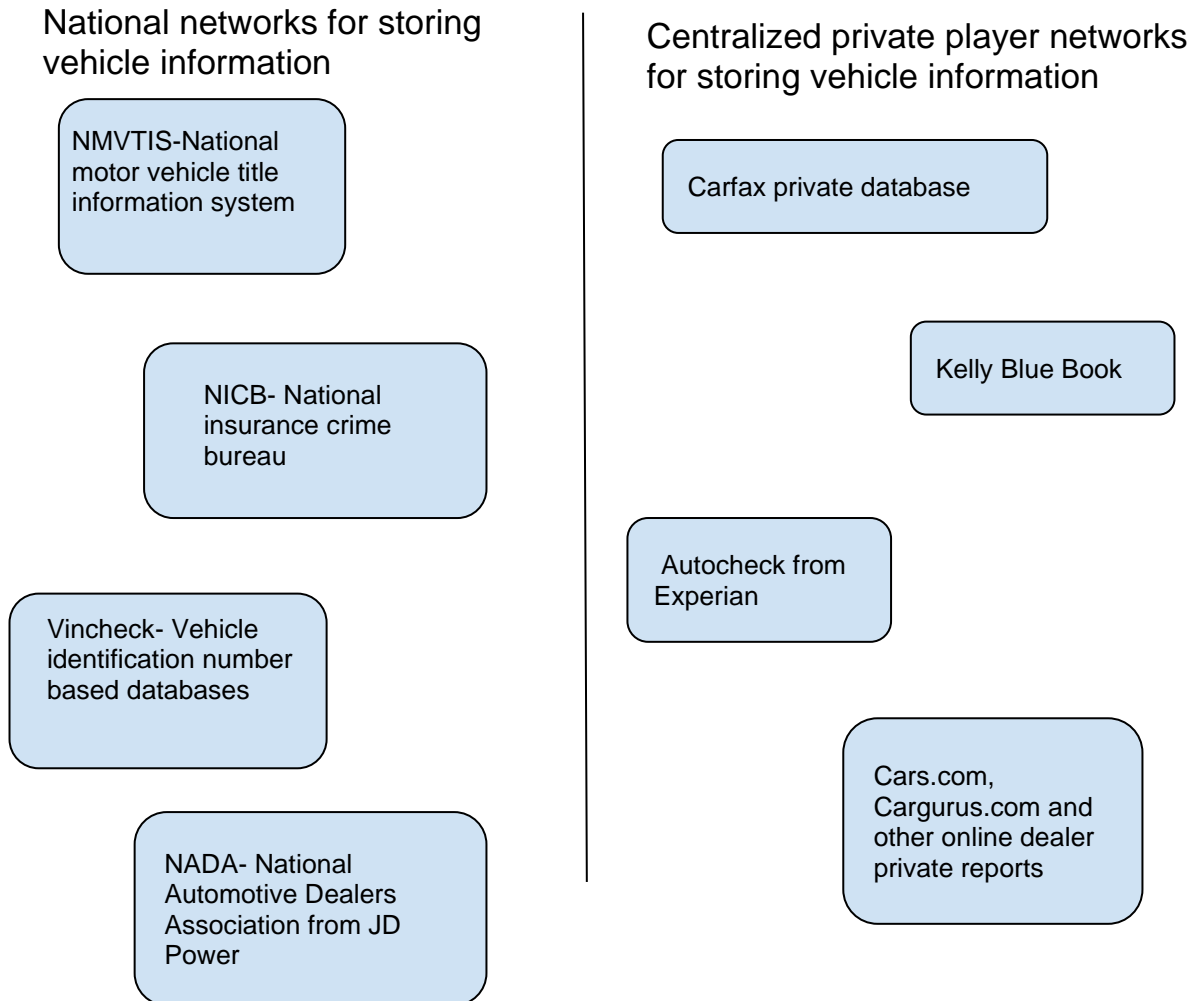
2. Current state of vehicle information systems

In today's world, vehicle information for cars or trucks in the US is currently gathered through various centralized national networks such as NMVTIS (National Motor Vehicle Title information System), VINcheck (VIN - Vehicle Identification Number) and other partners. Different countries maintain various information repositories that may or may not have the same level of detail and maturity. And the other major part of the centralized vehicle information networks is stored today in the hands of private networks such as Carfax, Autocheck(owned by Experian), Kelly Blue Book (KBB) etc. These centralized networks contain pieces of information around the following:

- When the vehicle was manufactured or available at a dealer from the OEM (Original Equipment Manufacturer)
- What was the date of purchase (if it was bought at a dealership)
- When was the service done (if the dealer enters details)
- Title information in some cases
- Price sold if car has multiple owners
- Any accident/theft info, if reported to the police
- Parts information /major work done (in case of damage to the car)

2.1 Challenges in gathering vehicle information

Even though the above vehicle information is valuable for an OEM, a dealership, or a private buyer, the approach to finding information is cumbersome. For example, a buyer will have to jump through various hoops to find relevant information about the vehicle. Without relevant information, the buyer ends up blindly trusting the dealership or a private seller. Additionally, this information is very expensive – with the dealer, private buyers or sellers spending hundreds of dollars to purchase these reports, such as Carfax and Autocheck. Despite that, these reports might potentially be missing valuable information about maintenance work done by smaller service shops.

Hence, with these different centralized networks, there is no guarantee that all the vehicle information is contained within a single entity – including critical details like when / where was the car manufactured, sold/resold, what was the duration of use by different owners, and eventually whether the car was retired to a junkyard or re-sold in auctions. In addition, once an OEM sells the car to a dealership, or a car comes out of the manufacturing plant, there is no reliable way to track all transactions on service maintenance, selling and reselling, without accessing different centralized networks. Centralized networks exist where private companies (such as Carfax, KBB etc) have data repositories.

National networks for storing vehicle information

NMVTIS-National motor vehicle title information system

NICB- National insurance crime bureau

Vincheck- Vehicle identification number based databases

NADA- National Automotive Dealers Association from JD Power

Centralized private player networks for storing vehicle information

Carfax private database

Kelly Blue Book

Autocheck from Experian

Cars.com, Cargurus.com and other online dealer private reports

Fig 1: Stakeholders involved in managing vehicle information

3. VIAAS- Vehicle Information as a Service-The Great Leveler Solution democratizing vehicle information and achieving live traceability through a Decentralized Blockchain

The solution lies in implementing a decentralized blockchain ledger where any individual or a retail customer or a prospective owner gets to access and input data on any service that gets done, be it in a dealer or at even a local service station. Traceability is paramount in achieving transparency of information. A decentralized ledger using the Blockchain to store the vehicle

information will contain all aspects: from the moment the vehicle was manufactured by OEM, gets sent to a dealer and begins its useful life, undergoes service, periodic maintenance, gets sold and re-sold until it eventually is retired or taken off the road. This also includes information, including if / when the vehicle is sent to another country, where used cars are resold for further use. Users will be able to access information from the blockchain in the form of a service **which we are envisioning called Vehicle Information as a Service (VIAAS)**.

3.1 Implementing the decentralized blockchain for vehicle information

Given that each vehicle is already assigned a VIN, it can also contain a corresponding Blockchain crypto token that is used as a unique identifier. And once this information is stored on the blockchain, there is no way to delete, modify or misplace the information, thus being highly beneficial to all the stakeholders in a free market. The market pricing, along with details of any private owner initiated, or dealer initiated buy/sell/service transaction that occurs, could all be stored into the blockchain. In effect, every transaction record that is put on the blockchain will live there forever, and the way we acknowledge the transaction is through a Proof-of-Stake blockchain algorithm that approves the transaction.

3.1.1 Example implementation of VIAAS with authentication and authorization architecture and workflow

It is important to understand that to pilot this, a minimum number of stakeholders will need to be included as part of the VIAAS Blockchain. Each stakeholder / market player will need specific authentication and verification steps. We consider the following players to be the stakeholders of the VIAAS blockchain: Private Vehicle Owner, Dealer, Online car marketplace providers, Car Service stations, OEMs.

As an example, if a certain vehicle service record needs to be updated into the VIAAS, there will be certain authentication and verification of the transaction that will be needed to make sure the information is accurate. Let's consider an example of a private car owner as a stakeholder:

Authentication steps : minimum required information to identify / authenticate access to VIAAS

When a private owner needs to update a vehicle record, they could request for authentication to the VIAAS network by following a minimum number of pre-determined authentication steps:

- Uploading their registration information that shows that the owner is indeed the rightful car owner
- Uploading their original purchase transaction of the car
- Uploading their driving license

Selecting the type of Vehicle information an entering information

Once the authentication completes, the private owner is authorized to select among pre-populated vehicle information record types, which can include a choice of "vehicle service", "buy/sell transaction", "lease record update" among others.

Creating a block node in the ledger encapsulating the transaction record and verification of the accuracy to be accomplished by the other nodes in the network

After the vehicle service record is updated, we would use a proof of stake/ proof of work consensus mechanism for the other nodes to verify the transaction.

- This can either be accomplished by awarding crypto tokens for stakeholders that validate the node transaction
- We have a consensus mechanism that is driven by existing users of the VIAAS, making sure that the decision making is still decentralized while keeping the transaction secure
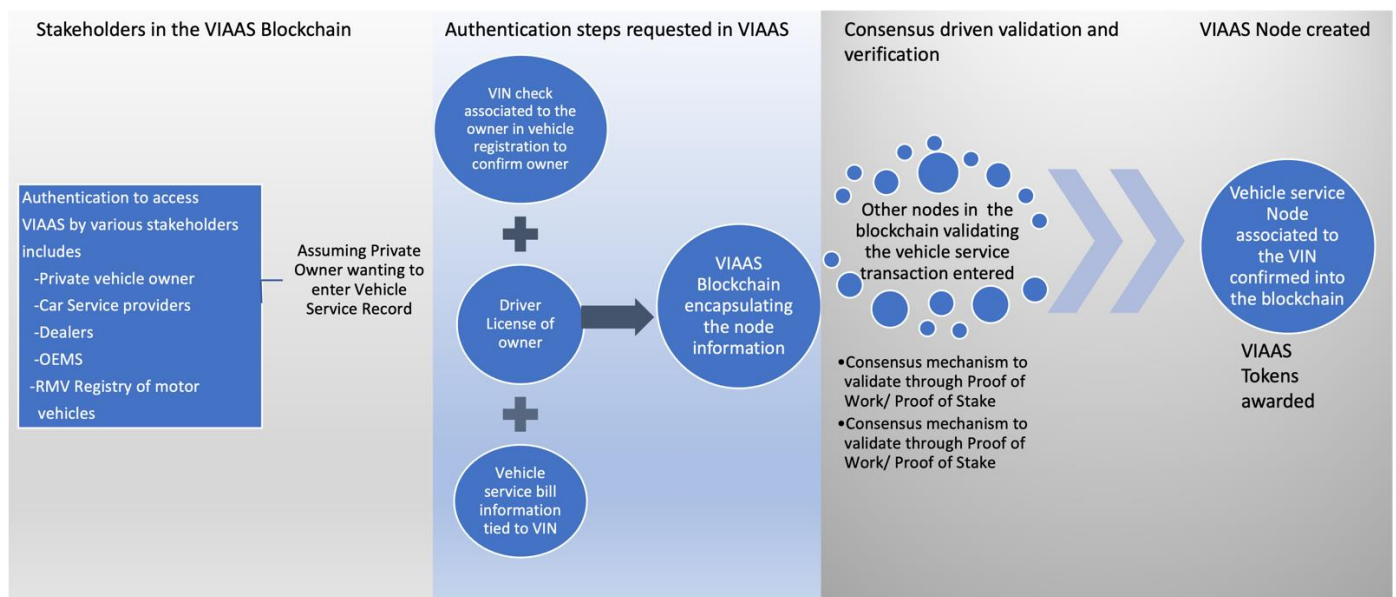
Fig 2: Example illustration of VIAAS Blockchain updating a vehicle service transaction from a private car owner

So, for every car, there will always be a way to go into the blockchain to check for the history of its service. There is no way this data can be corrupted as there is no centralized authority which can compromise the system. And this data is accessible by all stakeholders, including the current owner of the car. As of today, such vehicular data is not within the ecosystem – people cannot access vehicle history unhindered and are still dependent on manual records, service history bills and third-party centralized players.
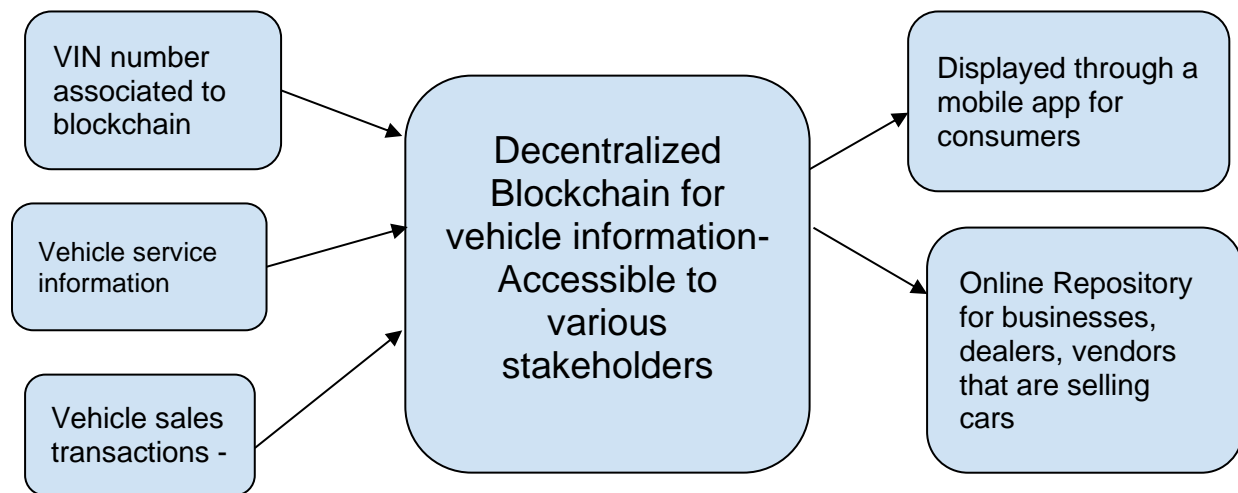
Fig 3: Vehicle information as a Service (VIAAS)

4. **Vesting the power of information back to the primary user and owner of a car**

The VIAAS decentralized blockchain will provide equitable access to automotive vehicle information. Primary users/consumers/drivers of the car thereby can always access their car's history and information at any time and re-use that for future selling or buying transactions (until the car is retired).

This resulting decentralized car service block chain which can be accessed from anywhere across the world will help decrypt the buy/sell and service transactions for every car, proving to be useful for a potential used car buyer who is in the market to purchase a used car. Any car information can be looked up, and this decentralized service blockchain will be that source of truth at any point of time.

How can this be implemented? There are a few use cases and platforms that could be used to build this approach.

- Open-source projects –Arweave data- decentralized data access and cloud for storing data forever https://www.arweave.org/ Arweave is a protocol that allows storage of data permanently with a single upfront fees. This is an open source community owned network that allows launching of decentralized applications backed by a sustainable endowment that ensures perpetuity of the data stored forever. Through the Arweave protocol is the permaweb that is a permanent web of pages and applications that live forever.

- Smart contracts for car buying transactions that can directly be connected with RMV/DMV. Smart contracts are instructions that are coded into crypto tokens and execute when a given set of predetermined conditions occur. This is particularly useful when a car gets registered or there is a buy/sell transaction connected to the car and the ownership changes

- Use a public scalable Proof-of-Work blockchain from Dominant Strategies (https://dominantstrategies.io/) . Dominant Strategies is developing a new scalable Proof-of-Work blockchain that is particularly relevant for human transactions and can handle day to day commerce. This involves running novel public blockchains that can be run by participants of the blockchain rather than restricting to a few mining pools.

5. **Example Use-case of VIAAS**: **Consumer to Consumer (C2C) common man/private used car-owner buyers-sellers information system**

5.1 Existing state of used car selling and buying for private car owners

Most car sales happen at a dealership, where there is a trade-in and dealer mark-up on the used car.

Current car sales process includes-
- Determination of potential value through Edmunds, TrueCar, KBB value

- Used car owner tries to get a quote from various dealers who are willing to buy their car based on their KBB value.

5.2 Option1 - Used car owner tries to sell directly in the market
Used car owner tries to sell directly on a car buying/selling marketplace like CarGurus, Cars.com, and even Craigslist or other places. However, it is typically very hard to execute the transaction, given that there is not much trust when a used car owner is trying to sell to a stranger, apart from the existing problem of lack of credibility of vehicle history and related information.

5.3 Option 2 Used car owner sells to a dealer
Dealer typically looks at the car and offers a below market price value. Private used car owner may not have much of a choice and might end up selling his/her car for the quoted value. The main issue, as noted earlier too, is that there is no trustworthy way to check the history of the car, other than looking at a VIN check or a Carfax report. However, those may not account for the full vehicle history and service records for the car since they are either geographically restricted or do not span multiple data systems from across the world.

5.4 Solution use case implementation

Using a decentralized blockchain ledger VIAAS system, a private used car owner can go in and input data on any car service that gets done at either a dealer or at even a local service station. Especially relevant since this information today may not always get documented in centralized systems such as Carfax or Autocheck and doesn't relay information across countries or geographies.

In effect, every service record that is put on the blockchain will live there forever, and the way we acknowledge the service transaction is through a proof of stake blockchain algorithm that approves every single transaction.

So, for every car on the planet, there will always be a way to search through the service blockchain VIAAS to check for the history of a particular's car service records. There is no way this data can be corrupted as there is no centralized authority which can compromise this system.

It is imperative that to make the VIAAS successful, we will need to include all stakeholders in the ecosystem - car dealers, car service companies, online car marketplaces, non-profit organizations collecting vehicle data (even OEMs) and primary consumers who own and use the cars.

List of potential partners include:
- Used car chains like AutoNation, CarGurus, CarMax, Edmunds
- Used car sales transactions for rental car companies such as Enterprise, Hertz etc
- Used car sale & used car financing companies of OEMS such as Honda, Toyota, Ford, GM etc

6. Conclusion

As discussed above, there are multiple implementations and use cases to choose from, for building a Blockchain enabled VIAAS thereby democratizing vehicle information. It is imperative to mention that these use cases are not restricted to just the automotive domain. These can be applied to other transportation systems such as aerospace, shipping, and other supply chain/logistics industries. This could also extend to information management in futuristic autonomous vehicles and electric vehicle fleets. With advances in Blockchain technology, we can accelerate the availability of vehicle information to all stakeholders through VIAAS at any time to enable efficient, accurate and faster transactions in the economy.

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