

# Automotive Future With Integration of IoV and Blockchain

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## I. INTRODUCTION

### A. WHAT IS A BLOCKCHAIN?

A blockchain is a digitally distributed, decentralized, immutable public ledger that exists across a network.

A blockchain collects information together in clusters, known as blocks, holding sets of information. Blocks have predefined storage capacities which when filled, are closed and linked to the previous block.

Some of the top applications of blockchain include

1. Money transfer
2. Healthcare
3. Decentralized finance (De-Fi)
4. Internet of Things (IoT)
5. Personal identity security
6. logistics
7. Automation Industry

### B. WHAT IS IoT?

Ubiquitous Computing, Internet Protocol, sensing technologies, communication technologies and embedded devices are merged together in order to form a system where real and digital worlds meet and are in symbolic interaction

There are more than 7 billion connected IoT devices today, this number will grow to 22 billion by 2025.

Some advantages of IoT

1. Access to the low-cost and low-power sensor technology
2. Cloud computing platforms
3. Conversational artificial intelligence (AI)
4. Connectivity

### C. WHAT IS IoV?

The Internet of Vehicles is a network of cars communicating among each other and with pedestrians handheld devices, roadside units (RSUs) and public networks using vehicle-to-human (V2H), vehicle-to-vehicle (V2V), vehicle-to-road (V2R), and vehicle-to-sensor (V2S) interconnectivity, creating a network with smart devices as participants.

Using Vehicular Ad Hoc Networks (VANETs), it allows vehicles to exchange information, efficiency and most importantly safety with others as well as with infrastructures

### D. BLOCKCHAIN IN IoV

IOV Blockchain is an infrastructure with blockchain technology underlying it. This infrastructural chain provides the automotive industry with decentralized application services and extends to various applications with different scenarios related to traveling. It also provides services to 2 billion vehicles worldwide and the trillion-dollar automobile consumer market.

## II. CHALLENGES OF EXISTING IoV SYSTEMS

### A. SECURITY ISSUES IN THE COMMUNICATION

For the traffic flow management a lot of reliance is there on wireless communication systems, which makes the IoV more vulnerable to several attacks such as data disclosure, session key leakage etc.

### B. CENTRALIZED CLOUD AND DATA STORAGE SERVERS

With the increasing number of requests by the growing fleet of smart cars around the world they try to access the cloud frequently in order to communicate with each other, traffic management is difficult. With billions of nodes comes huge data storage, crashing the server which destroys the whole system connection.

### C. PRIVACY OF VEHICLES IN VANET

Due to wireless transmission of messages between the connected nodes, the traffic information can be attacked and a fake message can be sent for any vehicle to change its path for theft plus accident purposes. It performs poorly against these attacks:

1. The attacker can obtain user IDs from the ID list
2. Spoofing attack enabling fake location data from the attacker
3. Anyone can impersonate the authorized user without using their ID/smart card by the means of replay attack
4. A session linking attack can be deployed to break down the sessions belonging to the same vehicle.

### D. PARKING MANAGEMENT IN SMART CITY ECOSYSTEMS

The parking management systems depend upon distance sensors, a microcontroller and an integrated camera. Currently the system depends upon the captured images of the car panel, it is difficult to get fully recognized images due to the camera resolution, its field of view, camera position etc.

### III. BLOCKCHAIN AS A SOLUTION

- Decentralization is one of the main characteristics of blockchain technology. Therefore, we can leverage this feature for rapid authentication of information on the Internet of Vehicles.
- It can also serve the purpose of traceability management of accidents.
- Blockchain being a peer to peer network with high trust factor, data in it is accurate, reliable, consistent while being widely accessible.
- Advanced encryption and hashing technology can protect the security and privacy of vehicle nodes.
- The transactions being timestamped and authenticated via private keys, it prevents forged messages; anonymized vehicle identity.

All this sums up for blockchain playing a crucial role in solving the problems being faced in IoV.

For instance, 30 giants like Ford, Renault, BMW, IBM, Bosch, Renault etc have formed a consortium called Mobility Open Blockchain Initiative (MOBI), its mission is to accelerate the application of blockchain. Researchers are working for a blockchain based system which will include designing and implementing vehicle tracking lifecycle, right from manufacturing, registration, customs, on the road and violations to buying and selling.

### IV. ADVANTAGES OF BLOCKCHAIN TECH IN IoV

- Private and distributed security, payments and accounting.
- Distributed authorization
- Privacy-sensitive data is shared on demand
- Users use changeable identities
- Ensure the privacy of users
- Preserving data

### IV. ARCHITECTURE OF BLOCKCHAIN IN IoV

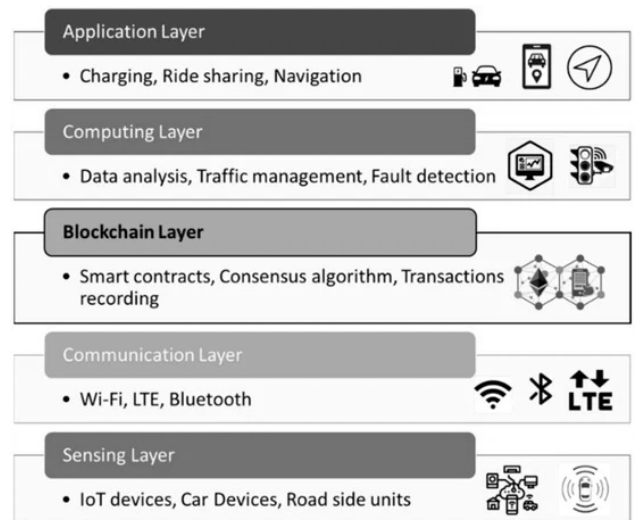


Figure 1. Blockchain and IoV architecture.

- The 1st layer includes all the sensors within the vehicles gathering data and identifying certain events of interest for instance, driving patterns, vehicle circumstances, weather etc.
- The 2nd layer allows various wireless communication modes (e.g., V2V and V2I). The communication layer makes sure that existing and future networks are always connected.
- The 3rd layer, blockchain, acts as a governance layer and is viewed as a bridge between the communication and application layers.
- The 4th layer is in charge of storing, analyzing, processing while making decisions regarding various circumstances in the IoV network.
- The application layer is the highest level of the IoV and may provide consumers with a wide range of vehicle services.

### IV. THE FOUR WAY TRADE-OFF OF BLOCKCHAIN

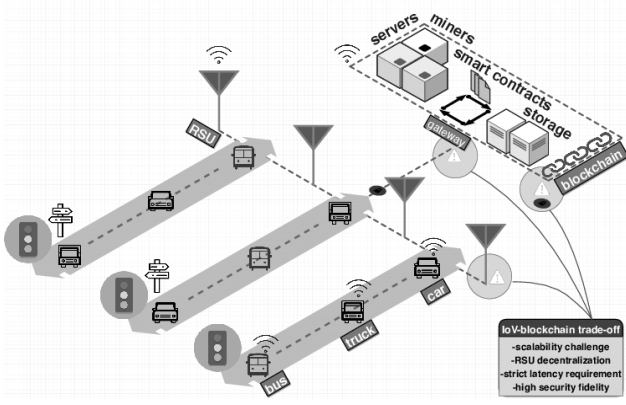


Figure 2. A IoV blockchain model with the four-way trade off

The following quintessential factors are represented here:

- Scalability
- Decentralization
- Latency
- Security

#### V. SYSTEM COMPONENTS AND RESOURCE SHARING

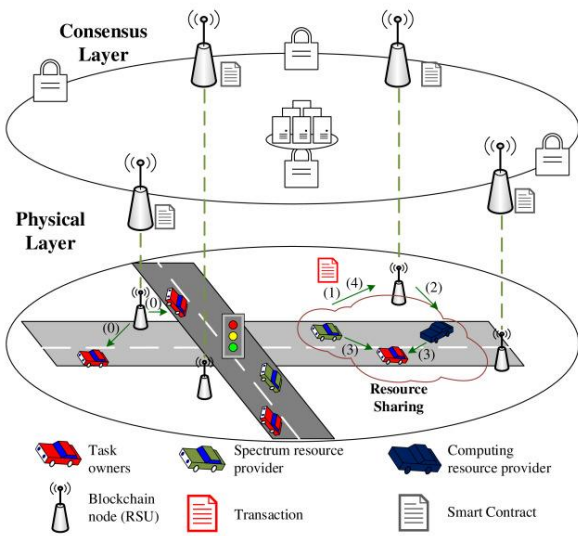


Figure 3. The system components

Here, in the physical layer there will be Blockchain Nodes called Road Side Units (RSU) along with the task owners and spectrum resource provider working with computing resources provider.

There will be resource exchange between the above-mentioned entities and transfer of data will occur through the RSUs to the consensus layer where blockchain tech will come into picture processing the smart contract and verifying the transaction.

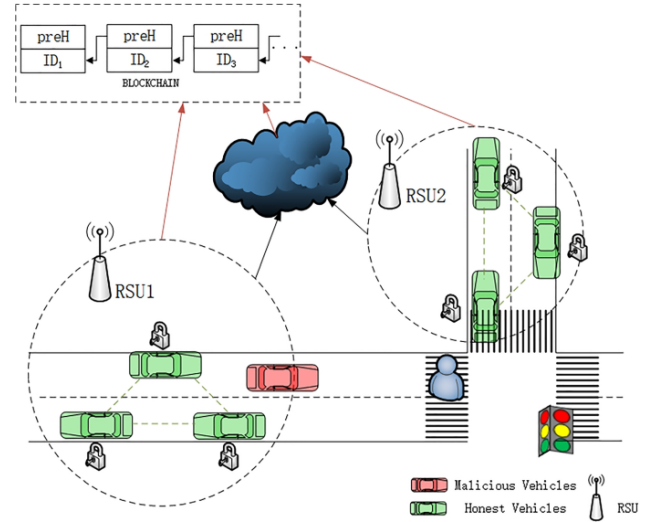


Figure 4. The equipment composition of IoV

Here, Several entities like Road Side Units (RSU), trusted nodes, vehicles and trust institutions are involved.

There will be exchange of data between the vehicles and RSU to prevent any malicious vehicle from sending false signals, for instance if there is any traffic on the roads and the vehicle intentionally sends signals that roads are empty it can lead to traffic congestion or accidents.

With the introduction of blockchain, honest vehicles will also be connected to the cluster where they will exchange true information with the nodes resulting in identification of malicious vehicles and tag them.

#### VI. CHALLENGES IN INTEGRATING BLOCKCHAIN IN IoV

The major challenges faced while integration are mentioned below:

- Storage capacity and scalability
- Unnecessary data creation handling
- Compatibility with the smart contracts
- Legal issues

#### VII. CONCLUSION

In this paper, we have reviewed how the integration of blockchain in IoV can be a revolutionary step for the future. Using different architectures to solve imposed challenges of IoV, blockchain not only solves security challenges in IoV but also makes sure of the identification and location privacy of all the participating vehicles.