Chapter 33
Use of Smart Contracts and Distributed Ledger for Automation

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ABSTRACT

Blockchain as a service has evolved significantly from where it started as an underlying technology for Bitcoin cryptocurrency when introduced in 2008. Realization of the immense opportunities this technology possesses encouraged the development of several other Blockchain solutions such as Ethereum, which focused more on the unique competencies much beyond just the digital currency. In this chapter, the authors provided insights into the unmatchable capabilities of Blockchain to evade cyber-attacks that can facilitate a much-needed push for the scalable operation of autonomous vehicles by providing a safer and trustable ecosystem through smart contracts. The chapter also discusses the integration of Ethereum Blockchain with Confidential Consortium Framework (CFF) to overcome the shortcomings of Blockchain in terms of speed and volume. Towards the end, they talked about some of the modern technologies such as IoT and AI that can be benefitted by Blockchain.

INTRODUCTION

Purpose/Motivation: Many organizations have already invested huge amounts in research and development of Autonomous Vehicles in efforts to commercialize them with a transformational amalgamation of technologies, Blockchain being one of them. The purpose of the chapter is to find the opportunities and challenges of using Blockchain-based smart contracts deployed on distributed ledger technology for AVs.

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Objective: To find the appropriate Blockchain solution for Autonomous Vehicles that can act as a platform-based ecosystem where AVs can interact with other vehicles, carry out transactions, avail various services, share valuable data and resources, etc. Moreover, to suggest a viable solution with a supporting architecture model that can assist in the development and implementation of the solution.

Methodology/Approach: Our approach for research and literature review comprises of identification of the goal of the study, followed by the screening of high-quality research papers from several sources such as IEEE, HBR, Springer, Emerald Insights and white papers from various websites to understand the latest developments. A systematic mapping study is conducted to bring together facts and analyses that form the foundation for developing new ideas to device frameworks and architecture that can provide safe, scalable, and efficient Blockchain solutions for Autonomous Vehicles.

Scope of Work and Limitations: With so many Blockchain solutions emerging every day that hold the potential to make the previous technologies obsolete, a thorough comparison of all the technologies that can highlight their pros and cons, can be studied thoroughly. Also, new ways of making the technology more standardized and economically viable can be analyzed with a special focus on building expertise in exception handling.

Findings: After extensive research and literature review, the researchers believe that an integration of the Consortium Ethereum Blockchain with Microsoft Confidential Consortium Framework (CFF) would be the most effective solution to build an ecosystem of connected Autonomous Vehicles.

Managerial Implication: Major inferences from the study include designing ground-breaking solutions that would bring Autonomous Vehicles, even more, closer to its prospective customers and promote the adoption of the technology on a large scale to make it more sustainable for day to day transit purposes. It is a technology that will impact our way of doing business, managing travel, handling logistics, and even our daily routine; hence it is imperative to build solutions that are safe and reliable.

Background: Blockchain Networks are not centralized, unlike traditional networks, and consist of nodes that are interconnected to each other, as shown in Figure 1. The two most popular Blockchains are Bitcoin and Ethereum, Bitcoin being the largest usually used for cryptocurrencies. Ethereum Blockchain has built-in functionality for smart contracts to deploy Decentralized Applications (DApps). Smart Contracts are computer codes that enforce agreements between parties based on the simple logic of IFTTT (If This Then That). Smart Contracts in a Blockchain works in a way similar to legal contracts in the real world. Through smart contracts, Blockchain can automate business by facilitating automatic real-time record management, invoice and receipt verification, payments, inventory management, logistics management, internal auditing & quality check, information sharing, etc. while keeping high-quality data secure and immutable. It can be used to automate the supply chain of various industries, including Manufacturing, Banking & Insurance, Legal, Health-Care, etc.

It is crucial to identify the business needs and requirements to decide upon the best Blockchain platform. It is a vital business decision to choose the right Blockchain platform else it can turn out to be a costly affair that might not even serve the purpose and will be utterly unviable for the business. Some Blockchain platforms don't allow high transaction rates, and adding each block is very expensive, e.g., each bitcoin transaction uses enough energy to run one US household for one entire week making high rate large scale global solutions unsustainable. Based on the features as listed in Table 1, researchers can start with deciding between Public or Private Blockchain, or do we need a hybrid one? What technologies can be integrated for better control of functionality? What kind of permissions do we need to assign to participants for accessing the Blockchain database? Answers to these questions depend on the Business needs of various industries. The Table 2 depicts the Segment Forecast for Blockchain Market in various sectors.