A Project Report

on

BLOCKCHAIN BASED TRAFFIC MOINTERING SYSTEM

Submitted in partial fulfillment of the
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Bachelor of Technology in Computer Science and Engineering

Under The Supervision
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CANDIDATE'S DECLARATION

I/We hereby certify that the work which is being presented in the thesis/project/dissertation, entitled **"BLOCKCHAIN BASED TRAFFIC MOINTERING SYSTEM"** in partial fulfillment of the requirements for the award of the BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING submitted in the School of Computing Science and Engineering of Galgotias University, Greater Noida, is an original work carried out during the period of month, JULY-2021 to DECEMBER-2021,, under the supervision **Mr.Soumalya Ghosh Assistant Professor, Department of Computer Science and Engineering of School** of Computing Science and Engineering , Galgotias University, Greater Noida

The matter presented in the thesis/project/dissertation has not been submitted by me/us for the award of any other degree of this or any other places.

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Supervisor

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CERTIFICATE

The Final Thesis/Project/ Dissertation Viva-Voce examination of **19SCSE1010604 – ETHESHAMUL HUDA, 18SCSE1010568 – YUSUF AMEEN** has been held on __________________ and his/her work is recommended for the award of **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING.**

Signature of Examiner(s) **Signature of Supervisor(s)**

Signature of Project Coordinator **Signature of Dean**

Date: November, 2013

Place: Greater Noida

ABSTRACT

The real-time traffic monitoring is a fundamental mission in a smart city to understand traffic conditions and avoid dangerous incidents. In this project, we propose a reliable and efficient traffic monitoring system that integrates blockchain and the Internet of vehicles technologies effectively. It can crowdsource its tasks of traffic information collection to vehicles that run on the road instead of installing cameras in every corner.

First, we design a lightweight blockchain-based information trading framework to model the interactions between traffic administration and vehicles. It guarantees reliability, efficiency, and security during executing trading. Second, we define the utility functions for the entities in this system and come up with a budgeted auction mechanism that motivates vehicles to undertake the collection tasks actively

The purpose of this project is to explore how to apply blockchain technology to intelligent transportation, create a hierarchical theoretical framework of intelligent transportation, and explore a sustainable application system of intelligent transportation under the blockchain. However, not only this hierarchical theoretical framework must consider unnecessary attributes and the interrelationships between the aspects and the criteria, but also the sustainable application system must be in consideration in multiple stakeholders.

This theoretical hierarchical framework aims to guide intelligent transportation toward the application of blockchain. This study also proposes the engagement of stakeholders for establishing a sustainable application system.

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CHAPTER-1

Introduction

1.1 Introduction

With the rapid development of modern sensing, communicating, analyzing and computing techniques and devices, recent years have witnessed tremendous academic efforts and industry growth in intelligent transportation systems(ITS) , imposing a profound influence on every aspect of our life with smarter transport facilities and vehicles, as well as safer and more convenient transport services. Thanks to the everincreasing uncertainty, diversity and complexity of behavior, mechanisms and strategies involved in this ecosystem, however, ITSs nowadays have demonstrated high-degree of social complexity instead of the expected intelligence, leaving many long-standing issues still unsolved or even worsened.

For the past few years, vehicles have been getting smarter with the progress of technology by installing camera sensors, microcomputers, and communication devices. These vehicles are connected with themselves and other facilities to form a vehicular network. Due to its potential commercial value, the Internet of Vehicles (IoV) has become a hot topic that attracts the attention of academia and industry. The IoV provides a convenient platform for information exchange and sharing between users, such as traffic accidents and road conditions, which can improve the utilization of resources and traffic conditions effectively. However, too many mobile and variable entities are involved in the vehicular network, they are usually strangers and do not trust each other. Because of that, information exchange in the IoV still face huge challenges about how to ensure information security and privacy protection in real applications.
how to design a reasonable blockchain structure based on the vehicle network, improve the efficiency of information exchange, and guarantee the truthfulness of pricing strategies is still a problem worthy of in-depth discussion.

1.2 Formulation of Problem

we consider such a scenario: In a smart city, there is a traffic administration (TA) that is responsible for monitoring real-time traffic conditions by collecting information of various road nodes in this city. The traditional approach is to install cameras at various road nodes, but doing so is costly and vulnerable to be damaged by natural and human activities. Especially in some remote corners, there is no need to install a separate camera. Driven by the IoV, the TA can crowdsource its tasks of traffic information collection to vehicles running on the road. Based on that, we need to study the traffic information exchange between TA and vehicles in a smart city.

There are two challenges shown as follows: (1) how to construct a reliable and efficient traffic information trading framework implemented by blockchain?; and (2) how to build a fair and truthful mechanism that selects a subset of vehicles as information providers to maximize the TA's profit while preventing vicious competition?

1.2.1 Tool and Technology Used

To settle the first challenge, we propose a block chain based real-time traffic monitoring (BRTM) system to achieve a reliable and efficient information trading process between TA and vehicles. First, we use modern cryptography methods and digital signature techniques to protect the contents of communication from privacy leakage. In addition to this, the traditional proof-of-work (PoW) consensus mechanism cannot be applied to our resource-limited vehicle network because of its high computational cost and slow confirmation speed. Thus, we design a lightweight block chain relied on the reputation-based delegated proof-of-stake (DPoS) consensus mechanism that is able to reduce confirmation time and improve throughput for this system.

To settle the second challenge, we propose a budgeted auction mechanism so as to incentivize the vehicles in a city to take on the tasks issued by the TA actively. Here, the TA publishes a task set that contains a number of different tasks about traffic information on various locations. Each active vehicle in this city submits the tasks that it can accomplish and corresponding bid to the TA, then the TA selects a winner set from these active vehicles to undertake its tasks and pay them accordingly.

Chapter 2

Literature Survey/Project Design

As the underlying technology of bit coin, the block chain is essentially a decentralized database that comprehensively utilizes distributed data storage, consensus mechanisms, point-to-point transmission, encryption algorithms, intelligent contracts, and other computer technologies. The block chain has the excellent characteristics of supporting data sharing and being tamper-proof, trustworthy, and traceable, making it suitable for building an information system to deal with multiparty collaborative business.

By applying block chain technology to intelligent transportation. Our research has built a transportation consortium block chain led by the government and involving multiple parties, giving full play to the carrying capacity of the road network, solving various traffic problems, and improving traffic safety and environmental protection. In this study, we analyzed the economic, social, and environmental aspects of the system based on the triple bottom line principle. The economic focus is on cost analysis, the social aspect focuses on the management of social issues, and the environmental aspect mainly refers to the environmental benefits of block chain-based intelligent transportation. Combined with new technologies such as the Internet of Things and the characteristics of block chain.

A. Network Model

Consider a smart city, there is a traffic administration (TA) that is responsible for monitoring real-time traffic conditioning this city. It can crowd source its tasks of traffic information collection to vehicles on the road by paying them a certain amount of money. Therefore, the block chain-based real-time traffic monitoring (BRTM) system consists of two important entities: TA and vehicle, which is shown in Fig. 1. In the BRTM system, the functionality of the entities in a smart city Sa, a ∈ Z +, can be shown as follows.

Traffic administration (TA): The TA in the city Sa can be denoted by T Aa, which collects the real-time traffic information from those vehicles running in this city. For instance, during peak time, traffic accidents often occur on some heavily trafficked roads. At this time, the T Aa needs to analyze road conditions instantly according to the responses provided by those vehicles that run on the designated location. If T Aa adopts the information provided by some vehicles, it must pay them with data coins. Here, data coin is a kind of digital currency considered as the payment for traffic information.

Vehicles: The vehicles in this system are installed with camera sensors, wireless communication devices, and microcomputer systems, which are able to collect, process, and transmit data to other corresponding devices.

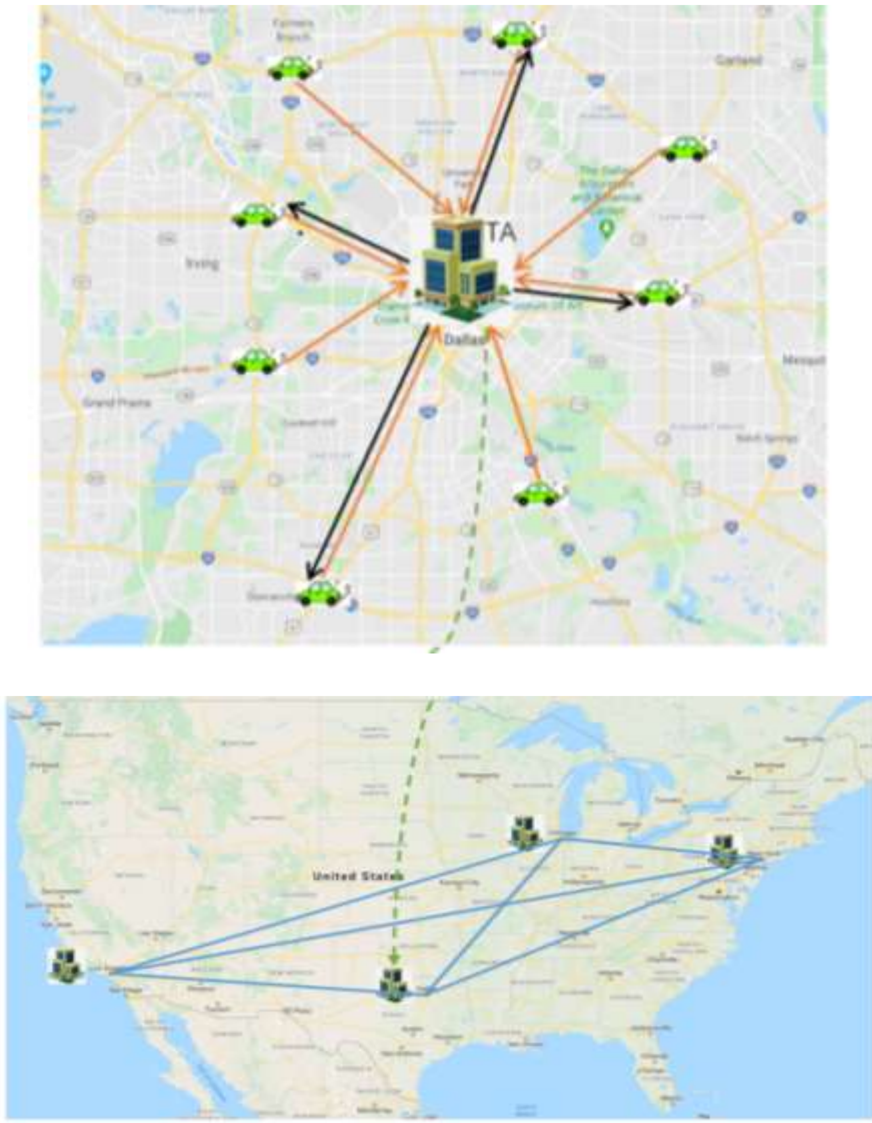

Fig. 1. An instance of BRTM system built on the United States, where the orange lines are active vehicles' requests to undertake the tasks and the black line are TA's acceptances for corresponding requests.

2.1 Related Work

In this section the we have highlighted the relevant related work. In past few years, there has been a boom of area of privacy and preserving the applications of industry 4.0.

In order to track the vehicle location, Anne Hardy et. al. (2017) proposed a system for tracking tourist travel location with smart phone based GPS technology. The system using mobile GPS for tracking the location of the tourists via an android mobile application [14]. But the GPS will track only if the tourist will have a smart mobile phone. Yeong Lin Lai and Jay Cheng (2017) proposed a location tracking system based on cloud storage. The proposed solution is using RFID tag to track the location of the vehicle. The authors have also used technologies such as Location Tracking Algorithms (LTA), Wireless Sensor Network (WSN) and Cloud Computing technology. The location will be tracked by the RFID and send to the cloud storage[15]. Cloud computing is a centralized environment for the storage of the data. The data in centralized environment of prone to security threats. Therefore, we need a decentralized and secure environment to store the data.

Kanza et. al. (2019) proved how blockchain is enabling the feature of decentralization for preserving pseudonymity and privacy [16]. Yuan et. al. (2016), had presented a vision for amalgamated the intelligent transport system and blockchain technology [17]. Shiver et. al. (2019), presented a model for autonomous vehicles that allows the user to store the data in decentralized environment [18], but the results can be applied in the settings of pre-autonomous vehicles. In [19], the authors have proposed the first privacy keeping blockchain based incentive network in VANETs. The authors had proposed an incentive mechanism called as CreditCoin to share network information through VANETs. Both Singh et. al. and Javaid et. al. have analysed the use cases of blockchain technology for securing and transforming the existing applications of Industry 4.0 [20, 21].

Chapter 3
Functionality/Working of Project

3 Proposed Methodology

To achieve the aforementioned objectives, a solution is proposed that is based on the integration of IoT and blockchain. In the proposed system architecture, the RFID tag is used to track the location and the data will be stored in the blockchain network. The proposed architecture is discussed below.

3.1 System Architecture

There are three layers in the proposed model, namely, Blockchain layer, Participants, Sensing layer as shown in Figure 2. The location of the car will be tracked with the help of RFID tag. All the track data will be stored in blockchain in the form of blocks.

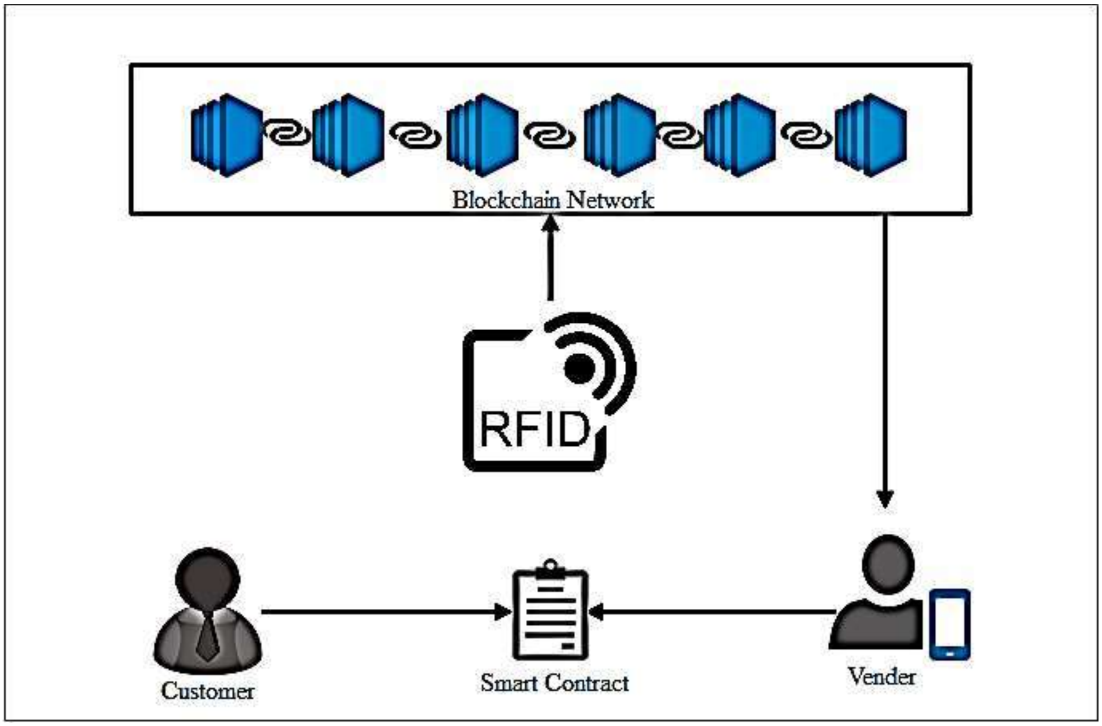

Figure2. Architecture of the Proposed System

The block will contains the hash address of previous block, time stamp, time threshold, random number and object as shown in Figure 3. The systems work flow is simple to understand as shown in Figure 2. Firstly, the customer will book a car and after car booking process, the documentation verification takes place. In document verification, all the documents of car such as insurance documents, RC, pollution will be verified by the customer and agency will check the driving license card of the customer. If all the documents are valid at both the ends then the car keys will be handover to the customer and the trip will be initiated. RFID tag will track the location of the car. After completing the trip, bill generation process will takes place. In this step, according to the number of kilometers travelled by the customer, a bill slip and a trip summary will be generated. Both the bill and trip summary will be share to the customer and the agency so that they can check whether the customer gone onto the right place as mentioned in the contract or not. If all the things are ok, then the payment step will be done by the customer based on the bill shared.

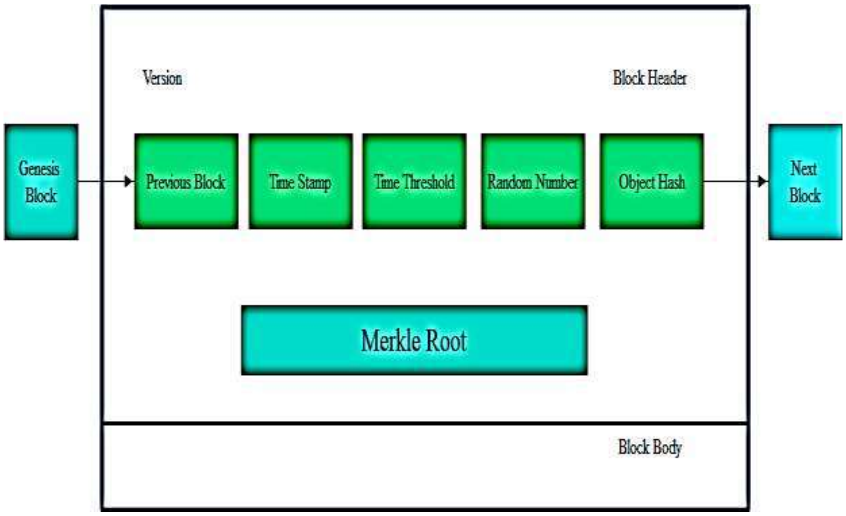

Figure3. Block Structure

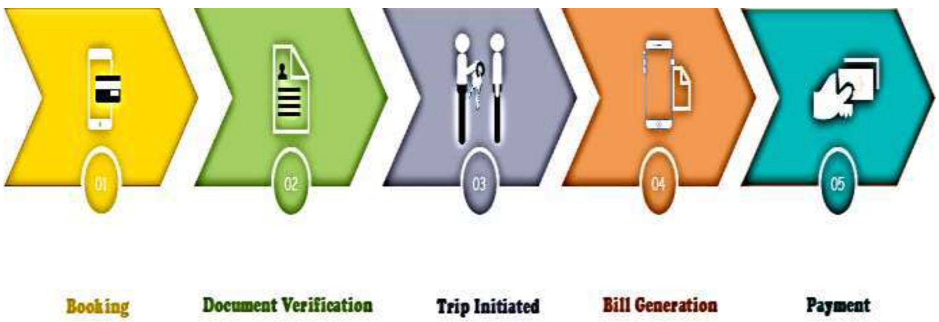

Figure4. Flow Diagram of the Proposed Solution

3.2 Proposed Algorithm

The precise execution of the proposed system is shown in Algorithm1. After the trip initiation, the process will get started. The vender will initialize the process first by giving some inputs to the algorithm. Algorithm input data such as car id, security amount, starting point, ending point, kilometre readings before starting the trip. The device will generate transaction regarding the location of the customer every time the RFID tag gets scanned. All the track data is stored into blockchain and shared with the agency so that they can check whether the client is going to the mentioned location or not. After the end of the trip, bill and a detailed trip summary will be generated and shared with both the participants. Table 1 lists all the acronyms that are used in the Algorithm1.

Algorithm No. 1 Working of Proposed Solution
Input: Cid, S_amt, S,D, T_km
Output: T_Sum, Bill_amt.
1. **VENDER** V (S,D)
2. **while** (true)
3. **if** (S !=D)
4. **then**,
ADD CURRENT LOCATION

5. **end if**
6. **else**
7. GENERATE BILL(Cid, S_amt, T_km);
8. **end else**
9. **end while**
10. **end VENDER**
11. **GENERATE BILL(**Cid, S_amt, T_km**)**
12.
13.
14.
15.
Var Bill_amt;
Var amt_Per_Km;
Bill_amt= (amt_Per_Km*T_km)-S_amt
end GENERATE

Table 1.	Abbreviations
V	Vender
Cid	Car ID
S_amt	Security Amount
S	Source
D	Destination
T_km	Travelled Kilometer
T_Sum	Travel Summary
Bill_amt	Bill Amount
Amt_Per_Km	Amount per Kilometer

Chapter 4
Results and Discussion

This section encloses the simulation tools, performance of smart contract and User Interface (UI) of the proposed solution. Ethereum block chain is used for the deployment of smart contracts as it is an open source platform.

In order to develop Decentralized Application (DAPP), the authors have used Ethereum blockchain. For evaluating the performance of the proposed system, the authors had used RinkeyBy. Remix IDE and MetaMask facilitate development, execution and testing environment for a smart contract. Solidity language is used for the development of smart contracts. Etherscan test network (RinkeyBy) helps to establish the connection between them.

The system specifications that is used for the simulation are Intel core i5, processor 2.4 GHz, RAM 8GB and HDD 1TB. The following are the parameters that are used to evaluate the performance of the proposed system:

- Execution time versus Gas (Gas is the required fees required to complete transactions in Ethereum blockchain)
- Transaction fees (in terms of Gas) versus block size.
- Gas required for the deployment of smart contracts.

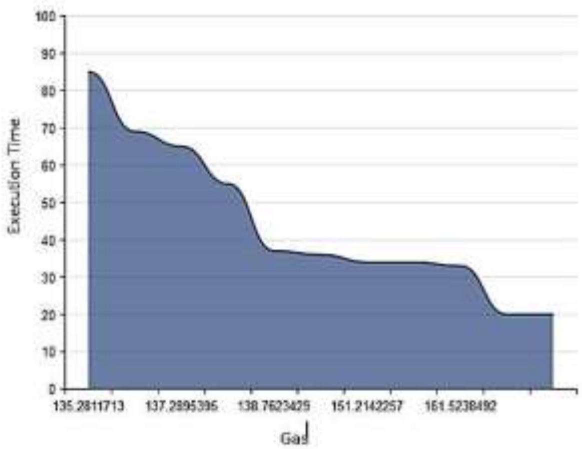

Figure5. Execution time versus Gas consumed

The execution time against the gas consumed is shown in figure 5. By plotting the graph between the execution time and gas consumed, the authors have concluded that as the more gas gets consumed, the less execution time will be required to complete a transaction.

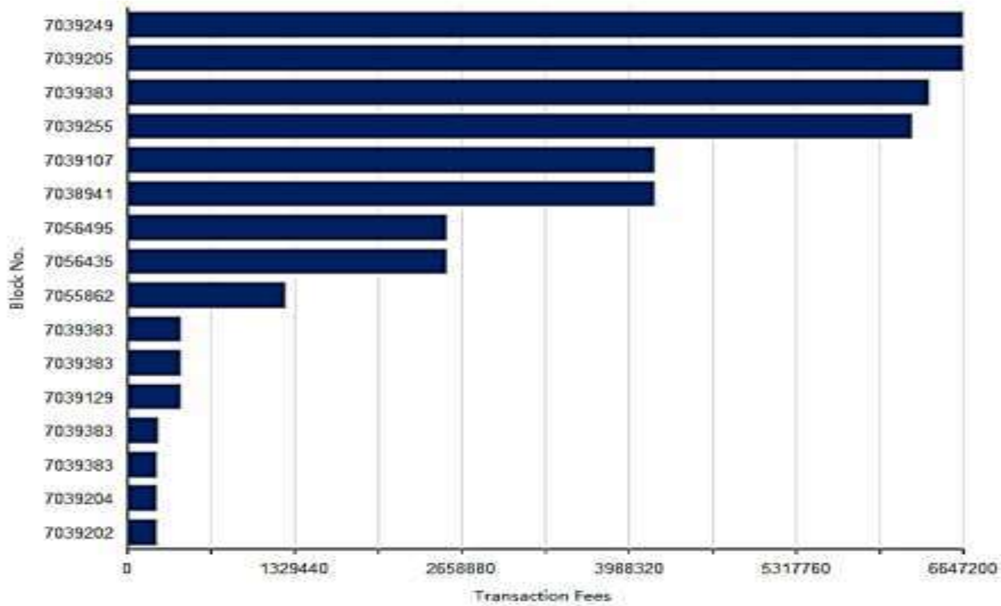

Figure6. Block No. versus Transaction Fees

Figure 6 encloses the relationship between the transaction fees (in terms of gas) and block number as shown. This relationship shows that as the block size increases, the transaction fees also increases.

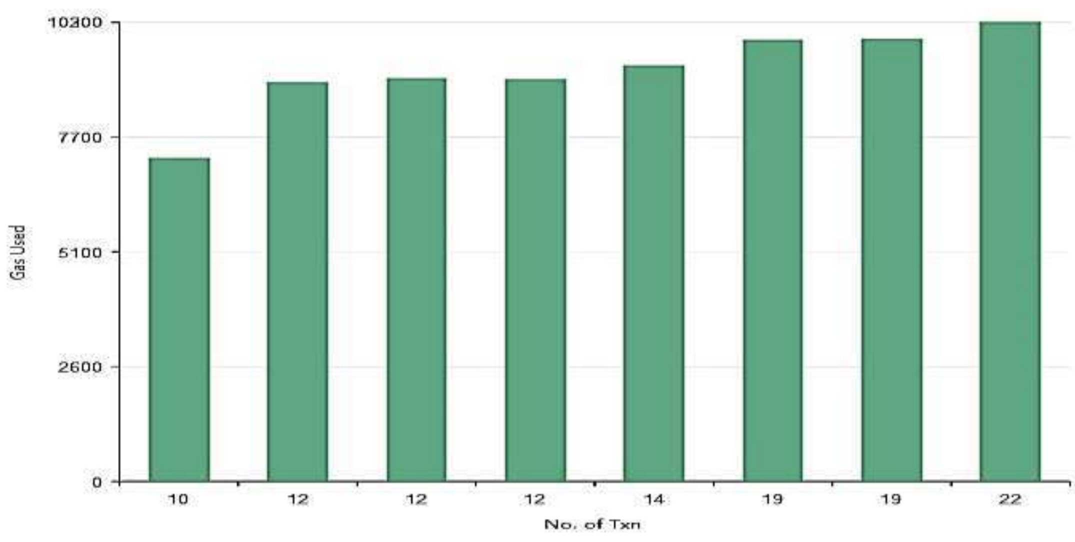

Figure7. Gas consumed versus No. of Transaction

In figure 7, the relationship of gas consumed against the number of transactions is shown. Also, it is clearly visible that the consumption of gas depends upon the number of transactions.

Chapter 5

Conclusion

Smart technologies such as blockchain and IoT have the potential to substantially transform the applications of industry 4.0. With the silent features of blockchain such as transparency, immutability, programmability, decentralized and distributed environment, it enables many innovative ways to design customer relationships with more trust. In this paper, the authors have proposed a tracking system based on the integration of blockchain and IoT for taxi venders. The proposed solution will help to increase the trust among the vendors and the clients. Ethereum blockchain is used to store the tracked data of the location. The location will be tracked when the RFID chip will get scanned by the RFID reader. After completing the trip, a detailed trip summary will be shared with the vender and the client.

In this project, we designed and implemented a reliable and efficient traffic monitoring system based on blockchain technology and budgeted reverse auction mechanism. To enhance the security and reliability of this system, we gave a lightweight information trading framework by using asymmetric encryption. The development system for urban intelligent transportation under the blockchain is very vague. Few existing studies have explored the combination of blockchain and intelligent transportation from a sustainability perspective. Compared with previous studies, this paper considers the impact of blockchain technology on sustainable intelligent transportation development from the three aspects of the economy, society, and environment. In addition, this study could also use other statistical tools, such as a structural equation model, to explore more influencing factors and carry out statistical verification of the model.

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