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CrediTag: an Automatic Toll Payment System

Mrs. D. Amirtha Sughi[1], Prashanth V. R[2], Sai Shiva. K[3], Vijay S[4]
Assistant Professor[1],
Undergraduate Student[2],
Undergraduate Student[3]
Undergraduate Student[4].
Department of Computer Science and Engineering, Easwari Engineering College, Chennai, Tamil Nadu, India
amirthasughi@gmail.com, prshnth98@gmail.com, kshiv427@gmail.com, iamvijay1998@gmail.com

Abstract

Vehicular announcement network is a leading technology for intercommunication between vehicles. Block chain networks are up and coming in storing transaction information .The aim of our paper is to summarize the contemporary research on VANETs and Blockchain technologies and to propose an automatic toll payment system called CrediTag which aims to provide a payment system for highway usage using and to store the credit transaction details in a secure and decentralized manner using Blockchain.

Keywords: VANET, Blockchain, Automatic Toll

1. Introduction

Transportation has become an integral part of everyday life. Of all the means of transport, Road transport is the largest and the most ubiquitous service. When vehicles utilize this vast network of roads sometimes, they have to pay money for the usage in the form of road taxes or in the case of highways toll payments. These payments are time consuming and often require spatial and human requirements for effective transaction.

Our work aims to provide a solution for fast and effective toll payment while being secure and reliable. VANETs and Blockchain Technologies are utilized for this purpose.
In VANET technologies, the users usually lack enthusiasm to perform transactions as a result of inherent fear of their private information being misused. Vehicle Registration Details, Customer identities and bank details can easily be appropriated.

This paper aims to solve this by providing a network named CrediTag where users are rewarded for being part of the VANET. Users can perform payment using the inbuilt currency. Thus, CrediTag is secure and confidential in nature. Users can register by themselves in the system. The user details such as mail ID, phone numbers are collected and stored. Then, the user is connected via VANET to the network. The vehicles in the VANET communicate with other through announcements. Each car connected in VANET acts as a node in the network. The user details are securely stored in a Blockchain Network where each block consists of the identity of a user.

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2. Current Payment Systems

Credit networks are networks used to provide each of its constituent node with a score of their reputation, which enables the identification of the integrity of a node. So, they are commonly used as form of medium of exchange in monetary networks. Nakamoto introduced Bitcoin, which is a blockchain centric digital currency. Bitcoin is famous for its ambiguity and anonymity. But Transactions can still be traced by following the steps. Thus, there is need for verifying their integrity

National Payments Corporation of India and the Government have started a National Electronic Toll Collection system to provide a digital system for tolls. It provides a country wide toll payment system.

FASTag consists of stickers which utilizes Radio Frequency Identification for identifying individual vehicles. FASTag is pasted on the motor. Each one is connected to the respective user's bank accounts.However, it must be noted that FASTag is an identification marker which due to their nature of being an affixed attachment on the windscreen makes it easy to counterfeit and to perform all kinds of malicious acts such as tampering of details, counterfeiting etc.This is avoided using CrediTag as no RFID systems or scanners are required. The Vehicles are part of an VANET Environment which monitors the movement of vehicles and also by employing Blockchain Technology, the user and transaction details are stored securely in a decentralized and tamperproof environment.

3. Related Work

Dimitri do B. DeFigueired et al [1] created TrustDavis which is a reputation system that works in a network online and acts as a security against malicious activities by monitoring players. Through this a player can be identified based on trustworthiness. The disadvantage here is that these systems can be overtaken and controlled remotely for wrong intentions.

Mr. Bhagirath Patel et al [2] deals with intelligent transport system (ITS). Instantaneous traffic information is given to the attention of the researcher. VANET and MANET are similar in many ways like having an organized network, different topological options, wireless capabilities etc. This paper explains the planning, organization and notable features in VANET.

Alexandre Viejo et al [3] studied that VANET's provide intercommunication between nodes of the network, in the form of messages. These announcements can be utilized to pass crucial information such as medical emergencies. Multi-signatures are utilized for security. The difficulty here is that Vehicles trustworthiness must be guaranteed.

Eli Ben-Sasson et al [4] studied payment systems using Bitcoin. Bitcoin uses an open widely spread ledger distribution through which data can be easily accessed by unauthorized persons. It utilizes proof constructions without prior communication between prover and verifier. Initially, anonymous systems for transactions are created. Second, zero cash is built. Here, a system for completely hiding any pattern of transactions that may have occurred is required.

Maxim Raya et al [5] introduced that intercommunication is inversely proportional to the security of a VANET environment. It uses aggregation of messages to overcome this inadequacy. The performance potential is evaluated and is deduced that both these goals are achieved using aggregation.

Wafa Ben Jaballah et al [6] discussed that Intercommunication between vehicles is integral for secure and reliable transport. However, they must be impervious to external

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attempts to manipulate them. So, for this purpose an algorithm based on Multicast is created which provides the required protection.

Florian Dotzer et al [7] showed the several issues of privacy that must be dealt with in intervehicle communication. Mainly, anonymity must be complete or there is no security at all is emphasized here.

Guilin Wang L Chen et al [8] introduced a decentralized wireless intervehicle communication. Exchanging road d enables proper planning. But this may lead to blatant violation of user privacy. This paper uses Threshold Anonymous Announcement service as a means of ensuring security.

M. Pease et al [9] addressed concerns about a set of isolated processes that provide intercommunication between only two parties. All processes which are not at fault possess a key for individual identification. Further research is required in the discovery of suitable algorithms.

Liqun Chen et al [10] studied a trio of schemes for intervehicle communication. However, several instances have indicated that they do not deliver on the promises of anonymity and integrity.

4. Proposed System

CrediTag aims to provide a payment system for highway usage using Credit Networks and to store the credit transaction details in a secure and decentralized manner using Blockchain Technology.

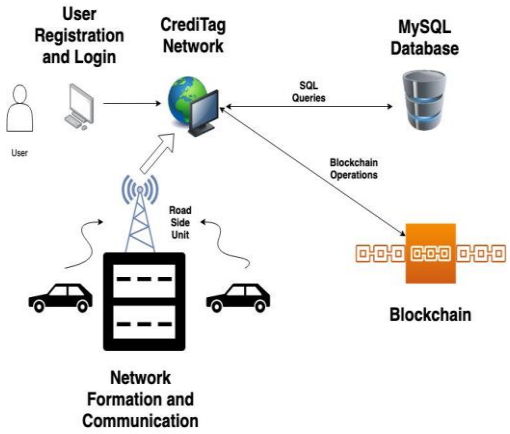

Figure 1. System Architecture

CrediTag provides an efficient and reliable way for secure transactions by creating a network of vehicle users via VANET and to enable them to pay for toll transactions with the help of Credit Coins which are the digital currency in this network. They are assigned to a user based on how much amount they pay to the network when they first register in the network. As transactions occur, each transaction is updated as a block in the Blockchain Network which is used to securely store the transactional details.

The proposed system consists of the following modules:

- User Registration
- Network Formation
- Neighbor Calculation and Communication
- Blockchain

4.1. User Registration

The User Registration proceeds in the following manner with these inputs such as name, email ID and phone number for new user and for existing user- the username and password is requested. The output is the message displaying either user registration or user login is successful.

4.2. Network Formation

A network formation consists of nodes. Each node has distance and range based on which coverage area is formed. Based on coverage area nodes communicate with each other and neighbor nodes are formed. If destination node is out of coverage area of source node, message transmitted to destination via neighbors.

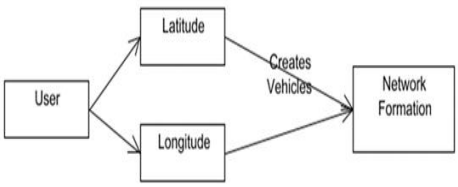

Figure 2. Data Flow Diagram

4.3. Neighbor Calculation and Communication

After network is formed based on vehicle location and toll side unit location neighbor is calculated. In VANET environment intervehicle communication takes place based on their neighbors which have intersecting range. As vehicles are dynamic neighbors are also dynamic and neighbors keep changing once vehicle starts to move from one location to another. After neighbors are calculated dynamically, data communication takes place between vehicle and toll side unit. A vehicle in the network requests another vehicle in the network about traffic status via toll side unit if they were out of range.

4.4. Blockchain

The users request and transactions were securely stored in Blockchain implementation. When a CrediTag was issued or received, it is considered a block and is included to one of the chains. The block chain uses the block miner to append the transaction details as a block to the block chain.

5. Performance Analysis

The resource utilization before the execution of the program is as follows:

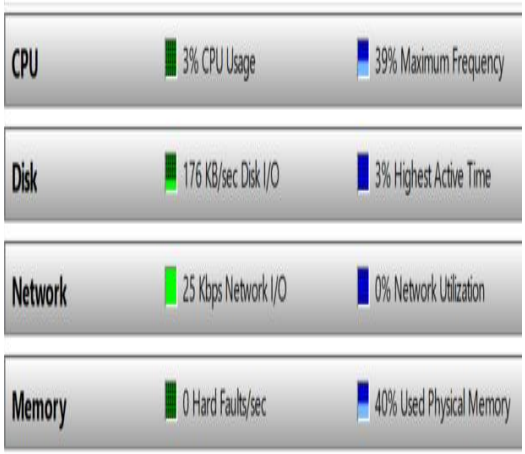

Figure 3. Normal Resource Usage

After the execution of the CrediTag program, the following changes occurred:

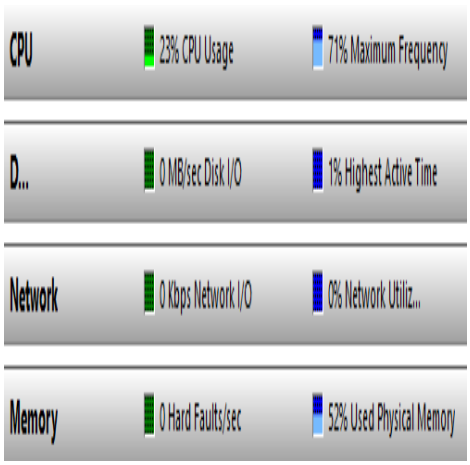

Figure 4. Resource Usage while CrediTag is running.

These changes occurred in system having Operating System of Windows 7, Python version 3.6, Java Jdk version 1.8, a Hard Disk of 500GB, a RAM of 4GB and an I3Intel Processor.

Thus, it can be seen that in a computer whose specifications match those of an everyday personal computer, the program can be run easily while allotting less than one-fifth of the total resources available.

6. Conclusion and Future Work

Thus, CrediTag provides an efficient method of toll payment using Vehicular Adhoc Networks and Blockchain. It ensures privacy as well as anonymity. The vehicles communicating in VANET environment exchange current location and surrounding traffic. The use of blockchain technology ensures privacy and free from security breaches. The cost can be greatly reduced as there is no need of any establishment of infrastructures such as bar code scanner, employees in the toll booth.

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CrediTag focuses on a single instantiation of toll payment. This is a simulation and in future, this technology can be implemented in real time systems utilizing a large network with real time functioning on several computing systems. Overall, this technology can be used to ensure that the waiting time in toll booths are either reduced partially or completely in future to ensure the smooth and efficient functioning of toll payment systems by the government.

References

[1] Dimitri do B. DeFigueired and Earl T. Barr, "Trust Davis: A Non-Exploitable Online Reputation System", 7th IEEE International Conference on E-Commerce Technology (**2005**).

[2] Bhagirath Patel and Khushbu Shah, "A Survey on Vehicle Ad-Hoc Networks", IOSR Journal of Computer Engineering (IOSR-JCE), Volume 15, Issue 4, November – December (**2013**), PP 34-42.

[3] Alexandre Viejo, Francesc Seb´e and Josep Domingo-Ferrer, "Aggregation of Trustworthy Announcement Messages In Vehicle Ad Hoc Networks", IEEE 69th Vehicular Technology Conference, Spain, April (**2009**).

[4] Ben-Sasson, Chiesa, Garman, Matthew, Ian Miers, Eran Tromer, Madars Virza, "Zerocash: Decentralized Anonymous Payments from Bitcoin", IEEE Symposium on Security and Privacy, San Jose, USA, May (**2014**).

[5] Maxim Raya, Adel Aziz and Jean-Pierre Hubaux, "Efficient Secure Aggregation in VANETs", Proceedings of 3rd International workshop on Vehicular ad hoc networks, September (**2006**), Pages 67–75.

[6] Wafa Ben, Mauro Conti, Mohamed, Claudio E. Palazzi, "Fast and Secure Multihop Broadcast Solutions for Intervehicular Communication", IEEE Transactions on Intelligent Transportation Systems, Volume: 15 , Issue: 1, February (**2014**).

[7] Florian Dötzer, "Privacy Issues in Vehicular Ad Hoc Network", PET 2005: Privacy Enhancing Technologies, Germany, (**2005**), pp 197-209.

[8] Guilin Wang, L Chen, SL.Ng, "Threshold Anonymous Announcement in VANETs", IEEE Journal on Selected Areas in Communications, Volume: 29 , Issue: 3 , March (**2011**) Page(s): 605 – 615.

[9] M. Pease, R.Shostak, L.Lamport, "Reaching Agreements in presence of faults", Journal of the Association for Computing Machinery, Vol 27, No 2, April (**1980**).

[10] Liqun Chen and Siaw-Lynn Ng, "Comments on Proving Reliability of Anonymous Information in VANETs", IEEE Transactions on vehicular technology, vol. 59, no. 3, March (**2010**), Page(s): 1503 - 1505.

[11] Lun Li , Jiqiang Liu, Lichen Cheng, Shuo Qiu, Wei Wang, Xiangliang Zhang, and Zonghua Zhang, "CreditCoin: A Privacy-Preserving Blockchain-Based Incentive Announcement Network for Communications of Smart Vehicles", IEEE Transactions on Intelligent Transportation Systems, Vol. no:19, Issue no:7, (**2018**).

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