Collaborative Fog Environment And Multi-Level Resource Sharing Framework In Data's

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Abstract- *For computation, storage, and communication, fog computing has outperformed classic cloud designs, where edge devices are leveraged to support delay-sensitive applications. Fog nodes have made computational intelligence more accessible to end devices. There are numerous fog computing frameworks that leverage edge devices for computation. In this paper, they suggested a fog device simulation framework that may leverage end devices to handle the peak computing demand to deliver higher Quality of Services (QoS). The regional fog nodes are placed at network edge locations and act as an intelligent agent to handle computation demands by arranging them on local servers, cloud data centres, or underutilised end-user devices. The suggested device-to-device resource sharing model uses devices with multi-layer designs and the Ant Colony Optimisation (ACO) and Earliest Deadline First (EDF) algorithms to deliver a higher quality of service. Performance of existing fog-based systems has been enhanced by the idea of using IoT devices as fog nodes. The proposed work is compared to industry standards for system cost, efficiency, energy use, and service quality. In terms of task efficiency, the suggested framework is comparable to xFogSim.*

Keywords- Earliest Deadline First , Ant Colony Optimisation, Quality of Services

I. INTRODUCTION

Cloud Computing is the delivery of computing services such as servers, storage, databases, networking, software, analytics, intelligence, and more, over the Cloud (Internet).

Cloud Computing provides an alternative to the on-premises data centre. With an on-premises data centre, they have to manage everything, such as purchasing and installing hardware, virtualization, installing the operating system, and any other required applications, setting up the network, configuring the firewall, and setting up storage for data. After doing all the set-up, they become responsible for maintaining it through its entire lifecycle.

But if they choose Cloud Computing, a cloud vendor is responsible for the hardware purchase and maintenance. They also provide a wide variety of software and platform as a service. They can take any required services on rent. The cloud computing services will be charged based on usage.

Cloud computing is indeed a consolidated paradigm that leveraged the industry of the Internet of Things (IoT).Applications, which usually require a lot of computing capabilities to run, have been successfully performed “in the cloud” using offloading capabilities. This practice is an effort that offloads (hence the name) most of the application’s workload to a remote data center facility for intensive data processing. This action significantly improves the computing resources of IoT devices facing high computation demands. Particularly, offloading has been useful for resource-hungry applications that span the Big Data concept, which habitually generate a large volume of data at different velocity and variety. However, the reliance on computation capabilities outside of edge devices is not ideal for those applications that require tightly controlled delays (latency) on the data transfer time with remote resources. As cloud data centers are ordinarily localized far away from the devices situated at the edge of the network, a degradation in the application’s quality of service is likely to occur, there for eputting the user’s quality of experience at critical risk.

With greater needs for sensor devices and the internet of things, a huge amount of data is produced which requires extensive computing resources. The concept of 5G has further increased the data generation rate with high-speed data rate between the device-to-device communication is used. Therefore, compute extensive tasks can be offloaded to cloud data centers with an additional cost of multi-hop network latency, end-to-end delay, bandwidth, and congestion. However, to facilitate the delay-sensitive tasks such as medical, power, gas and oil leaks, the concept of fog computing is adopted that helps in performing task computations on near fog devices. Thus, reducing the network load while sending the data to cloud data centers. This inclusion helps in reducing task latency, end-to-end delay, and bandwidth. In a multi-agent fog environment, the concept of fog broker is used which manages the local fog nodes, defines task execution policies, and communicates with other devices.

There are three layers in conventional fog networks. The lower level comprises IoT devices that request resources from gateway broker nodes. The second step comprises gateway nodes that connect the end-user devices with fog nodes and also perform resource management. In case, the gateway broker does not have vacant resources it requests nearby brokers for resources. The broker returns the task results to IoT devices. The application that can be facilitated through fog nodes is security systems, healthcare systems, or facial detection, etc. The gateway broker can schedule the task to local resources; however, doing that constantly can result in long queues which can degrade the system performance.

Efficient energy management module which enables the system to preserve energy through task scheduling over devices having significant energy.

Safe handover mechanism under mobile environment, especially, when both end user device and volunteer fog nodes are mobile, the localization becomes very complex.

Configurable mobility module that allow researchers to include their own mobility models through the extensive markup language.

Evaluate and demonstrate the effectiveness of our proposed policy using the well-established Fog Computing Simulator known as MATLAB.

II. LITERATURE SURVEY

To realize the construction of intelligent transportation system, data mining based on large-scale taxi traces has become a hot research topic. A crucial direction for analyzing taxi GPS data set is to recommend cruising areas for taxi drivers. Most of the existing researches merely concentrate on how to maximize drivers' profits while overlooking the benefit of passengers. Such imbalance makes the existing solutions do not work well in a real-world environment. Here they construct a recommendation system by jointly considering the profits of both drivers and passengers. Specifically, they first investigate the real-time demand-supply level for taxis and then make an adaptive trade-off between the utilities of drivers and passengers for different hotspots. At last, the qualified candidates are recommended to drivers based on the analysis results. Simulation results indicate that the constructed recommendation system can achieve a remarkable improvement on the global utility and make equilibrium between the utilities of drivers and passengers, simultaneously.

Vehicular social networks (VSNs) have attracted the research community due to its diverse applications ranging from safety to entertainment. Social vehicles standing for private cars and floating cars standing for taxis are two important components of VSN. However, the lack of social vehicles data causes some factors are neglected including social aspects and macroscopic features, which blocks researching social attributes of vehicles in VSN. Generating a realistic mobility dataset for VSN validation has been a great challenge. In this work, they present the detailed procedure to generate social vehicular mobility dataset from the view of floating car data, which has the advantage of wide universality. First, through the deep analysis and modelling of the dataset of floating cars and combining with the official data, we predict the origin-destination (OD) matrix of social vehicles with the gravity model, and then calibrate the OD matrix with the average growth factor method. Second, they construct network description after editing the road network. Third, they use simulation of urban mobility to reproduce the scenario in view of micro simulation by generating the mobility dataset of social vehicles based on floating car data and urban functional areas. At last, they prove the effectiveness of our method by comparing with real traffic situation in Beijing. The generated mobility model may not accurately represent the mobility of social vehicles in few spots, such as train station or airport, however, exploiting figures and facts of transportation in the city have been considered in the study to calibrate the model up to maximum possible realization.

In this work, demonstrate that Vehicular Social Networks (VSNs) require specific data dissemination techniques. To this aim, they consider the Barabási model and they study the impact of its use for data dissemination in VSNs. Moreover, the use of a probabilistic data dissemination protocol based on social features proves that the time-evolving dynamics of the vehicular social network graph presents a small-world structure, where nodes tend to connect through clusters whose average distance is low on average. This result highlights how VSNs are a specific class of vehicular ad hoc networks with peculiar features that distinguish them from classical online social networks.

Fabric is the first block chain framework for running distributed applications that is fully extensible. It has flexible consensus protocols that allow it to be adapted to specific use cases and trust models. Fabric is also the first block chain framework to run distributed applications written in generalpurpose programming languages without requiring a systemic reliance on a native crypto currency. Current block-chain platforms, on the other hand, enable "smart-contracts" to be written in domain-specific languages or depend on a crypto currency. Fabric incorporates the permission model by using a compact notion of membership that can be combined with industry-standard technologies.

Wireless vehicular networks offer the promise of connectivity to vehicles that could provide a myriad of safety and driving-enhancing services to drivers and passengers. With wireless technology available on each car, it is expected that huge amounts of information will be exchanged between vehicles or between vehicles and roadside infrastructure. Due to defective sensors, software viruses, or even malicious intent, legitimate vehicles might inject untrustworthy information into the network. Besides relying on the public key infrastructure (PKI), this article proposes a social network approach to study trustworthy information sharing in a vehicular network. They first cover recent research progress in measuring direct trust and modelling indirect trust in online social networks then discuss how to apply them to vehicular social networks despite several pressing research challenges.

The Internet-of-Vehicles (IoV) allows vehicles to share information for common services, such as traffic status or safety alerts, not only among themselves but also with neighbouring devices and users. Vehicular Social Networks (VSNs) appear when IoVs is combined with social features like chat, sharing achievements, wish-listings, etc. In this work, they demonstrate that VSNs require specific data dissemination techniques. To this aim, they consider the Barabasi model and they study the ´ impact of its use for data dissemination in VSNs. Moreover, the use of a probabilistic data dissemination protocol based on social features proves that the time-evolving dynamics of the vehicular social network graph presents a small-world structure, where nodes tend to connect through clusters whose average distance is low on average. This result highlights how VSNs are a specific class of vehicular ad hoc networks with peculiar features that distinguish them from classical online social networks.

Participatory social networks can provide great amount of data about users and their surroundings. When properly crafted, this data can be used as an important source of information about human behaviour. In this work, they use a vehicular social network aiming to evaluate the impact of external factors from vehicular environments on users' contributions to social networks. Results from a publicly available Waze dataset show that users are mostly motivated to post traffic jam information and that they do it during rush hours on weekdays and during the afternoon on weekends. They also observe that users who receive low reliability on their posts tend to keep low scores in the following. Finally, results additionally indicate that users at higher speeds do not contribute to the network and that posts experiencing longer delays until published are poorly evaluated.

III. PROPOSED SYSTEM

The proposed simulation framework for fog networks that inherit the concept of the device to device communication to offload the task to the nearby end device. These end devices are named as volunteer nodes because they volunteer their resources and communicate directly with task requesting nodes to achieve the device-to-device communication feature of 5G. There are gateway nodes act as a broker node to resolve the incoming computing requests. The dedicated fog devices and volunteer devices are used to perform computation. The framework is dynamic, devices having sufficient energy, and available resources can participate in the resource sharing model where the broker nodes allocate requests to the most capable device, keeping in view the energy and other constraints. When a task is performed, the volunteer computing device sends results directly to the requesting device and acknowledges to the broker device.

The proposed simulation framework consists of mobile and static nodes. Let's assume, there are n fog locations. Each fog node has a broker node that can resolve the incoming computing requests. Moreover, there are few mobile devices which act as a fog node to share their resources. Whereas, the requests are generated from user devices that only send requests which are resolved through fog broker. The user device sends job tasks to the fog broker with the strict QoS constraints. The fog broker schedules the incoming computation jobs to a local fog node or volunteer device.

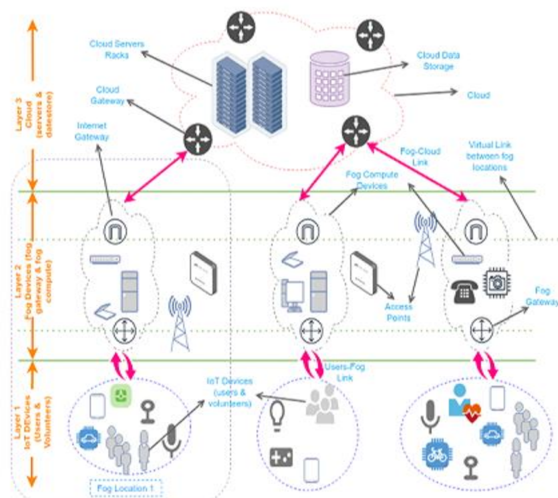


Fig 1 Block Diagram of Proposed System

MODULES DESCRIPTION

User devices

The nodes which include IoT sensors, mobile devices, and other handheld devices. These devices communicate with gateways devices to resolve computation requests.

Volunteer user devices

- Volunteer devices are the mobile fog nodes which can share their resources on request.
- The volunteer devices broadcast their resource information along with available energies to nearby fog gateway nodes.
- This received information is used to select the most suitable device for the request.
- The volunteer node executes the assigned task and returns the result directly to the requesting user nodes.
- Thus, for result delivery no intermediate node is considered, this is to reduce the delay and network congestion.

Design Fog gateway

- It is responsible for receiving resources requests, heartbeats messages from the user, and volunteer devices.
- The gateway selects the suitable device for the incoming request and forwards the task to the selected device accordingly.
- The potential computation devices include dedicated fog nodes available at fog gateways, neighboring fog locations, cloud data centers, or volunteer end devices.
- The resource allocation algorithm is responsible for selecting the computation device.

Dedicated Fog Servers

- It refers to the nodes available at each fog location having significant computing resources with no energy constraints.
- These servers can accommodate multiple requests at a time.
- The fog servers share their resource information along with task residence time with gateway nodes.
- This information is used for computation device selection.

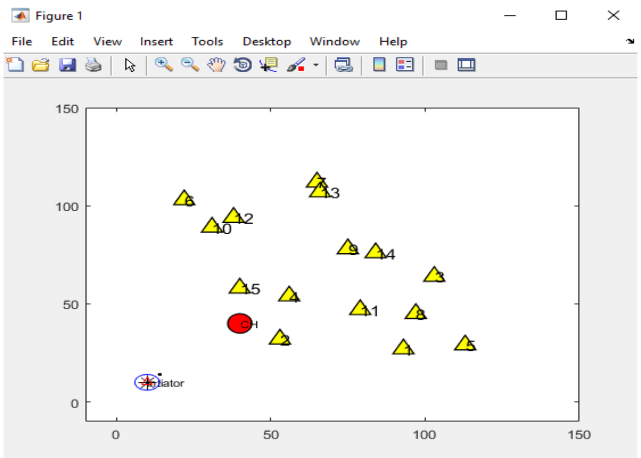
Cloud data centres

- This module can handle compute and data-intensive tasks.
- Moreover, with specific APIs, sensor data can be stored in the data centers.
- Further, this module is added to support batch processing with no stringent deadlines; whereas, these tasks may require resources for concurrent execution.
- In such cases, the framework provides an interface to upload those tasks to the cloud where more compute resources are available.
- Such tasks may include machine learning and artificial intelligence algorithms where the intermediate results are the input for the next layer.
- In such situations, the cloud data centers perform the required computations and share the results with fog nodes for better intelligent decisions

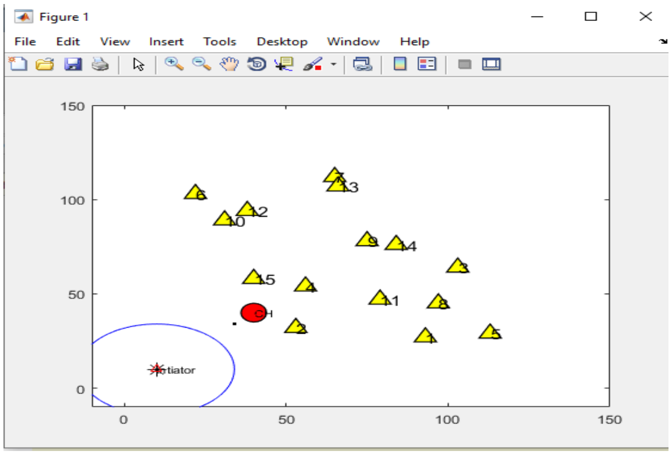
Mobility Models & Handover

- The mobility is an important aspect of performance degradation in a mobile environment.
- The fast-moving vehicles or devices can very rapidly disassociate from the network.
- Therefore, data loss and re-transmissions decrease overall network performance/efficiency.
- In the proposed framework, devices can adopt different mobility models.
- The list of mobility modules that exist is Linear, Circular, Gauss Markova, Turtle, etc. Moreover, to handle the impact of various mobility modules, a handover module is inherited to help device association through access points to prevent data loss.

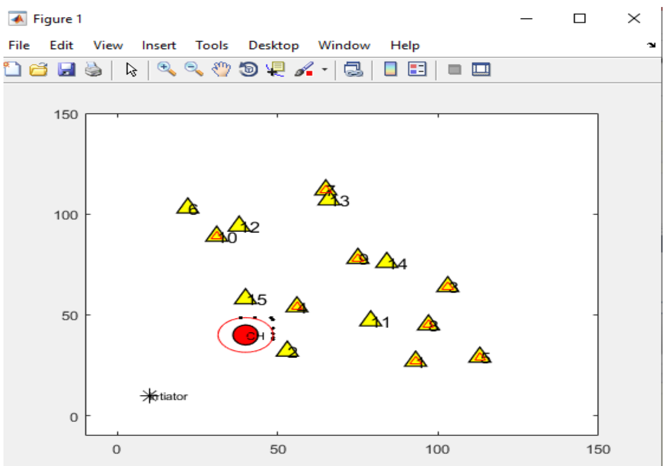
IV. SCREEN SHOTS



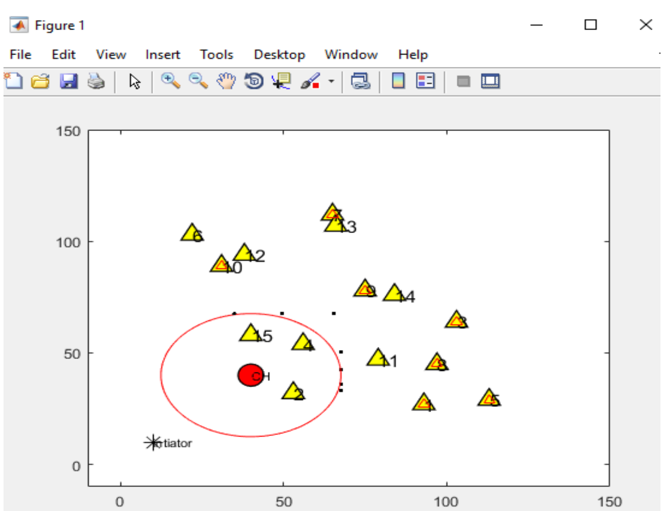
Create a Nodes in Cloud



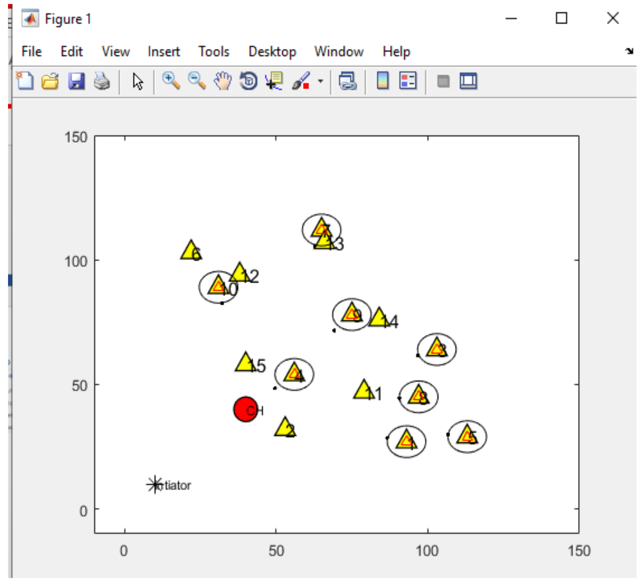
Start Data Transmission



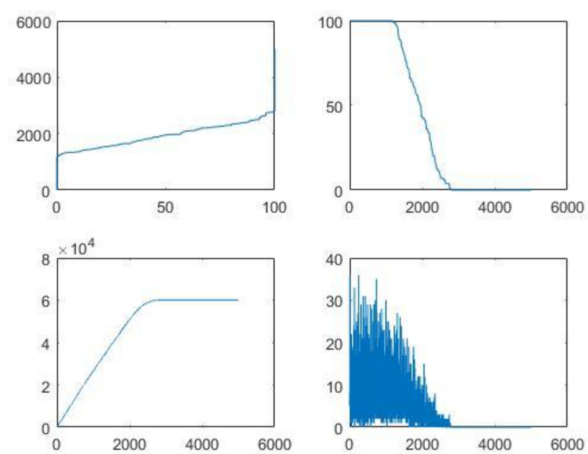
Header Communicate between the nodes



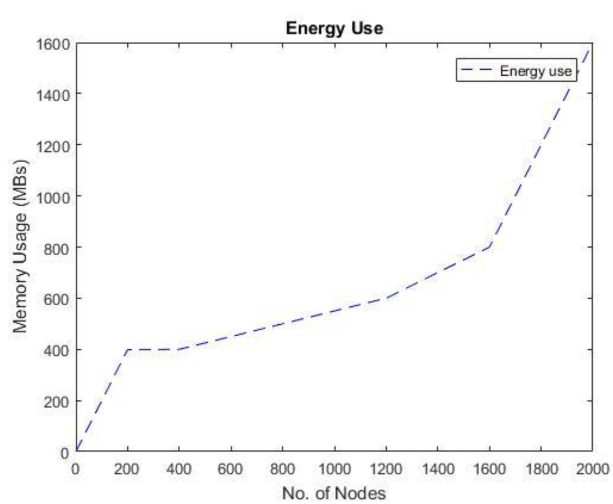
Nodes Get the data



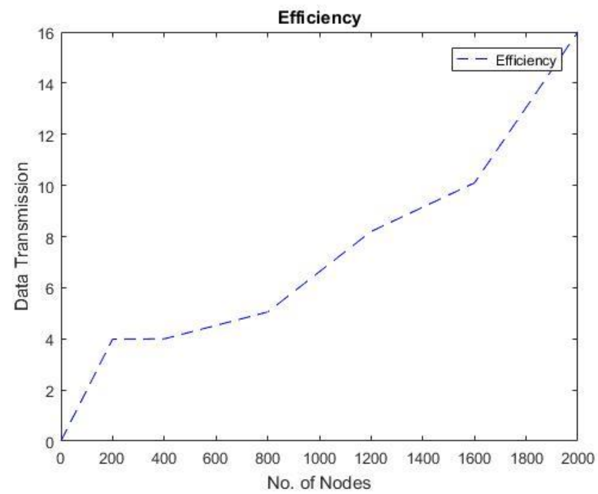
Nodes are Communicate with each other



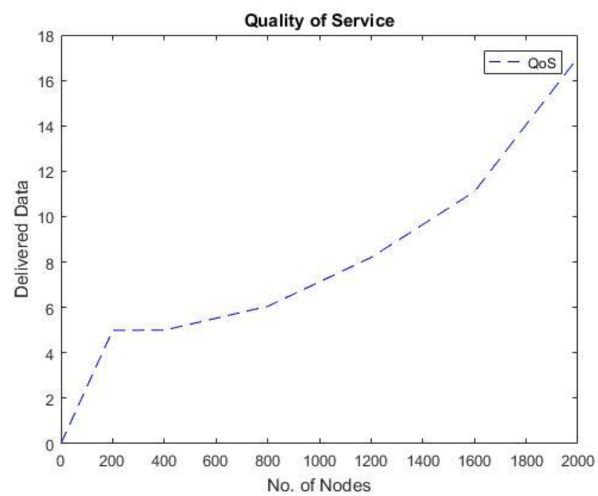
Analysis of Data Transaction



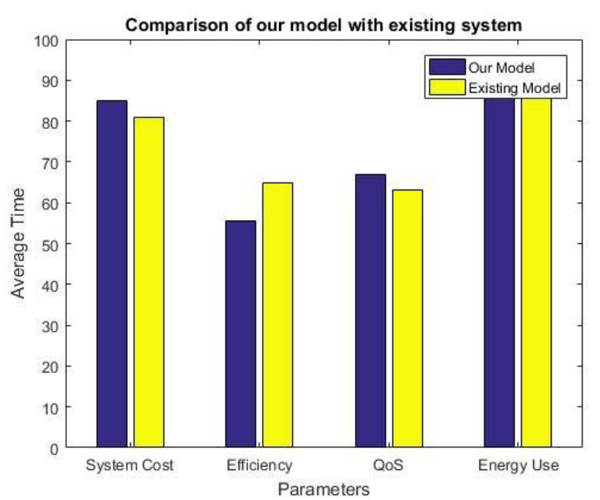
Performance of Energy Use



Performance of Efficiency



Performance of QoS



Comparison of Proposed and Existing System

V. CONCLUSION

Fog computing has proven its role for delay-sensitive applications in both domestic and industrial environments. This paper proposed a simulation framework based on a IoT device grid that can act as a fog node to execute the requested tasks. The mobile devices are promoted to fog nodes depending on their energy level and computation capacity. The nodes can move following the pre-defined mobility models. To achieve service quality, an algorithm is proposed which helps in better utilizing the available resources and achieve maximum system throughput. Thus, the framework provides a multilevel resource sharing model. The tasks are allocated based on task deadlines. The evaluation section shows a significant gain in performance by adopting various IoT devices as a work force for the roadside units. However, the proposed work relies on nearby IoT devices; thus, limited availability or access to these devices can affect the performance of the proposed system.

To overcome this limitation, our proposed scheme computes the best component(s) to be moved upwards in the fog-cloud hierarchy based on data deadlines. In the future, planning to expand this work by incorporating machine learning algorithms to predict device mobility patterns and select the most suitable device for task offloading. Similarly, another way forward is to explore the task dependency issues for the fog computing environment.

REFERENCES

[1] Wang, Xiaojie, Hengyuan Zhang, Lei Wang, and Zhaolong Ning. "A demand-supply oriented taxi recommendation system for vehicular social networks." IEEE Access 6 (2018): 41529-41538.

[2] Kong, Xiangjie, Feng Xia, Zhaolong Ning, Azizur Rahim, Yinqiong Cai, Zhiqiang Gao, and Jianhua Ma. "Mobility dataset generation for vehicular social networks based on floating car data." IEEE Transactions on Vehicular Technology 67, no. 5 (2018): 3874-3886.

[3] Vegni, Anna Maria, Valeria Loscrí, and Pietro Manzoni. "Analysis of small-world features in vehicular social networks." In 2019 16th IEEE Annual Consumer Communications & Networking Conference (CCNC), pp. 1-2. IEEE, 2019.

[4] Androulaki, Elli, Artem Barger, Vita Bortnikov, Christian Cachin, Konstantinos Christidis, Angelo De Caro, David Enyeart et al. "Hyperledger fabric: a distributed operating system for permissioned blockchains." In Proceedings of the thirteenth EuroSys conference, pp. 1-15. 2018.

[5] Yang, Qing, and Honggang Wang. "Toward trustworthy vehicular social networks." IEEE Communications Magazine 53, no. 8 (2015): 42-47.

[6] Vegni, Anna Maria, Valeria Loscrí, and Pietro Manzoni. "Analysis of small-world features in vehicular social networks." In 2019 16th IEEE Annual Consumer

Communications & Networking Conference (CCNC), pp. 1-2. IEEE, 2019.

[7] Neto, Victor R., Dianne SV Medeiros, and Miguel Elias M. Campista. "Analysis of mobile user behavior in vehicular social networks." In 2016 7th International Conference on the Network of the Future (NOF), pp. 1-5. IEEE, 2016.

[8] Nakamoto, Satoshi, and A. Bitcoin. "A peer-to-peer electronic cash system." Bitcoin.–URL: https://bitcoin. org/bitcoin. pdf 4 (2008).

[9] Xu, Xiwei, Ingo Weber, Mark Staples, Liming Zhu, Jan Bosch, Len Bass, Cesare Pautasso, and Paul Rimba. "A taxonomy of blockchain-based systems for architecture design." In 2017 IEEE international conference on software architecture (ICSA), pp. 243-252. IEEE, 2017.

[10] Xu, Xiwei, Ingo Weber, Mark Staples, Liming Zhu, Jan Bosch, Len Bass, Cesare Pautasso, and Paul Rimba. "A taxonomy of blockchain-based systems for architecture design." In 2017 IEEE international conference on software architecture (ICSA), pp. 243-252. IEEE, 2017.

[11] I. Lequerica, M. G. Longaron, and P. M. Ruiz, “Drive and share: Efficient provisioning of social networks in vehicular scenarios,” IEEE Communications Magazine, vol. 48, no. 11, pp. 90–97, 2010

[12] S. Nakamoto, “Bitcoin: A peer-to-peer electronic cash system,” https: //bitcoin.org/bitcoin.pdf/, 2008.

[13] V. R. Neto, D. S. Medeiros, and M. E. M. Campista, “Analysis of mobile user behavior in vehicular social networks,” in Proceedings of the 2016 7th International Conference on the Network of the Future. IEEE, 2016, pp. 1–5.

[14] G. Wood, “Ethereum: A secure decentralised generalised transaction ledger,” Ethereum project yellow paper, vol. 151, no. 2014, pp. 1–32, 2014.

[15] K. J. O’Dwyer and D. Malone, “Bitcoin mining and its energy footprint,” in Proceedings of the 25th IET Irish Signals Systems Conference 2014 and 2014 China-Ireland International Conference on Information and Communications Technologies. IET, 2014, pp. 280–285.