JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 3371-3376
https://publishoa.com
ISSN: 1309-3452

A Novel Framework for an ECC Secured Recommender System for Automated car Parking Management using Cloud and Edge System

Mrs.Menaka.N[1]

[1]Research Scholar (Ph.D.), PG and Research Department of Computer Science,
Quaid-E-Millath Government College for Women (Autonomous), Chennai.
menaka.research2021@gmail.com

Dr.Mrs.Jasmine Samraj[2]

[2]Research Supervisor, PG and Research Department of Computer Science,
Quaid-E-Millath Government College for Women (Autonomous), Chennai.
dr.jasminesamraj@qmgcw.edu.in

Received 2022 March 25; **Revised** 2022 April 28; **Accepted** 2022 May 15.

ABSTRACT

Nowadays, smart parking is gaining a lot of attention between people, because it provides quick and convenient parking spaces for cars, at the same time it also facilitates an increase in vulnerability of the user's travel information. Therefore, it has always been difficult to secure user data kept on the cloud. The system proposed an 'Automated Car Parking Based Recommender System' (ACPR) to customize the parking for the user, based on their travel preference. Here the proposed system uses the main cloud system for global parking management and Edge Systems for localized parking management. To overcome the existing privacy issues (identity, location, availability management, authentication etc…) the system adapts Elliptic Curve Cryptography (ECC) algorithm. This novel automated recommendation paired with ECC enhances the security, ensuring the suitable recommendation with high-level privacy on the user and driver's data. The experiments demonstrates that the system additionally provides recommendation to nearby hotspots preserving privacy and the system contains low overheads and is very cost-effective.

Keywords- Car Parking and Hotspot Recommendation System, Elliptic Curve Cryptography (ECC), Edge Systems, Security.

I. INTRODUCTION

Smart city provides smart services to its users. One example of this transition is Smart Parking System (SPS). SPS facilitate each of its owners and the users. Several corporations have already invested, and lots of applications have already been projected in this important analysis area. Whereas sharing automobile parking space data could help users, it also poses security and privacy risks corresponding to authentication, single purpose of failure, location, and identity disclosure [1,2].

In figure 1: the smart parking scenario are discussed, two differing kinds of implementations are usually mentioned [3]. In the initial phase, it's the responsibility of the smart parking application to receive user's requests then suggest the vacant automobile parking space for the user by itself, this strategy is usually utilized.

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 3371-3376
https://publishoa.com
ISSN: 1309-3452

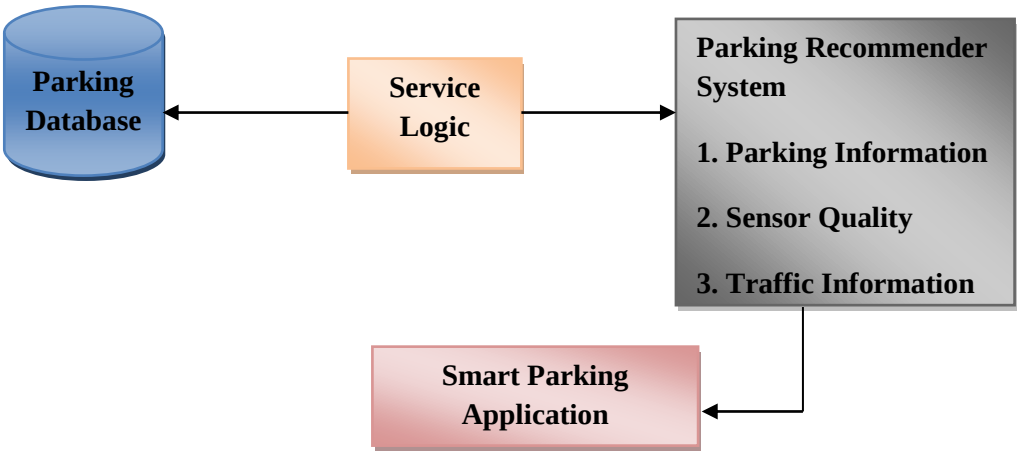

Figure 1: General Smart Parking System using Recommender system

For the second kind, the smart parking application gathers user requests. It sends these to a third-party Recommender System that suggests parking heaps related to various factors adore traffic situations, proximity, parking quality, and user experience. Due to the shortage of access to a range of services, an advanced-smart parking application can have great issues assessing the numerous factors that enter providing parking suggestions for users. Consequently, it's suggested that use the services of third-party recommender systems that are dedicated to achieving these services.

The second implementation (recommendations from a 3rd party) mentioned above is the focus of this research. Each implementation acknowledges that the advanced parking app is reliable for gathering consumer requests and establishing a parking database. The second kind of solution, on the other hand, includes a third-party recommender system as shown. The system plans this article, by analyzing the defaults in existing literature, the system planned localized privacy model and code related model to handle the privacy and security problems.

- An Automated Parking Car Based recommender system' (ACPR) is used to recommend the suitable parking according to the users convenience.
- The system proposed the anonymous authentication mechanism for secured registration utilizing recommendation to supply anonymity and integrity throughout the communication process.
- Also, the system possesses resistant against impersonation attacks, the system further defend communication between users and Key Distribution Center.
- The system adapts ECC algorithm to secure the system from third party threat. As the third parties cause a major threat to each the protection and privacy of the user.
- The trade-off between both privacy and utility is assessed by experimental data, drawn through actual parking metrics, permitting users to urge parking lot suggestions whereas protective their privacy.
- Additionally, to preserve the driver's privacy and security, the system planned a model that has low storage overheads, computation, and communication.

The rest structure of this article is defined as follows. Section 2 discusses the preliminaries and required background details of smart parking system. And Section 3 describes related work. The model of the system, as well as design goals for the system, is explained in section 4. Section 5 defines the results of the performance evaluation as well as the security enhancement. Section 6 concludes with a conclusion and future research.

II. LITERATURE SURVEY

Lu et al. [4] advised a public parking system for big car parks that maintains the secrecy of its users. Roadside units (RSUs) are placed in the parking structure so as to gather data from sensors set at parking spots. Ni et al. [5] planned a

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 3371-3376
https://publishoa.com
ISSN: 1309-3452

theme to produce information to drivers, via a cloud server, on wherever to park, protective their privacy. According to the strategy a driver can submit encrypted request to the nearest RSU that contains the driver's current position, destination, and current and arrival timings. Whenever a vehicle reaches an RSU, it delivers an encoded question towards the cloud server that either decodes it or provides open lot feedback to the user. Huang et al. [4] allows autonomous vehicle (AV) drivers to find the nearest parking lot in real time whereas maintaining their privacy in their localized. Authors of [6] recommend a parking management system that uses cluster signatures to safeguard the privacy of its users. In [7] G. Wang et al., introduced a secured VANET system. Y. Saleem et al. [8]. However, these systems have a serious disadvantage that they have a third party for information perturbation and believe a centralized parking management system. A. Amiri et al. [9], [10] planned a wise parking system utilizing block chain within which the author used cloaking technique to generalize the cars locations into cloaking area to preserve the privacy of the drivers. Some parking service suppliers have adopted differential privacy technique which is not effective.

III. METHOD IMPLEMENTATION

The key goal of the system is to provide an adaptable smart Parking System with enhanced security.

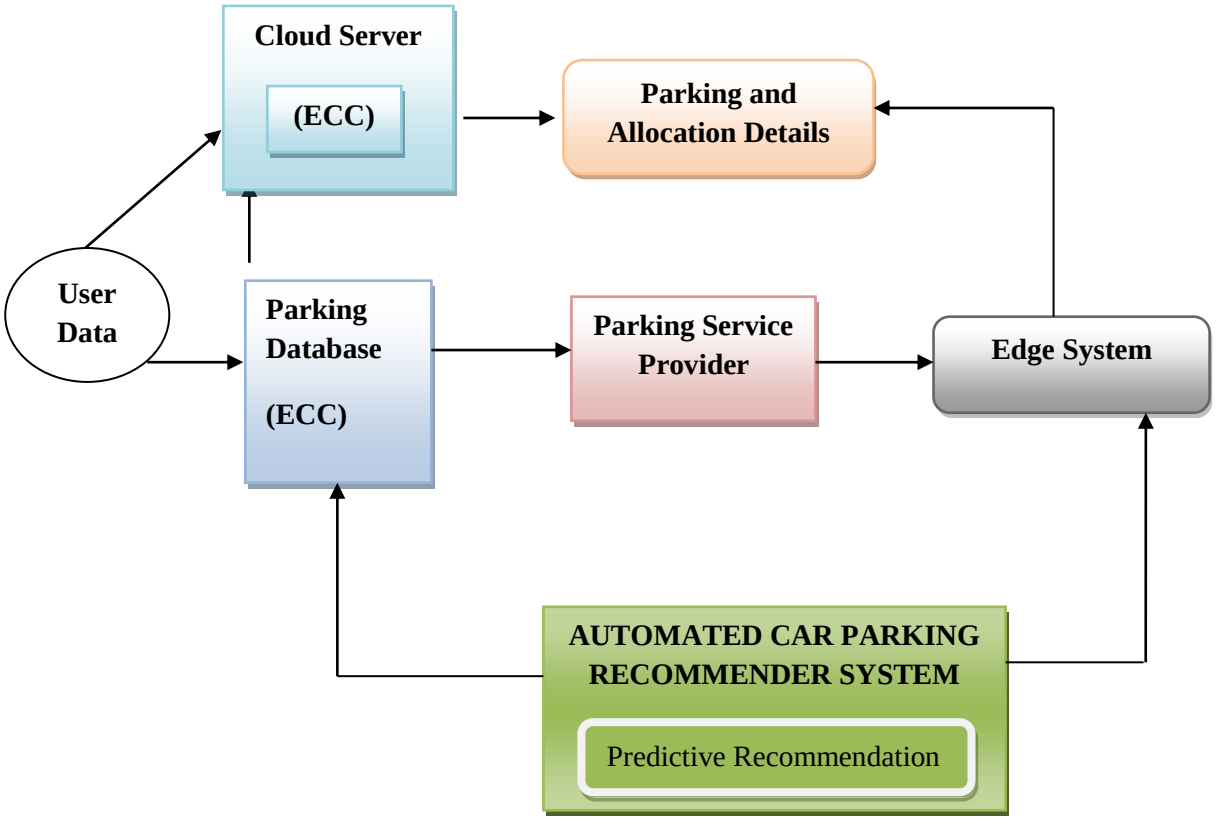

Figure 2: Proposed System Architecture

From Figure 2: The detailed system model is deliberated, providing an automated Smart Parking System.

a) **User:** Here the users are drivers handling the car. All the user details are collected and checked for reference. After validating the details are stored in the main server.

b) **Edge System:** The proposed model adapts edge systems to handle localized parking system. The edge system contains the details of local or nearby parking slot. The parking can also be pre-booked according to the availability and convenience of the user. If any congestion or attack occurs the edge system alerts the user and server to preserve the records.

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 3371-3376
https://publishoa.com
ISSN: 1309-3452

c) **Automated Car Parking Recommender System(ACPR):** It is recommendation systems that makes suggestions based on a range of constraints such as parking availability and traffic statistics etc… the system also recommends the nearby hotspot considering to the user's previous records.

d) **ECC**: For Privacy Preserving the system uses (ECC) which is a Cryptographic algorithm Using Elliptic Curves. ECC is very beneficial in securing communication among multiple entities. To prevent from attacks and for privacy preserving the system adapts ECC for encrypting recommendations.

e) **Predictive Recommendation:** Using the preferred rating and validating the user travel history the recommendation of nearby hotspots are made automatically on prediction basis.

Hence, through proposing an Automated Car Parking Based Recommender System' the parking is made more comfortable and easier. The system is cost-effective producing more convenience to the user.

Algorithm 1. Algorithm for privacy preserved cloud parking through edge system

Input: parking details
Output: parking recommendation

```
Begin
{
 Read: Car details
 Set: i=0// assign car parking details to edge system
 Initialize: Car = 0 //initialize car for parking
Do
{
Car subscription in edge system
Cloud edge integration
   While (parking available)
      {
Car subscription
Encrypt sensitive data
Recommend parking suggestion
        }
} Until (EOF)
}
```

Step 1: The car details are uploaded and an analysis on the parking is made.

Step 2: Then the analyzed parking details are assigned to the edge system.

Step 3: The cars are allotted to the respective parking.

Step 4: Then, cars subscription in edge system is enabled.

Step 5: Then cloud and edge integration is performed.

Step 6: The car subscriptions to the parking are done.

Step 7: The sensitive data of the user and driver are encrypted.

Step 8: Then the hot Spot and suitable parking suggestions are produced to the user.

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 3371-3376
https://publishoa.com
ISSN: 1309-3452

IV. RESULT ANALYSIS

In the result analysis the proposed ACPR system is compared with various existing system with time and Security and final results are made accordingly. A Large Scale text data set for recognizing user data are taken from Kaggle. The data set used Github Repository for this dataset and trained model. The data set scraped about 4500 user travel data to evaluate the user preference.

Table 1: Comparative analysis of ACPR model with LDP Model

Privacy Budget	ACPR Model	LDP Model
0.1	**4**	**6**
0.2	**3**	**7**
0.3	**3.5**	**6.5**
0.4	**3**	**5**

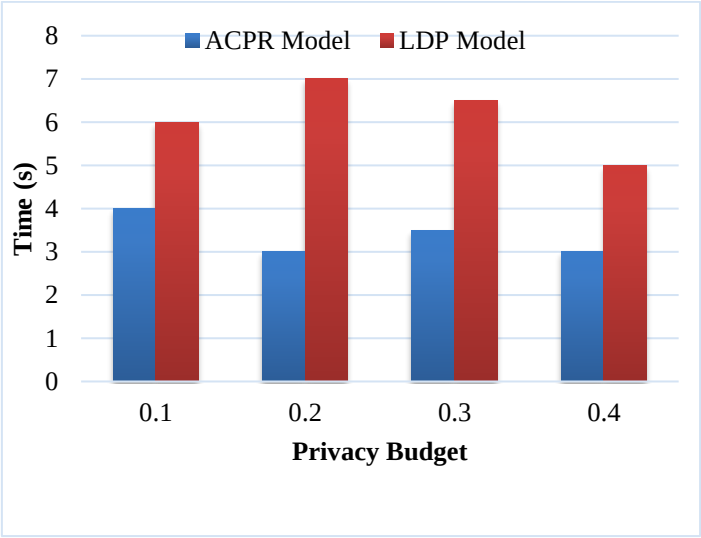

Figure 3: Time Complexity of ACPR and LDP on varied privacy budget.

In figure 3: The time complexity on privacy budget is discussed. Here in first slot the proposed ACPR model took 4 Seconds Whereas the LDP model took 6 seconds. Same as that continuously the ACPR model consumes less time with budget privacy measures.

Table 2: Performance Evaluation between Existing Models and Proposed Model (ACPR)

Parameters	ACPR	DLT	LDP
Time Consumption	**2**	**6**	**5**
Recommendation	**7**	**4**	**2**
Privacy	**7**	**6**	**4**
Performance	**6.5**	**3.5**	**4.5**

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 3371-3376
https://publishoa.com
ISSN: 1309-3452

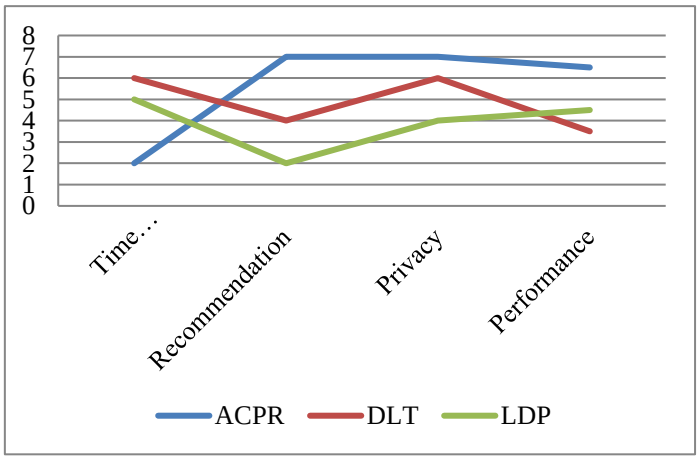

Figure 4: Performance evaluation of ACPR with DLT and LDP

In above Figure 4: The overall performance is compared with the proposed 'Automated Car Parking Based recommender system' (ACPR) with Distributed Ledger Technology (DLT) and Local Differential Privacy (LDP) are made and proposed system is proved to be the best and adaptable one.

V. CONCLUSION

The paper proposed a secure and privacy-preserved Automated Car Parking Recommender Scheme (ACPR) based on Elliptic Curve Cryptography (ECC). The system adapts Cloud System to handle the global recommendation and edge system to handle the localized recommendation. Additionally, the system provides the recommendation to the nearby spot as an added guidance to the vehicle user. Hence through the proposed system the parking facilities are made easier with enhanced privacy. In future, the payment schemes are concentrated and made more comfortable to reduce the waiting time.

REFERENCES

[1] Worldwide Interoperability for Semantic IoT (WISE-IoT). Accessed: December 1, 2019. [Online]. Available: http://wise-iot.eu/en/home/.

[2] P. Sotres, C. Torre, L. Sanchez, S. Jeong, and J. Kim, ''Smart city services over a global interoperable Internet-of-Things system: The smart parking case,'' in Proc. Global IoT Summit, 2018, pp. 1–6.

[3] B. Shao, X. Li, and G. Bian, ''A survey of research hotspots and frontier trends of recommendation systems from the perspective of knowledge graph,'' Expert Syst. Appl., vol. 165, Mar. 2021, Art. no. 113764.

[4] R. Huang, C. Lu, X. Lin, and X. Shen, ''Secure automated valet parking: A privacy-preserving reservation scheme for autonomous vehicles,'' IEEE Trans. Veh. Technol., vol. 67, no. 11, pp. 11169–11180, Nov. 2018.

[5] J. Ni, K. Zhang, Y. Yu, X. Lin, and X. Shen, ''Privacy-preserving smart parking navigation supporting efficient driving guidance retrieval,'' IEEE Trans. Veh. Technol., vol. 67, no. 7, pp. 6504–6517, Jul. 2018.

[6] L. Zhu, M. Li, Z. Zhang, and Z. Qin, ''ASAP: An anonymous smartparking and payment scheme in vehicular networks,'' IEEE Trans. Depend. Sec. Comput., vol. 7, pp. 133496–133508, Sep. 2018.

[7] M. Arif, G. Wang, and V. E. Balas, ''Secure VANETs: Trusted communication scheme between vehicles and infrastructure based on fog computing,'' Stud. Inform. Control, vol. 27, no. 2, pp. 235–246, 2018.

[8] Y. Saleem, M. H. Rehmani, N. Crespi, and R. Minerva, ''Parking recommender system privacy preservation through anonymization and differential privacy,'' Eng. Rep., vol. 3, no. 2, Feb. 2021, Art. no. e12297.

[9] W. A. Amiri, M. Baza, K. Banawan, M. Mahmoud, W. Alasmary, and K. Akkaya, ''Alasmary and K. Akkaya, ''Towards secure smart parking system using blockchain technology,'' in Proc. IEEE 17th Annu. Consum. Commun. Netw. Conf. (CCNC), Jan. 2020, pp. 1–2.

[10] W. A. Amiri, M. Baza, K. Banawan, M. Mahmoud, W. Alasmary, and K. Akkaya, ''Privacy-preserving smart parking system using blockchain and private information retrieval,'' in Proc. Int. Conf. Smart Appl., Commun. Netw. (SmartNets), Dec. 2019, pp. 1–6.