International Journal of Scientific Research and Engineering Development-– Volume 8 Issue 2, Mar-Apr 2025

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RESEARCH ARTICLE OPEN ACCESS

Smart Car parking System using Blockchain and IOT

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Abstract:

Due to urban regeneration, the expansion of transit services into suburban regions, and the overall trend toward increasing mobility in our society, the number of visitors and clients in many metropolitan areas has seen spectacular rise in recent years. The outcome is an excess of cars compared to available parking spots. An effective parking management system is now necessary because of this. A citizen who wishes to park their vehicle on the premises of any business can receive a decent service via the use of an automated system that is based on an Internet of Things (IOT) parking management system. With the use of sensors, the Internet of Things (IoT) links the physical infrastructure of parking spaces with information and communication technologies. This allows for the provision of smart management services based on applications. An Internet of Things (IoT) application would be created to put this idea into action. Using this software, users will be able to see which parking lots have available spots and park accordingly. Every parking lot should have a control system that can track the availability of parking spots, whether they are free or not, and let users know if the lot is open or not. Also, the app will show you how much you owe for parking based on how long you parked. Additionally, it can detect when a car has pulled up to the gate, allowing for automatic opening. Operators can now use the robotic guide lines to autonomously park the car after checking for available spaces.

Keywords: Automatic Car Parking System, IOT, Robotic Car parking, Slot Assignment

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I. INTRODUCTION

Issues with traffic are inevitable. This is because the built-in parking facilities and transportation networks just can't handle the current volume of vehicles. The smart parking system was created to help with the issues highlighted above. Thanks to the smart parking system, customers may find and reserve a spot at any parking lot that suits their needs. The installation of a hassle-free payment method also facilitates the entry and exit of vehicles. Internet of Things (IoT) based parking management systems allow us to provide excellent service to citizens who wish to park their vehicles on the premises of any company. With the use of sensors, the Internet of Things (IoT) links the physical infrastructure of parking spaces with information and communication technologies, allowing for the provision of smart management services that are based on standalone devices. A standalone program would be created to put this idea into action. Users will be able to see what parking spaces are available and reserve a specific lot using this standalone app. Every parking lot should have a control system that can track the availability of parking spots, whether they are free or not, and let users know if the lot is open or not. Also, the app will show you how much you owe for parking based on how long you parked. Additionally, it can detect when a car has pulled up

to the gate, allowing for automatic opening. With this feature, customers can easily find parking spaces that are available for hassle-free parking. So, the parking problem is resolved by the system.

[1] An innovative and comprehensive integration of the Hungarian job allocation system with the H-net neural network has generated a frame capturing model, which can be informed by the research of Shubham gade et al., but it requires the recognition of a specific block. The author will now use the sequence list to improve the slot allocation outcomes. This crucial data allows for real-time tuning of the scheduling approach used to locate the nearest electric vehicle charging station. Here the author obtains a sorted list as part of the choice tree process. The decision-tree method locates the nearest EV charging station and checks for availability using this list. Findings from this study might be useful in proving the efficacy of the Hungarian method of task allocation.

[2] In various domains, including parking space occupancy prediction, the deep learning approaches proposed by H. Canli et al. [2] have shown to be effective. This research presents a novel approach to predicting when parking spaces will be full using cloud computing and deep learning, as well as a novel mobile app for this purpose. The occupancy rate of parking spaces was predicted using a long short-term memory (LSTM) model based on deep learning, which can handle big data sets and multiple variables with relative ease. Models were developed with various parameters and scenarios and compared to SVM, Random Forest, and ARIMA models to show how effective the model was. Tables 3 and 4 display the outcomes. A training set that included Capacity, Density, Time, Day, and Holiday yielded a 99.57% success rate. [3] the third A smart parking management system that utilizes AI techniques was introduced by Hwan Jung et al. The system that was put into place is able to identify the vehicle by its number, which it then uses as an object identifier, and then follows the vehicle using YOLO technology. A CNN-based deep learning algorithm was used for training and learning purposes in order to determine if a car was parked or if an accident had taken place. After training with a reasonable amount of photos, the deep learning system was found to work effectively in a number of studies that tested detection accuracy.

II. LITERATURE SURVEY

[4] In their description of these systems, Joseph, Leobin, et al. [4] show how they can address parking issues caused by the lack of a contemporary, dependable parking system. Each part of society, including the economy, society, and safety, can benefit from such a system. Additionally, it aids in conserving time, fuel, and the environment. In order to improve the author's parking system without negatively impacting the economy, we can use economic research to identify a realistic proposal.

[5] W. A fully autonomous parking lot was suggested by Kim et al. using edge cluster computing. A mobile edge serving as a fully autonomous vehicle and xed edges utilizing Raspberry Pi as a physical model make up the suggested parking lot. In order to assess the efficiency of smart parking lots, the author utilized the RaSim simulator to compare the travel time and distance in a smart parking lot with that of a conventional parking lot. The author also calculated the optimal number of edges for a smart parking lot service and examined battery consumption during data exchanges between edges. After 13 edge terminals were installed, the smart parking lot cut down on travel time and distance by 47% when compared to the regular parking lot. Since this was the case, thirteen edges were optimal for the smart parking lot.

[6] B. To improve the analysis and management of parking places, Benjdira et al. introduced a system that uses Deep Learning and Image Processing. The author started by outlining why this topic is significant in contemporary urban settings. [7] In order to find out if there are any available

parking spots in a certain region, Amara Aditya et al. proposed that IPS be comprised of an Internet of Things (IoT) framework that sends data in real-time to the cloud. We may also use the included smartphone app to check for local parking availability and make a reservation based on that information.

[8] An intelligent parking system utilizing radio frequency identification (RFID) and a deep learning algorithm is shown in a model by Vo, Van-An et al. While maintaining important features and stable operation, the suggested system is developed with low-cost electronic components to reduce manufacturing costs compared to existing commercial solutions. Using the integrated computer hardware platform of the Raspberry Pi 3, our research team has created an algorithm based on deep learning artificial intelligence.

[9] License Plate Recognition (LPR) is an important component of Internet of Things (IoT) smart parking systems, according to a study by Ming Li et al. [9]. It delves into the two main approaches to LPR detection—traditional and deep learning—and explains why the latter is better. We use insights from earlier studies to overcome the issues presented by deep learning-based LPR algorithms, including the computation cost and accuracy rate. To get around these problems, the suggested approach uses the YOLOv6 algorithm. Making a unique dataset, doing tests, validation, and training, and finally evaluating the proposed model's efficacy are all parts of the process. The proposed method offers better accuracy and lower calculation costs than current state-of-the-art methods, as shown by the experimental findings. With the help of this study, Internet of Things (IoT) smart parking systems can improve their LPR technology, leading to better and more dependable parking management solutions.

[10] Ten. Kalyani, G. et al. The suggested solution uses a live camera feed to identify when a parking spot becomes available. In order to process the parking spot information, the suggested system gathers real-time data utilizing a camera. Prior to determining whether a parking spot is available, its coordinates are provided. The author is able to determine if the parking spots are available by using the coordinates to detect pixel changes. Despite the abundance of similar devices, the suggested method stands apart by utilizing cameras rather than conventional sensors. When compared to a sensor-based parking system, this one uses less money, fewer people, and is easier to set up.

[11] By capitalizing on these enormous technical advances, the Internet of Things (IoT)—introduced by V. Rajyalakshmi et al.—has revolutionized every facet of contemporary life, including parking systems The development of a smart parking system was driven by the desire to automate the process of advising drivers of available spots using an integrated multiple-slot model. This system aims to save the time and money spent on parking lot staffing while also improving the user experience. The goal of developing "smart cities" is to enhance the standard of living for locals by facilitating easier and more efficient modes of mobility. Smart parking technology aids drivers in this area with both parking and car security.

[12]S. Bilotta, Laura. According to et al., predicting the availability of off-street parking spots is a complicated non-linear process that involves numerous types of criteria, such as the variety of parking sites (downtown, on hospital, surrounding theaters, airports, etc.). In this study, we set out to discover a way to forecast, every fifteen minutes for the following twenty-four hours, how many off-street parking spots will be available in the city of Florence. Drivers may benefit greatly from such a forecast for the middle of the road the day before when arranging transportation and parking. In addition, the computing expenses can be significantly reduced with the help of the 24-hour predictions. To that end, they have researched and examined a wide range of methods and performance indicators. two primary methods for evaluating parching predictions were identified by the author in the literature.

[13] A M. In this research, Valizadeh et al. provide

a comprehensive methodology for optimizing the utilization of light parking lots. In this model, an artificial neural network is trained to predict the total demand for parking fees and the number of cars in the lot hourly the following day. This allows for more profitable participation in the market the following day. The development of the real-time market and intelligent car charging/discharging occurred at the same time as the problem of arranging parking participation in the day-ahead market.

[14] More cars on the road means fewer parking spots, thus cities need efficient parking systems, as Dahiya et al. [14] explain. When drivers try to use more conventional means to locate a parking spot, they frequently encounter traffic, lost time, and irritation. The limitations mentioned in this study are addressed, and a model is proposed to alleviate the difficulty that users are facing. Based on a thorough review of various ML models utilizing the IoT-enabled dataset of Birmingham, this work proposes the random forest model for parking spot prediction and compares it with existing methods. Precision, recall, F1-score, and accuracy are some of the evaluation metrics used to validate the suggested model's performance. The results show that when compared to other models, the suggested random forest model predicts the availability of parking spaces in IoT-enabled regions with the highest accuracy and the least amount of waiting time.

[15] M. In their presentation, Turki et al. showcased our PufParkChain solution, which improves both the user experience and operational effectiveness by integrating a lightweight blockchain network. To optimize storage resource requirements for IoT nodes and guarantee efficient latency in automobile authentication, this network is deliberately built. We prioritize the execution of car authentication with a strong focus on security. To strengthen protection and dependability, we leverage the Physically Unclonable Function (PUF). Additionally, the authors have offered a thorough examination of the proposed system's security along with a thorough explanation of how the PUF mechanism is put into action.

III PROPOSED METHODOLOGY

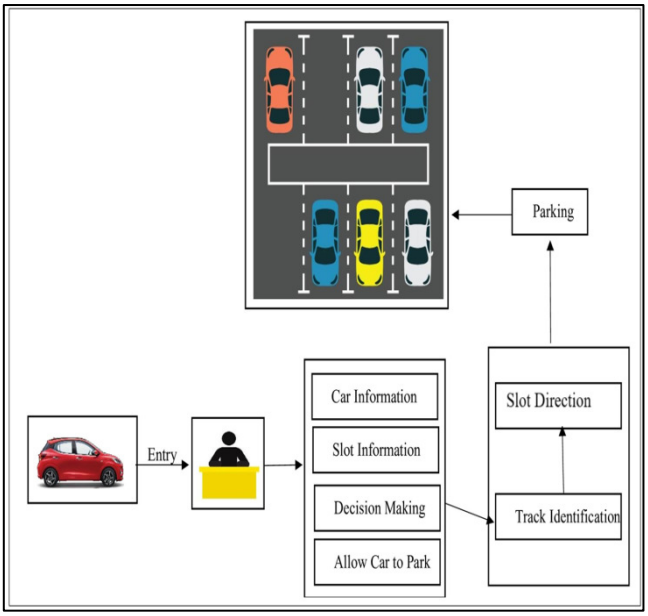

Fig 1:System Overview Diagram

The method that has been suggested to establish a Smart car parking System overview in Figure 1 up top. The suggested method was based in part on the execution of the procedures detailed below.

Step 1: Smart car parking log in frame*:* Launching the project prompts the user to provide their credentials before opening the smart car parking system frame.

Step 2: Registration Frame*:* Clicking the "Register" button is required of all new users. After the user inputs their name, ID, phone number, email address, password, and mobile number, the registration frame opens. A confirmation message will be shown once the registration is complete. The user is able to log in using their credentials when they click OK, which returns them to the main window. The

system launches the operation frame after the user logs in.

Step 3: Operation Frame: You may access the five primary menus on the operating frame: Profile Management, Parking, Location Management, Nearest Parking Station, and Logout. Under "Manage Profile," users have the option to change their name, phone number, email address, and password. Nevertheless, the login ID has not changed. Once the details are updated, a confirmation message will be shown.

Step 4: Parking: Parking, view, delivery, and reset are the four submenus that make up the primary menu for parking. Security with the Help of Blockchain Technology Here, we make use of the Byte Data that was acquired linearly in the previous phase. Individual threads are initiated for every vehicle to guarantee the security of this parking information.
Before storing the byte data, it is used to deploy the blockchain architecture. To do this, we calculate the hash key for the data bytes using the MD5 bit hashing technique. A random character selection is used to compress the resulting hash key, keeping the key length manageable.

At some point in time, you will obtain the block chain's head and body. After doing so for every byte of data, you will get the final head key, which doubles as the terminal key. Keeping these keys and putting them to use in an integrity evaluation using Bilinear Pairing is the next step.

Integrity Evaluation using Bilinear Pairing : The Blockchain containing the bytes of parking lot information is generated in the preceding stage by means of the hash key computation. Utilizing the terminal key to assess integrity through the detection of an Avalanche effect follows its secure generation and storage in the preceding phase. First, the Integrity inquiry layer reiterates the whole blockchain creation process, as mentioned earlier. Therefore, the terminal key that was received is compared to the one that was previously saved. The two terminal keys need to be identical for the data to be considered secure. In such case, the second stage of the integrity examination will be initiated. On the basic level, we can see the Integrity evaluation in Equation 1.

$$\boldsymbol{f(BI)} = \int_0^n (PT! = CT) \Rightarrow f(NTE) \_\_ (1)$$

Where,

$f(B_I)$=Block Integrity

N=Number of CCTV video

P_T=Previous Terminal Key

C_T=Current Terminal Key

$f(NTE)$ =Next Tier Evaluation

Staff members can build a blockchain by entering automobile parking details in the "Parking" submenu, which includes the following fields: slot number, vehicle number, client name, mobile number, date, time, and parking time. Perspective: Employees can examine the table detailing parking information under this submenu. Delivery: In this submenu, you can retrieve car details from the database using the vehicle number. You can also pay for parking by scanning a QR code, which updates the relevant data in the database. Data can be "reset," or removed from the database, using this menu option.

Step 5 : Manage Location : There are two submenus on the main menu of manage location. oversee the area, change the area. The current parking station's coordinates are saved in the database under the "Manage Location" submenu. You can change the parking station's position by editing its latitude and longitude.

Step 6: Nearest Parking Station : From the main menu of the closest parking station, you can access two submenus. Please update the location of the closest parking lot and include it. The closest three parking lots can have their names, addresses, latitudes, and longitudes entered into the database

using this feature.
The details of the nearby parking station can be edited and saved to the database.
Smart Car Parking Through IOT and Cloud Customer Panel.

IV RESULTS AND DISCUSSIONS

The suggested architecture for Smart car parking was built on a Java-based system using Netbeans as the integrated development environment (IDE) and MySQL as the database. The machine has a Core i5 processor and 8 GB of RAM.
To find the root mean square error (RMSE), compare the actual and expected evaluations and then deduct the difference from the total. The equation below describes this procedure.

$$RMSE= \sqrt{(xp - xo)}^{\,2} \quad \text{---------- (2)}$$

Where
Xp – Expected accurate time for block creation
Xo – Obtained accurate time for block creation

The experimental evaluation involved processing an increasing number of blocks for the blockchain using the suggested system. The values obtained are displayed in the table and graph below.

No. of Blocks	Expected time to create Blocks (Ms)	Obtained time to create Blocks(Ms)	MSE
10	15	14	1
20	22	22	0
30	35	33	2
40	44	40	4
50	59	55	4

Table 1: MSE Record Table

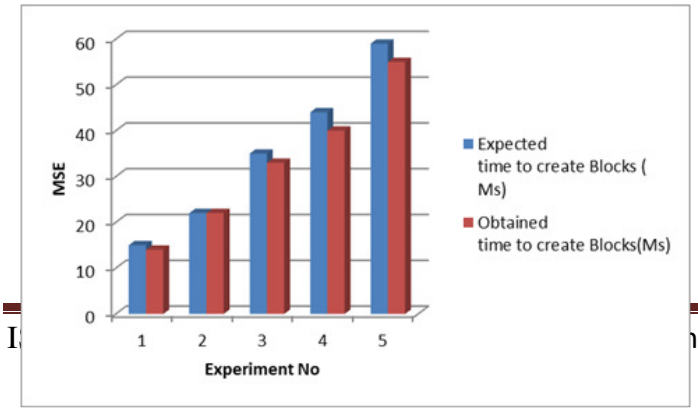

Figure 2: Block creation MSE creation time

The initial results of this blockchain creation system's installation demonstrate the practicality of the suggested approach. We computed the root-mean-squared error (RMSE) to quantify the magnitude of the methodology's faults. The suggested technique got a value of 1.4832.

V CONCLUSION AND FUTURE SCOPE

Patronage and tourist numbers have increased in numerous cities as a result of urban renewal, suburban transit expansion, and increased social mobility. Too many automobiles on the road and not enough parking spots is a major problem. It is crucial to have a reliable parking management system. Internet of Things (IoT) parking management solutions allow organizations to enhance citizen parking. Connected parking garages provide sophisticated management that operates independently. An application would implement this concept. Before you park, make sure there is room. Automated systems keep track of available and used parking spots and inform customers of their current status. The app would display the parking service payments in a time-based format. When cars approach, the gates open automatically. To make things easier, you may see if there is parking available and then let the robot take care of it.

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