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Optimized Smart Parking System Using Reinforcement Learning Techniques for Efficient Urban Parking Management.

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Abstract- ***Blistering urbanization and a growing number of cars have posed a serious problem of parking in ultramodern metropolises. It is a common occurrence that motorists waste a lot of time in the process of finding parking space which creates business traffic, destruction of energy and environmental pollution. Internet of effects(IoT) technologies have also been used to enable smart parking systems to cover parking spaces and provide motorists with real- time vacuity information. Being exploration has also made significant focus on detector grounded monitoring systems and parking central control platforms where parking data is collected and processed in real time. Other studies have combined machine literacy and IoT technologies to alleviate parking space discovery and operation systems. but majority of the systems are restricted in the aspect of scalability, high cost of structure, restricted ability to see content and in dynamic civic landscape, nondynamic decision- making.***

Keywords: Smart Parking System, Reinforcement Learning, Internet of Things (IoT), Parking Slot Allocation, Intelligent Transportation Systems, Smart City Applications.

I. INTRODUCTION

1.1 Background to the study:

The urban areas are overstretching most of the transport systems in the cities besides the magnitude of automobile usage within the urban areas. People at the cities are spending significant

portions of time to find parking facilities and as such, the amounts of cars are increasing and the emissions even less efficient, because of the inefficient use of the parking areas. Control of the parking area is extremely essential in the creation of smart transport systems and smart cities.

The intelligent parking systems developed based on IoT (Internet of Things), Cloud computing and Artificial Intelligence are also a significant contribution to the transportation technology due to the opportunity to monitor the parking status in real-time. IoT-based monitoring Systems and Parking Sensors would inform the drivers on when and where they can and cannot park by using digital platform, and would thus be better in utilizing the available parking spaces and help the drivers locate the parking spaces when and where they can so that it is fast and efficient.

The other problem is that the rule-based systems, according to which the parking space had been designated at any point of the day, were not to be flexible and addressed the fluid and diverse nature of the urban space. Nonetheless, with the introduction of machine learning, namely, the reinforcement learning, it can become, maybe, possible to enhance the present condition of the smart parking systems, to the extent of establishing intelligent solutions to the problem of parking space distribution by continuously learning as new events interact with the dynamic urban setting and reaching a conclusion about how to distribute the parking spaces in the most effective way. So, the implementation of the reinforcement learning methods to the manufacturing and functioning of the smart parking technologies will offer the possibilities to simplify the functioning of the smart parking systems.

1.2 Problem Statement:

In cities, one of the most critical problems is associated with the traffic jam due to a lack of parking places caused by high traffic flow of the

same (i.e., cars to find parking place leads to the increase of the traffic on the road more than the number of parked cars). This, in turn, makes a driver who tries to find the available parking space create more traffic and burn more fuel than he/she should, take far more time than he/she should take to accomplish his/her task.

The appearance of IoT-based products in the sphere of smart parking offering will allow tracing and managing the parking spots in real-time, but these tools have many negative aspects (e.g., high cost; limited scanning range; scaling; and the impossibility to remain versatile in the process of making the parking decisions).

Because the majority of the smart parking systems are still restricted to the scope of the static management of parking, it cannot accommodate the dynamics of the parking demand, so a new sophisticated method of distributing parking space to meet the needs of drivers seeking available parking space is required in a bid to maximize the utilization of the available parking in smart cities.

1.3 Motivation:
The population growth and the volume of vehicles commuted on the roads is not only giving the cities where the growing number of cities a constant problem of having sufficient good-quality parking that can accommodate the various areas but also presenting a strain to cities that are preparing smart cities-making urban areas available and sustainable is key to success and one of the factors to count to success is devoted to efficient management and provision of parking.

A combination of the Internet of Things (IoT)-empowered parking systems and the reinforcement learning can result in the emergence of new adaptive parking allocation methods. The learning aspect provided by the reinforcement learning enables a system to learn continuously depending on the available information in the environment and then formulate the most sufficient decisions over time. The approaches implemented to smart parking systems will enable to reduce the search time of drivers to minimum, to utilize parking areas as much as possible, and reduce traffic congestion. Therefore, the current project is to offer scalable, smart parking systems because the cities are expanding their smart city projects.

1.4 Objectives of the Study:
The research has two important intentions.

OBJ 1: Review the existing approaches and methods of smart parking systems.
OBJ 2: To pin down the existing weaknesses/ constraints of the park administration.

1.5 Contributions of the Paper:
In this paper, several contributions were made to smart parking systems and smart transportation. They are as follows: the global overview of available smart parking technologies (to date); determining key limitations and research gaps of existing IoT-based parking management systems; creating an efficient smart parking framework that relies on the reinforcement learning techniques to enhance the efficiency of parking distribution, reduce the time devoted by drivers to searching a parking place, and to enhance the overall efficiency of the parking systems in the cities.

1.6 Organization of the Paper:
(1)The paper outline is as follows: Section (2) will consist of a literature review of smart parking systems and reinforcement learning techniques as they had been prior to the current research being conducted; Section (3) will consist of proposed research methodology of an optimized smart parking system; Section (4) will be the results and analysis of each of the experimental methodologies that were followed in this research; Section (6) will be the conclusion and recommendation on further research.

II. REVIEW OF LITERATURE:

The problematic task of coping with the parking is becoming increasingly complicated as the city residents continue to increase in number, not to mention the amount of vehicles that citizens own[6]. Hence the innovative technology of Intelligent Parking System (IPS) has been designed with a view to improving the functionality of the parking machines, minimize congestion and maximize the traffic flows in the roadway systems in the

cities[1][6]. There are numerous types of technology that have been utilized in various projects (ex: IoT, Machine Learning, Deep Learning, and Distributed Communication Network protocols) to deal with a wide variety of approaches to offering solutions to the existing parking management problems. The next section is the discussion of the results of a thematic review of the existing literature, the comparison of the outcomes of the most important experimental studies, assessments of the academic community and industry, and the identification of the main gaps in the field of parking management research.

The subject undergoes thematic classification of literature through five different stages:

The research on smart parking could be divided into four main categories: traditional technology / technology development to smart parking solutions; machine learning applications to smart parking research; implementable/deployable deep learning systems applicable in real-time or near real time; hybrid combinations of the above two or more approaches [2] [4] [6].

2.1.1 Traditional Methods:
Traditional smart parking systems mainly rely on centralized management architectures integrated with sensor-based monitoring techniques [5] [7]. These systems were among the earliest approaches developed to improve parking efficiency and monitor parking space occupancy in urban environments. Various sensing technologies such as ultrasonic sensors, infrared sensors, RFID modules, and microcontroller-based devices have been widely used to detect vehicle presence and transmit occupancy information to a centralized database [5].

One of the notable implementations is the NodeMCU-based smart parking system, which combines microcontroller technology with infrared sensors to provide real-time parking space monitoring [5]. The collected information is processed through a centralized platform that assists drivers in identifying available parking spaces efficiently. Such systems significantly improve parking utilization and reduce the time spent searching for parking locations [5].

Furthermore, IoT-enabled parking solutions integrate sensor technologies, cloud computing services, and mobile applications to provide drivers with real-time updates regarding parking availability [1] [7]. These systems may also support automated gate management and reservation functionalities. By providing accurate parking information, IoT-based systems reduce traffic congestion and minimize the time drivers spend searching for vacant spaces [1].
Earlier parking reservation systems also enabled users to reserve parking spaces through pre-registration and identification mechanisms such as access tokens [7]. However, these systems required extensive sensor deployment and centralized communication infrastructure, resulting in increased installation and maintenance costs [8].

Although traditional systems laid the foundation for intelligent parking solutions, their dependence on centralized infrastructure and hardware-intensive deployment limited their scalability and adaptability in rapidly changing smart city environments [6].

2.1.2 Machine Learning Methods:
Machine learning techniques have gained significant attention in smart parking systems due to their capability to analyze parking data and generate accurate parking occupancy predictions [2][9]. Compared to conventional rule-based approaches, machine learning models provide more efficient and adaptive solutions by learning patterns from historical parking information and making data-driven decisions.

Various predictive models such as Random Forest (RF), Support Vector Machine (SVM), and K-Nearest Neighbors (KNN) have been employed to estimate parking occupancy using historical parking activity datasets [2]. These predictive approaches enable parking systems to forecast space availability and assist in improving parking resource utilization. In several studies, ensemble machine learning techniques applied to structured parking datasets have demonstrated occupancy prediction accuracies exceeding 90% [2].

In addition to occupancy prediction, researchers have integrated machine learning algorithms with Internet of Things (IoT)-based smart parking systems to

enhance parking resource allocation and demand forecasting [1] [2]. Such integrated systems analyze multiple parameters, including traffic conditions, driver behavior, historical usage patterns, and parking demand trends. Considering these factors enables the prediction of peak occupancy periods and supports intelligent parking space allocation strategies [9].

Machine learning-based approaches therefore provide more adaptive, scalable, and efficient parking management solutions compared to traditional parking systems, making them suitable for future smart city environments [6] [9].

2.1.3 Deep Learning Techniques:
Deep learning techniques have recently emerged as effective solutions for analyzing large volumes of image and sensor data in smart parking environments [11]. Unlike traditional machine learning approaches, deep learning models automatically extract complex features from input data, thereby improving parking occupancy detection and classification accuracy.

One of the widely adopted approaches involves the use of Convolutional Neural Networks (CNNs) for image-based parking space detection [2]. Smart parking systems equipped with cameras can utilize CNN models to classify parking spaces as occupied or vacant based on captured images. Such automated image-based detection systems reduce dependency on manual monitoring and improve real-time parking management efficiency.

However, the effectiveness of CNN-based approaches is influenced by environmental factors such as lighting conditions, image quality, weather variations, and camera positioning [2]. Poor illumination and adverse weather conditions may reduce classification accuracy and affect overall system performance.

Advanced deep learning architectures such as IncepDenseMobileNet have been introduced to improve feature extraction capabilities and classification performance in smart parking systems [2]. These hybrid architectures combine multiple deep learning mechanisms to improve object recognition and parking space identification. Experimental studies have reported classification accuracies as high as 98.6% for parking space and vehicle-type recognition tasks [2]. Such results demonstrate the potential of deep learning methods in developing highly accurate and intelligent parking management systems.

2.1.4 Hybrid / Recent Approaches:
Recent research has increasingly focused on hybrid intelligent parking systems that integrate technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), Reinforcement Learning (RL), and distributed communication protocols [4] [9]. These hybrid approaches aim to overcome the limitations of traditional centralized parking systems by providing adaptive, scalable, and intelligent parking solutions.

One notable example is the ChirpPark Protocol, which demonstrates the effectiveness of distributed parking management using LoRa communication technology and multi-agent coordination mechanisms [4]. Unlike conventional centralized architectures, this system eliminates dependency on cloud servers and improves scalability for large urban deployments. Furthermore, hybrid systems integrating IoT sensors, deep learning algorithms, and cloud computing services can provide dynamic parking allocation and predictive parking resource management [1] [2]. These systems process real-time parking information and enable intelligent decision-making based on traffic conditions and parking demand patterns.

Decentralized hybrid intelligent systems also provide additional services such as real-time monitoring, mobile application support, automated payment mechanisms, and enhanced user interaction [4]. Therefore, hybrid approaches represent a promising direction toward achieving efficient, scalable, and smart parking infrastructures for future smart cities.

2.2 Comparative Analysis of Existing Methods:

Author	Year	Method	Dataset	Performance	Limitations
Nair et al.	2025	NodeMCU IoT Parking System	Sensor-based real-time monit	Efficient slot detection	Limited scalability

			oring		
Zheng et al.	2025	IncepDense MobileNet (Deep Learning)	Real parking occupancy dataset	98.6% classification accuracy	High computational cost
Zhou et al.	2026	Diffusion-based data synthesis	Synthetic parking dataset	High-quality training data	Simulation dependency
Russo et al.	2025	ChirpPark Multi-Agent Protocol	LoRa IoT network.	Reduced parking search time	Communication latency issues
Tanvi et al.	2025	IoT-based parking monitoring system	Urban parking sensors.	Real-time availability detection	Infrastructure cost

Table 5.1.2: Comparison of Models

2.3 Critical Review:

Significant progress has been achieved in the development of smart parking technologies over recent years. Existing research demonstrates that smart parking systems have improved parking management through the integration of IoT devices, machine learning models, deep learning techniques, and intelligent communication infrastructures [1] [2] [6]. However, despite these advancements, current smart parking systems still face several challenges that limit their effectiveness in large-scale urban environments.

The major strengths of existing smart parking systems can be summarized as follows:

1. Real-time Monitoring: IoT-enabled parking systems provide real-time information regarding parking space availability, enabling efficient parking management and reducing search time for drivers [1] [5].
2. Predictive Capabilities: Machine learning approaches can predict parking occupancy and demand patterns using historical and real-time parking datasets [2] [9].
3. Improved Detection Accuracy: Deep learning techniques have significantly enhanced image-based parking space detection and vehicle classification performance [2].
4. Intelligent Resource Allocation: Advanced intelligent systems support adaptive decision-making and improve resource utilization in smart city environments [4] [9].

Despite these advantages, several limitations continue to affect the performance of existing smart parking systems:

1. High Infrastructure Cost: Sensor-based systems require large-scale deployment of hardware components and communication infrastructure, resulting in high installation and maintenance costs [5].
2. Environmental Sensitivity: Vision-based systems relying on machine learning and deep learning techniques often experience reduced performance under poor lighting conditions, adverse weather, and visual obstructions [2].
3. Scalability Issues: Many centralized smart parking architectures encounter difficulties in handling large-scale urban parking environments efficiently [4].
4. Data Collection Limitations: Several existing studies rely on limited or synthetic datasets, reducing the practical applicability of experimental results in real-world scenarios [3].
5. Computational Constraints: Advanced machine learning and deep learning algorithms often require high computational resources, making deployment on edge devices and low-resource systems challenging [2].

These limitations indicate the necessity for more scalable, adaptive, and cost-effective smart parking frameworks capable of operating efficiently in future smart city ecosystems [4] [9].

2.4 Identified Research Gaps:

The literature review reveals several research gaps that continue to limit the effectiveness and practical deployment of existing smart parking systems. Although various technologies have been proposed to improve parking management, several challenges remain unresolved and require further investigation [1] [4] [6]. The major research gaps identified are discussed below:

1. Limited Urban Scalability:

Most existing IoT-enabled parking systems rely heavily on centralized cloud architectures. While such systems perform adequately in small environments, they may experience scalability challenges when deployed across large metropolitan areas with thousands of parking spaces [4].

2. High Cost of Sensor Deployment:

Many smart parking systems require extensive installation of sensors and communication devices for real-time monitoring. The deployment and maintenance cost of such infrastructures significantly affects their practical implementation in large-scale environments [5].

3. Insufficient Real-World Datasets:

Several studies have been conducted using small-scale or synthetic datasets, which limits the generalization and reliability of machine learning models in real-world parking scenarios [3].

4. Lack of Adaptive Decision-Making:

Existing parking systems generally use static allocation mechanisms and possess limited capability to dynamically adapt to changing traffic conditions and parking demand patterns [9].

5. Limited Smart City Integration:

Many current parking solutions operate independently and lack integration with broader smart city infrastructures such as intelligent transportation systems, traffic management platforms, and urban mobility services [1] [6].

These research gaps indicate the need for intelligent, scalable, and adaptive parking management frameworks capable of supporting future smart city ecosystems and dynamic urban transportation environments [4] [9].

III. PROPOSED METHODOLOGY:

3.1 System Overview:

The proposed smart parking solution has an effective framework that leads to a more efficient method of assigning parking spots and eliminating driver frustration related to finding a free place to park in the highly populated metropolitan areas using the Internet of Things (IoT) technologies and intelligent decision-making algorithms to monitor and provide guidance to find a free parking spot.

The intelligent parking system has three major components i.e. sensing layer, processing layer, and the application layer. Each parking will have a sensor which will be used to detect whether a parking space is occupied or free and the sensor will send this data using a Internet connection to a central processing facility. The complicated allocation algorithms are used to determine the most suitable parking position among the incoming cars based on the parking space information that is obtained by the sensors.

The processing level of the system is the interpretation of data, which the sensors provide to see the availability of any free parking lots and assigning parking slots to cars as they arrive with the assistance of intelligent algorithms. The application layer facilitates the easy identification of the available parking space by the drivers, and offers navigation support to the newly allocated parking spaces through web or mobile applications. The smart parking framework to be proposed is a combination of real time monitoring of parking spaces and an intelligent decision-making mechanism to maximize efficiency of using parking resources as well as reducing the traffic congestion of vehicles seeking parking space.

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3.2 Workflow:

Figure1: Workflow diagram

The smart parking system suggested has a well-designed workflow that involves the process of data acquiring, data processing, the decision making process based on the gathered data, and guiding the users. The smart parking system is based on the use of parking sensors on each specific parking space and detecting the presence of cars in the parking space and capturing the data on the occupation of the parking place. The information generated through parking sensor is sent to the server (which is at the home of the user or transmission will be sent to an already existing cloud server) the information can be stored there and later used. The smart parking system is able to determine the availability of a parking space through data processing that ensures that all real-time data regarding parking space is checked and that factors like distance, occupancy, and parking demand are determined.

After the system checks the presence of a parking space, an intelligent decision making module is applied to identify the available parking space that is to be assigned to the vehicle arriving. The variables to be taken into consideration in the decision-making module will be the distance to the destination, potential possible traffic on the pathway, and any local variables that might or might not exist. Upon the allocation of the best possible parking space to the vehicle, the system will give the driver guidance/direction (to his/her mobile phone or the car navigation system) to the allocated parking space. The result of the structured working process will be the current and right parking recommendation that is able to serve as a driving force and enable drivers to spend less time in order to locate the parking space and more time on using the parking resources. This is a systematic workflow that delivers an efficient way of controlling the parking resource and assigning it dynamically with real-time information.

3.3 Dataset:

The processing layer of the system evaluates the information gotten by sensors of availability of parking spots. The parking spaces are then allocated to incoming vehicles through the application of smart algorithms. Application layer enables the drivers to locate the available parking easily and provides navigation support through the mobile/web applications on reaching the recently allocated parking space. The smart parking system proposed will provide real-time data on the free parking slots and will also have an intelligent decision making system to optimize the use of the resources that will reduce the congestion within the traffic of drivers seeking available parking slots.

The currently utilized dataset in this study is the dataset of a structured dataset of a chain of parking lots and the dynamics of the car movement within and around a parking lot. Each individual record within the data set is identified by a unique identifier which identifies the presence or absence of an occupied parking space denoted by the slot ID which is coupled with the day/time when an entry was made and the location/time upon which an entry was made on the parking space of the vehicle. It has also been divided into training and testing sample in order to test the model that is proposed. IoT parking sensor data enables real-time access of the position whether a specific parking space is in use or not; yet, historical data enables the projection of future availability of parking spaces, and will enable analysis and optimization information of the most suitable parking application solutions. The proposed model will have access to a mixture of real-time information obtained through the IoT sensors and historical parking data to offer the model more intelligent, flexible, and enhanced parking management that can ensure greater mobility within the city and enhanced efficiency in the parking.

IV. RESULTS AND DISCUSSION:

4.1 Outcomes:

The new smart parking system shall assist in efficient and reliable management of parking facilities. This is because one of the goals of this new system is to ensure that the drivers take a shorter time before locating available parking facilities by offering them real-time information on the availability of vacant parking spaces and then directing them to the vacant parking space to avoid unnecessary vehicle movement in the parking lot and the street system.

The other objective of the new system is better utilization of the existing parking spot space since many of the traditional parking facilities do not fully utilize the available space, whereas other spaces are always in high demand. Such traditional ways of offering parking areas are no longer based on the current/ future parking requirements. The system will also distribute the use of the space in the respective area equally; in addition since the process of allocation and sizes of the parking space will be dynamically assigned/allocated based on real time information about the allocation process and sizes of the parking space, the system will also be capable of adjusting to the changes in traffic to demand of parking.

Finally, the new smart parking system will also be quite scalable and a robust system. The smart parking system implies the existence of a sensor of the IoT-based system and a cloud-based data processing algorithm. This is a scalable system that will be in a position to support the operation of a large parking facility like shopping centres, airports and universities and also in a smart city. The existing system will also enable further integration of other sensors and other parking spaces without altering completely the overall smart parking scheme hence the system will be able to respond to the demands with high reliability and handle vast deployments in the urban setting.

This will be an evaluation plan of comparative nature.

To ascertain the functioning of a new intelligent parking system will involve a side by side comparison of the old system; furthermore, the performance indicators of the new intelligent parking system that will involve the time it takes to find a location, the average user experience (response time) in requesting a location up to successful use of the system, the number of parking location available relative to the total number of locations, and overall resource allocation (including data) provided by the new intelligent parking system relative to the old park management systems.

The comparison will be achieved by comparing the use of the manual (single) resource management (utilization of space) against use of the IoT to dynamically relocate spaces. One of the studies conducted before has investigated the application of intelligent parking management system based on machine learning and dynamic (real-time) assignment of parking place (and subsequently will be compared to traditional approaches to developing the parking system). Moreover, this study will also examine whether the new intelligent system of parking can enable users to effectively manage their parking space in accordance with the extent to which they are congested to ensure that they are as efficient as possible.

The findings that are created by the performance assessment of the current and new intelligent parking systems will be presented in the form of graphical presentation (i.e., charts, tables, or other statistical tools) that will clearly record the improvements in the amount of time spent on finding the parking spaces, time spent, and efficiency with which users can access the spaces they have been assigned to with the help of both the traditional and the new intelligent (IoT) parking systems in comparison to the traditional ones.

4.2 Discussion:

The benefits of having the new smart-parking framework over the existing services are various.

A smart parking management system will be able to control the parking facilities efficiently and present the users with the latest information about the parking spaces available through the real-time sensor information which could be obtained with the help of IoT devices. The new structure will also be endowed with intelligent features to enable the decision making process of parking space assignments; an

example, by estimating the distance that users need to travel to access the available parking space, and the availability and demand of parking space by other users.

Moreover, the framework will also embrace cloud computing in order to be in a position to work on a high amount of data on a massive basis within the city without putting the amount of performance at risk.

Also, the framework will be relying on cloud computing to be in a position to process a bulky mass of data on a large scale within the city without compromising the performance levels. By directing drivers to the already available space, we hope to minimize the time that drivers waste in accelerating and decelerating their vehicles in vain, thus, as a consequence, enable us to minimize fuel consumption. The information we will obtain through this system will also enable us to help the city planners and managers of parking facilities to analyze the traffic flow so that they can better the mobility planning in urban communities.

V. USE CASES AND APPLICATIONS:

The suggested smart parking model will assist in solutions of current problems in metropolitan areas. The development of suburban centres is ever rising and the number of vehicles is also increasing; as a result of this, parking space allocation has turned out to be one of the largest challenges to a number of cities. Through the adoption of Internet of Things (IoT) sensors, together with real-time data surveillance and smart decision-making tools, this solution can be effectively applicable in most places such as shopping malls, airports, hospitals, universities and large retail areas. The suggested system will enable users to see real-time available parking space; therefore, leading to the improvement of the overall effectiveness of the functioning of the parking facility, and a decrease in the volume of traffic congestion that is related to the process of finding a parking space in the parking facility.

In the case of the industry, the proposed smart parking system will assist the parking operators and facility managers to utilize their parking facilities. The services of parking administrators will get access to more control over their resources with the decrease in the number of manual controls the administrators of parking facilities will have to exercise because of the real-time monitoring of the occupancy of a space and automatization of the process of allotment of spaces. In addition, the information collected in the system can provide an insight to the parking operators that will enable them to research the demand of their parking facilities and shape parking reservation systems, automated billing and implement dynamic pricing solutions. The new smart system of their parking can be used to manage their parking slots, as well as allow individuals to access real time information about their parking, with the assistance of real time information obtained through the use of the IoT devices like sensor devices to monitor their parking. This structure will also provide intelligent systems that will assist in the decision making process on how to allocate the spaces to the users based on the distance that a user is likely to travel to take advantage of the available parking, availability and demand of parking amongst other users.

The new structure will also utilize the cloud computing in such a way that, it can work with large volumes of information in various sites within a whole city in an extremely efficient and effective way without necessarily impacting performance in a negative way.

VI. CONCLUSION

In this paper, current smart parking system and intelligent parking management approaches have been thoroughly reviewed. Several variants of methods have been identified to identify the smart parking systems; both the classical sensor-based systems (e.g., machine learning) and the deep learning-based parking detection systems have been reviewed. The literature review also stated that despite the numerous innovations that have been done concerning technology when it comes to parking management, there are several challenges that concern; as such, there is the need to have smarter and responsive management systems on parking to support and accommodate various

conditions that are dynamic in the urban setups of the future.

On the industrial aspect, the smart parking system proposed will help the parking operator and the facility managers to put their parking facilities into use. Managing the occupancy of a space in real-time and automating the procedure of the space assigning, the services of parking administrators will have an even more significant level of control over their resources due to the reduced number of manual controls that they would need to exercise. Also, data gathered using the system, can give the parking operators an idea that will allow them to study the demand of their parking structures and design parking reservation systems, automated billing and adopting dynamic pricing schemes. Their parking can be transformed into the new smart system based on the real time information gathered by the IoT devices i.e. sensors, which can not only enable the traffic management agencies to manage the parking slots more effectively, but also enable individuals to receive the real time information on the parking. This framework will also offer intelligent systems to help in decision making on the distance between the spaces to users regarding the distance that a user may walk to make use of the offered parking, the availability and the demand of the parking among the other users.

Finally, the smart parking system proposed in this paper can improve the performance of the current parking systems by developing novel smart city-related innovation. Besides offering a superior method of using the current/city infrastructure currently and in the future, the intelligent parking solution will also serve as a platform of research providing new intelligent systems that will use the information presented by this intelligent parking solution, thus significantly decreasing congestion in urban centers where people are seeking parking spots. Finally, the smart parking solution will offer means to enhance the manner, in which individuals use urban spaces, co-create sustainable urban space, and enhance the modern-day parking management procedures.

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