

Smart Parking System using Internet of Things Technology

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Abstract - Due to the increasing number of vehicles parking has become a difficult task and also causes a lot of traffic. In today's world people do not have proper knowledge about street parking space; it not only costs drivers their time but also the fuel. This paper involves an efficient technique based upon cloud parking system which uses Internet of Things technology. This introduces an easy and hassle free method of parking. Through this system the user can find an appropriate parking space depending upon the location and the number of free parking spaces available in the area. Hence, through this system we can not only reduce the traffic but also the waiting time of the user

Key Words: Smart parking system, reservation, resource-allocation, Global Positioning System (GPS).

1. INTRODUCTION

The increase in number of vehicles has enforced the concept of smart parking system. It has been observed that the traffic clogging in cities is caused due to the lack of parking space, and it takes a lot of time for the drivers to find an appropriate parking slot. Street parking space is one of the most important attribute in most of the cities due to the increase in number of vehicles day by day. This not only eliminates the traffic but it also proves to be convenient to the public. The shortage of knowledge about the parking occupancy at roadside causes vehicles to find empty parking space around urban streets. This is the only cause for increase in traffic flow but also wastes time and fuel. The search process for vehicle's parking space is very frustrating and along with that time and fuel are also wasted so our paper aims to address this problem and solve it by using a cloud based mobile application.

The Internet of Things technology has been a significant step forward towards solving real world problems in a smart way. The present work presents a cloud based mobile application based on IoT that helps the user to book a parking slot according to their need. The system builds the parking space as an IoT network and the data of the vehicle's location and the space between the parking space and the user's location is transferred to the cloud and then it can be accessed by the user. The data of the parking space is continuously updated. Thus, the user can make an advance reservation according to the needs of the user so that the user can park the car in a parking space wherever they want to go.

The incentive for this paper is produced for the need to minimize traffic in cities caused by vehicles. It has been

observed many accidents usually take place in parking lots which aren't organized properly and there isn't proper management. Thus, there is a need of a smart parking system where a vehicle is allotted a unique parking space and no mishaps can occur due to it. It is organized such that minimal accidents occur. This system is very beneficial in cities where there are a lot of vehicles and the parking spaces are less. A downtown activity

examine on a few noteworthy urban communities uncovers that cruising for kerb opening is a frequently disregarded source of blockage, representing up to 30 percent of aggregate activity flows. The baffling inquiry process, alongside the time and fuel squanders are the kind of difficulties or issues that an Intelligent Transportation System (ITS) means to address, or extensively talking, to construct helpful, green and vitality effective Smart Urban areas. There are different ITS or Smart City ventures related to stopping checking with various center focuses, for example, private stopping, off-road stopping, and on-road stopping.

2. RELATED WORK

For as long as two decades, there have been various looks into what's more, interests in the auto stopping area. A few of them had been conveyed by and by like Parking Guidance what's more, Information (PGI) frameworks. PGI frameworks give drivers with constant data on stopping inside controlled territories through factor message signs. They utilize conveyed sensors basically on the passageways and ways out of stopping territories to accumulate data about aggregate inhabitation. Different executions ordinarily utilize one sensor for each one parking space which has been found in business shopping centers and in business regions to additionally use parking spots and abatement looking time.

In (1), the author has proposed a system that enhances the performance by decreasing the number of users who cannot find a space and decrease the cost. This system has been implemented and has been successful. After analyzing the results we can conclude that the waiting time of the user has been reduced for parking. The system utilizes the WSN which consist of the RFID technology to observe car parks. Thus, the RFID reader obtains the number of free parking spaces available in the parking space and thus this is a low cost and a highly efficient process. Hence, this system provides a mechanism to avert various disputes and also decreases the waiting time of the user.

In (2), the author has proposed a new parking system called iParker. This is based upon the MILP model that gives a solution to allocate the parking space dynamically to the users. The system offers the user possible choices of parking spots so that the user can choose an appropriate spot according to the needs of the user. The system is based on RTR (real-time observation) and STR (share-time observation). The author has also proposed the policy of pricing so that the profit is maximized. It balances the resources so that they can be utilized properly and also eliminates the traffic congestion. The exploration centers around another stopping detecting framework and an indoor route benefit for auto stopping. Later on, we plan to assess our framework utilizing continuous information furthermore, more prominent number of assets and goals. Furthermore, a versatility examination is to be performed to inspect the proficiency of the proposed versatility strategies. Last, it would likewise be valuable to recreate diverse stopping landing situations, in actuality.

In (3), a versatile space location framework has been depicted and tests have been done to analyze the execution of the framework to that of a settled detecting framework. The oddity of the exhibited portable detecting unit is the guide coordinating strategy used to rectify the GPS floats/mistakes and the administered learning calculation to distinguish the autos/spaces. In light of the tests completed in Guildford, estimations demonstrate that the general precision of the versatile detecting framework with outline is 76% and it can achieve 94% when the GPS precision is high. The GPS exactness is an issue that can be fathomed by utilizing further developed limitation systems. The settled sensor approach has a stable 85% precision rate for the tried situation what's more, is autonomous from some other innovation, for example, GPS. The upside of the versatile detecting approach is that it requires an essentially more modest number of sensor units thought about with the settled detecting arrangements 132 portable detecting units contrasted with 12000 settled sensors to cover 8000 stopping spaces on account of SFpark. The portable detecting framework turns out to be more articulated as the quantity of parking spots to be checked increments.

In (4), the author has proposed a "smart parking framework that endeavors advancements for parking spot accessibility discovery and for driver restriction and that apportions parking spaces to drivers rather than just providing direction to them. We have centered on deciding a proficient and ideal allotment system for the two clients and the framework by settling an arrangement of MILP issues, which are ensured to have an achievable arrangement and to fulfill some decency limitations. Reenactment results appear critical execution upgrades over existing stopping conduct, including the utilization of direction based frameworks.

Current investigation centers around choosing (conceivably state dependent) legitimate choice interims and on the utilization of estimating control to modify parking spot costs for various classes of clients or other offering compose systems that can upgrade reasonableness. In addition,

through a progressing coordinated effort with the City of Boston, we intend to extend arrangement tests to on-road stopping on a few urban squares.

In (5), the author's investigation proposed a probabilistic-possibilistic display for vulnerabilities with respect to the quantity of V2G spots at crest stack hour in savvy conveyance extension arranging alluded to as PPDNEPV2G. This model is utilized when authentic information of an indeterminate variable is fragmented (i.e. low or it isn't precisely related to that factor; anyway they have a comparative conduct). To this end, the Z-number technique is utilized to get the probabilistic-possibilistic displaying of the V2G number at top load hour. In expansion to this model, PEV parking area assignment and assurance of PEV parking area number are considered to discover the ideal case. To improve the DNEPV2G issue, NSGA-II is multi-target improvement technique used. The advancement result demonstrates the ideal number and area of lines, substations also, PEV parking garages. The appropriateness of the proposed PPDNEPV2G demonstrate has been represented utilizing a 24-transport test framework what's more, the genuine 20 kV conveyance system of Ghale-Ganj city of Kerman area in Iran. Reenactment results demonstrate that PPDNEPV2G performed adequately. It implies that by forcing least PEV parking area venture cost EENS are made strides at the same time.

3. PROPOSED SYSTEM

The system is based upon IoT. It utilizes the WSN comprising RFID innovation to screen auto parks. An RFID reader checks the rate of free parking spots in the area. The utilization of RFID technology causes execution of an expansive scale framework with ease.

3.1 Implementation

The system gives an instrument to prevent any problems in the area and also reduces time spend on searching for a parking spot. Through the system the client can pick an appropriate parking spot. Data on the chose stopping area will be affirmed to the client. At that point, the system refreshes the status of the parking spot to "pending" amid which time the system won't permit other clients to save it. In the event that after a specific time of pending time the framework discovers that no vehicle is stopped in that space, at that point it changes the status to "accessible." The system will refresh the status from the WSN hub (the status of auto stop spaces) at the point when another vehicle participates in the system. Hence, the status of the general stopping system is constantly refreshed continuously. The system will help plot the stopping time for each parking spot progressively and can bolster the business with hourly stopping charges. The data is stored in a cloud based server and can be accessed through a mobile application by the user. The application is based upon the FCFS (First Come First Serve) basis. The app provides a user-friendly interface which makes the booking process effortless. This application shows all the

available parking spaces and the time up to which they are booked.

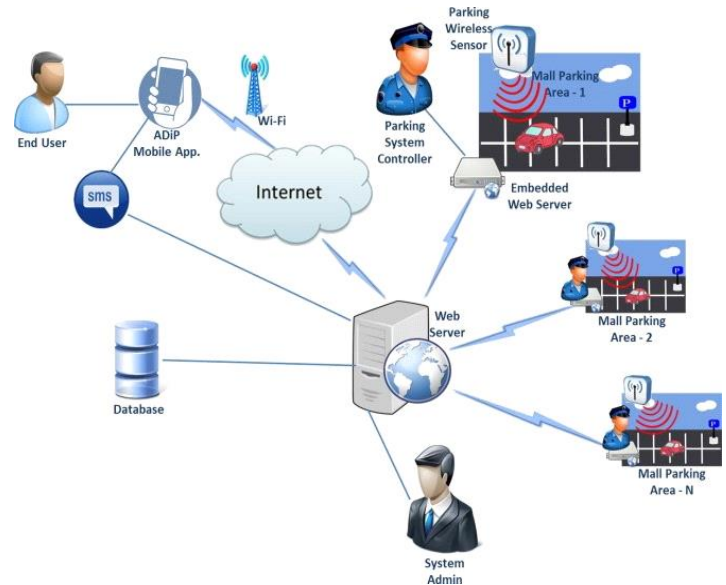
3.2 Reservation

The application shows the free spaces in the area. The user can also pre-book the parking slots according to their requirements and the time for which they require the parking slot. The user can book the parking space from their current location to their desired location. They can book the slots for a minimum 1 hour and a maximum of 6 hours. The user will be charged a minimal amount for the booking so that some revenue can be generated from this.

3.3 System Architecture

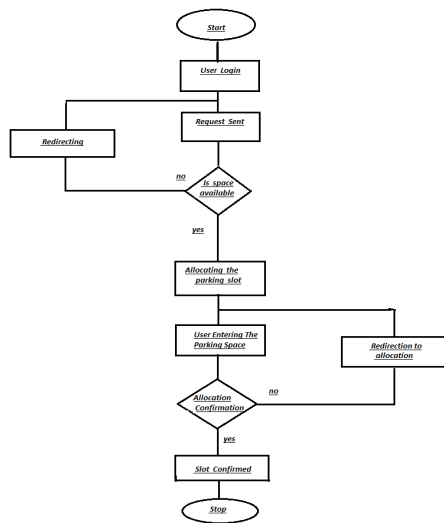
The components of the system are

- **Server:** This is a Web component that stores the asset data given by nearby units found at every parking slot. The system enables a driver to hunt and discover data on parking spots from every parking slot without the need to straightforwardly get to the local server by specifically getting to the cloud-based server.
- **Local:** This unit is situated in every spot and stores the data of each parking spot, as appeared. The unit incorporates the accompanying:
- **Hardware Unit:** This is an Arduino module, which is associated utilizing an RFID reader. The card reader confirms the client data and afterward shows this data on the screen. In the event that the data of the RFID tag or card is right, the Arduino module will control the opening of the entryway for the vehicle to enter. The Arduino module interfaces with the cloud server through an Internet association with exchange information from the nearby vehicle to the cloud server database.
- **Display:** This showcases data on the limit of the neighborhood parking spot, the aggregate current level of free spaces, the status of the RFID label check, the client card when entering, and a scaled down guide of the space.
- **RFID tag-** This is utilized to check and confirm client data and figure the level of aggregate free spaces in every parking slot.
- **Software:** This is an application running on Android, the clients will introduce it on their cell phones and utilize it to save parking spots. The clients get to the systems by means of 3G/4G portable associations.



This figure above shows the implementation of parking system. The end user uses a mobile app to book the parking slot according to its need. The mobile application is connected to the web server that finally allocates a parking space from the available parking system. There are many parking spaces available in the nearby area from which the appropriate space is allotted to the end user. There is a system admin also available that controls the database system and manages if there is a significant problem or networking issue in the design or booking system. At the point when a client needs to discover a free parking spot, they should login to our system. After login, a demand message is sent to scan for a free parking spot. At that point, the system will send back a reaction message containing the data, including the free space deliver and the directions to achieve it. At the point when the client arrives, he should be approved to enter. This approval is accomplished by means of the RFID innovation or by checking the client card. This component is straightforward however conservative. In the event that the data is right, the client is permitted to park. On the off chance that the present space is full, the system will send a proposal message that incorporates data on another space, including the location and new bearings, with a base expense. The new space will be chosen in view of the neighbor table of the present parking space.

The flow chart below shows the process in which the user can book the parking space. First the user should login to the system using valid credentials so that every user can be assigned a unique id and after logging in the user can send a request for the appropriate parking spot. If the spot is available the user will be able to book it otherwise the user will be redirected to the home page to book another spot. After the booking is done the user can enter the space and park at the spot that was booked after the information is validated.



4. CONCLUSION

This study focuses on the problems regarding the parking problems and aims to eliminate it. Thus, the user will find it easy to find a parking spot and also saves time of the user. The application provides an easy interface for the users and the average waiting time is also decreased. The large scale applications will be considered in our future study.

REFERENCES

[1] Thanh Nam Pham, Ming-Fong Tsai "A Cloud Based Smart-Parking System Based on Internet-of-Things Technologies".

[2] Cristian Roman, Peter Ball "Detecting On-Street Parking Spaces in Smart Cities: Performance Evaluation of Fixed and Mobile Sensing Systems"

[3] Yangfeng Geng "A New Smart Parking System Based on Resource Allocation and Reservation"

[4] Amirhossein Nasri "Probabilistic-possibilistic model for a parking lot in the smart distribution network expansion planning"

[5] Amir O. Kotb "iParker, a new smart parking system based upon dynamic resource allocation and pricing"