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Smart Parking Sensors, Technologies And Application Based IoT

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***Abstract*—** the major problem in day to day life is parking of vehicles especially the car parking at an particular place. And this issue indirectly leads to traffic congestion. A basic concept of using IoT insmart parking services in the smart cities as an important application of the Internet of Things (IoT). the system can will be accessible through a mobile app or through the webpage and it can be used to monitor then to find the empty slots in that area. the user can be parking their vehicle in the empty slot through the mobile application and before only he can book his slot for the particular time in particular place.

Keywords—IoT Internet of things Car parking, Connectivity(c), Constrained Applicatio), Protocol (CoAP), End node(e), Hypertext transfer protocol(HTTP), Internet of Things (IoT), Internet protocol(IP), Message queuing transport telemetry protocol(MQTT), Processing node(p), Smart cities, *Transmission control protocol(TCP)*,

I. INTRODUCTION

The car parking has been, and still is, a growing problem with increasing vehicle sizes in the luxury segment. this is especially true when bearing in mind the confined parking spaces in parking lots and cities. the smart vehicle parking is a system that can helps drivers to find a vacant spot using sensor in each parking space by detecting the presence or absence of a vehicle. Automated parking systems are generally powered by electric motors (that move vehicle into a storage position). The Accurate localization of vehicles in videos or images is a key taskfor several applications, such as traffic controlling, parking-lotoccupation, or city planning. Gathering quick vehicles informationin the input images provides fast attention in a congestedpopulation larger area. Without the automated object detection, where thesystem would need the deployment of power sensors or manualwork at higher costs. Then Due to the rapid expansion of car ownershipworldwide in recent times, the vehicle safety has become a concernand critical issue. The reduced cost optical devices have made iteconomically feasible to install cameras to monitor visual-basedevents. The contributions of our work include: 1) increasing parking resource utilization, 2) increasing parking revenue, 3) improving parking experience of drivers by lowering cost, parking spot searching and walking times. Our work is different from the one in where a dynamic resource allocation model was proposed. The limitations of that model are that only reservation for limited period of time (e.g., few minutes) was allowed and fixed.

II. RELATED WORK

For the past two decades, there have been numerous researches and investments in the car parking domain. Some of them had been deployed in practice like Parking Guidance and Information (PGI) systems. PGI systems provide drivers with real time information on parking within controlled areas through variable message signs. They use deployed sensors mainly on the entrances and exits of parking areas to gather information about total occupancy. Other implementations typically use one sensor per one parking spot which has been seen in commercial shopping malls and in business districts to further utilize parking spaces and decrease searching time. Most of the researches have focused on how to detect the occupancy state of parking spots. However, those systems still have not solve all the problems. The competition for parking leads to higher traffic congestion where parking is monitored, leaving other parking resources vacant. Also, this leads for the known phenomenon of "multiple cars chase same spot." It is indeed essential to have the data on the occupancy state in parking areas but it is more important to efficiently utilize those data. There are others researched parking reservation systems. For instance, we used Unstructured Supplementary Service Data (USSD) as communication medium between divers and parking reservation system. Although it is not free to use USSD for most of network operators, it is still a cheap and reliable technology to adopt in parking reservations. Inaba et al. utilized RFID tags to store and update the reservations status and they discussed the difference between real-time and share-time reservations where the difference between them is that in share-time reservations, drivers must use the service in a known entry and exit time frame as they share the resource time. Whereas in real-time reservations, they are allowed to park for unlimited interval of time for being independent on other drivers. Wang et al. [09] had introduced a prototype for a distributed system at which there is one central processor which gathers the reservation requests and redirects them the relevant local processors. Their system utilizes Blue-tooth and Wi Fi to detect the

occupancy states inside parking lots, the drivers with available spaces accordingly. Short Message Services (SMS) reservations were presented in many research papers. For example, Hanif et al. developed an embedded SMS reservation system using microcontroller, keypad, gate access control and a remote terminal unit (Micro-RTU). Micro-RTU is a standalone terminal with a processor and a GSM module to receive SMS and trigger I/O pins. Reservation over internet was demonstrated using by a sensor network in ZigBee and pressure sensors to detect the occupancy state of parking spots. Reservations are allowed using some apps. These reservation systems could reduce the parkingproblems.

III. EXISTING SYSTEM

Existing Vehicle Parking System provides system device and here it finds a slot in the parking place. The information about the parking area, its only available within the Bluetooth range. So new system is covers large distance need to be developed to improve the parking facilities. Then it provides the best protection for our investment.

Disadvantages of existing system

- No sufficient place for parking.
- No security for vehicles.
- Creates traffic.

IV. METHODOLOGY

Parking is a semi-distributed system as shown in Fig. 1: there are one central request center (CRC), one parking manager (PM) and multiple local smart allocation systems (SASs.);

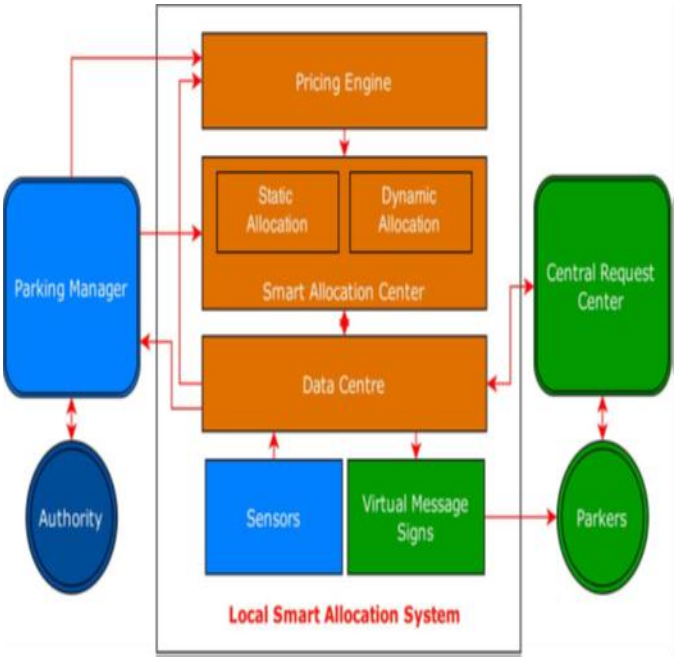

Fig 1: parking framework

Pricing Engine—Pricing engines are small applications that run a pricing model on web-servers. The duties of a pricing engine are to fetch parking utilization data and updates from parking authorities every predefined time interval and to set the new parking prices accordingly. The engine runs independent on the SAS, calculates the new prices and updates the data center**.**

Sensors—Every resource is occupied with a spot occupancy detection system. Ideally this system must provide accurate data on the utilization of the parking resource, deployed either indoors or outdoors. The detection system is normallycomposed of a wireless/wired sensor network that can provide occupation stateof every parking spot.

Data Centre—Holds all the information from all iParker components and store them in a structured data container. It's consisted of a pricing table which contains the up to date information on pricing per resource per utilization table which holds the utilization data,

Smart Allocation Centre—A web service that runs a sophisticated MILP model that optimally and fairly assigns/ reserves parking resources to the parkers. The assignment is based on key variables that are not limited to driver constraints, current resource utilization, up to date pricing information and events occurrences**.**

Virtual Message Sign (VMS)—Updates parkers/public with up to date pricing and parking availability information. This is achieved by deploying numerous numbers of VMS panels across cities especially around on-street parking areas. For off-street parking lots, one VMS panels at the entrance is sufficient to inform arrivals of updated information. It is important to mention that a parker will only pay according to the price rate fixed in the reservation offer,

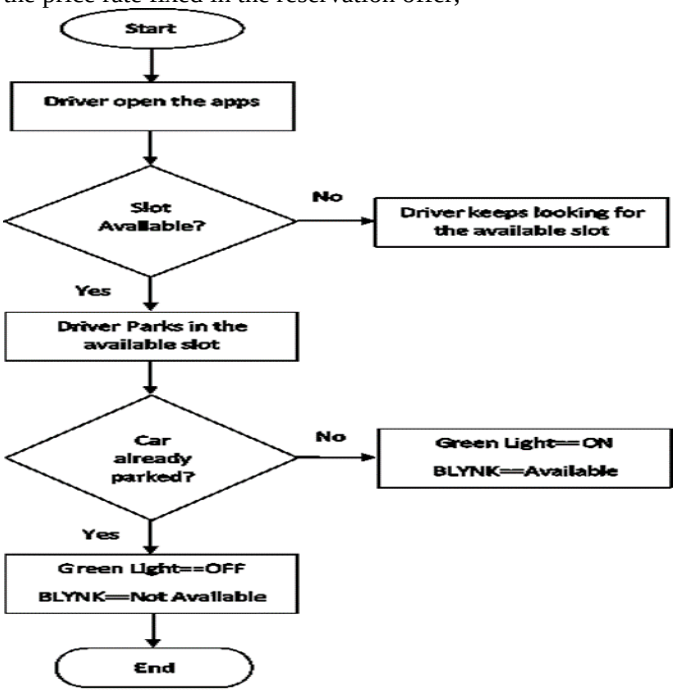

Fig 2: Flow chart of the parking system

Fig2. Belongs to the flow chart of vehicle parking system by installing the android application regarding to vehicle parking we can make out the empty slots can be notified with the help of this application we can search for a parking area on and around your destination.then select a particular place for the slot and through the mobile application we can browse where the parking slots are available in that parking area. Select the amount of time (in hour) for which you would like to park your vehicle for. Then once you have successfully parked your car in the selected parking slot, conform your occupancy using the mobile application, this above-mentioned procedure for booking a slot and parking a vehicle through mobile application.

Advantages

- Optimized parking
- Reduce traffic
- Reduce pollution
- Increased safety
- Decreased management costs
- New revenue streams
- Enhanced user experience
- Integrated payments and POS
- Real-time data and trend insight

V. RESULTS

The review of existing smart parking applications shows that most of these applications use sensors for parking occupancy detection in closed parking lots which would require a considerable amount of expenditure for installation and maintenance of the difference might be due to less expenditure in using predictive analytics than deploying sensors in all parking spaces. Here the real-time occupancy information of parking spaces cannot be acquired by using the predictive analytics andaccuracy of parking occupancy information by crowdsourcing is not a reliable. The parking occupancy detection using machine vision will vary between the closed and open parking lots as they can be varying light conditions in an open outdoor parking lot. As mentioned earlier, challenges faced by low lighting and shadow conditions can be addressed.

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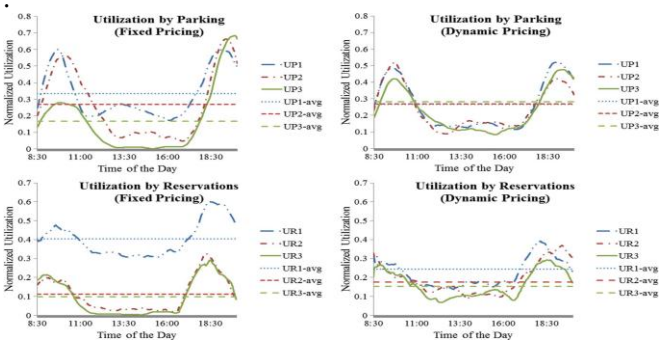

Fig 3 Utilization comparison under fixed and dynamic pricing. The comparison is between parking resources 1, 2, and 3.

Fig.3 refers to effect of dynamically varying the resource pricing according to real time utilization and it mainly observed as expected that by continuously changing the prices of resources, we can control and limit the utilization of those resources. Then this change results in a fair balance of utilization between parking resource which in turn assist in reducing the overall traffic congestion caused by parking.

VI. CONCLUSION AND FUTURE WORK

Here we identify a research gap in utilising smart parking sensors, technologies and applications for open parking lots. here the existing of the smart parking technologies and applications are not suitable for the open parking lots because of the varying environmental conditions and high expenditure. As there are no immediate economic gains from the providing smart parking services in an open parking lot, the expenditure plays an important role in choice of smart parking technologies. then the Parking guidance system which is one of the most existing smart parking technology it can be used to get the count of available parking spaces in open parking lots. the Machine vision is another technology which uses the visual camera to acquire real-time parking occupancy information on open parking lots due to its minimal expenditure. The usage of the visual camera is dependent on regulations supported by the country which needs to be considered prior, there is no single ideal technology suitable for parking occupancy detection. Here it isBased on the type of parking lot and the size, a different combination of the smart parking technologies and sensors can be used for the efficient available parking occupancy detection. and In order to further improve parking efficiency, navigational directions should be provided to a vacant parking space. this challenge further research in the use of deep learning and multi-agent systems would help to the provide the real-time parking occupancy information along with navigational directions to the available parking space in an open parking area.

VII. ACKNOWLEDGMENT

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