SMART PARKING SYSTEM

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Abstract-The project entitled "SMART PARKING SYSTEM" presents an IOT based smart parking system which provides an optimal solution for the parking problem in metropolitan cities. Due to rapid increase in vehicle density especially during the peak hours of the day it is difficult task for the users to find the parking space to park their vehicles. This study proposes a smart parking system based on Node MCU, components and mobile application. The proposed smart parking system consists of an onsite deployment of a slot module that is used to monitor and signalize the state of availability of each single parking space. A mobile application is also provided that allows an end user to check the availability of parking space and book a parking slot accordingly. Smart parking can increase the economy by reducing fuel consumption and pollution in urban cities.

Keywords- Smart parking system, IR sensors, Parking lot, Reservation

I. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects devices, vehicles, buildings, and other items embedded with electronics, software, ultrasonic sensors, and network connectivity that enables these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit; when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through it is embedded computing system but can interoperate within the existing Internet infrastructure. Smart parking can be considered as one of the Internet of Things applications, a technology which appeared firstly in

1999.More specifically, IoT can be regarded as concept under which a group of things/objects that can be connected via wireless and wired connections, Things can interact with each other for the creation of new services or even applications.
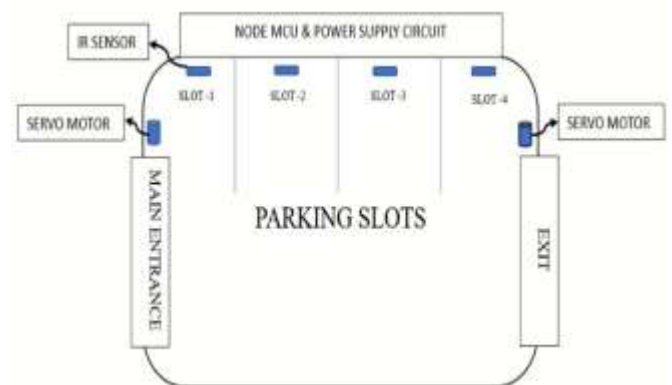

Fig: Basic structure of smart parking

With the growth of population and economic development, the number of vehicles on the road is increasing day by day. Parking is becoming one of the major problems for cities and is becoming very costly. For instance, finding parking space during work is challenging. It is more frustrating for the users to search for a parking spot in a parking lot. To overcome this problem many parking guidance systems have been proposed in recent years that try to enhance the basic parking system. All the systems require a mechanism to detect if a vehicle is in the parking spot. The person can register for the parking slot to park his/her car. A unique id is generated for registered user and the time limit is given. The system will calculate the in and out time of the vehicle which is placed in the parking slot and the amount will be detected from their account.

A. *Benefits of Implementing Online Parking system*

1. No need to waste time on looking for parking.
2. Reduction in time and fuel spent by road user searching for parking.
3. Less queues as motorists will be guided to parking areas.
4. Proper selection of vehicle according to the availability of parking space.
5. Online parking results in higher revenues and profitability for parking facilities.

B. *Internet of Things*

The concept of Internet of Things (IoT) started with things and identity communication devices. The devices could be tracked, controlled, or monitored using remote computers connected through Internet.

The internet of things has different definitions. In Short it is defined as the things present in the physical world or in an environment are attached with sensors or with any embedded systems and made connected to network via wired or wireless connections. These connected devices are called as smart devices or smart objects. And it consists of smart machines, which communicate, interact with other machines, environment, objects etc. And these can be processing by using some processors such as network processor, hybrid processor MCU/MPU etc. And the devices are connected by using some technologies called GPS, Wi-Fi, BT/BTLE, RFID etc.

Internet of things was first introduced in 1999 at auto-ID center and first used by Kevin Ashton. This latest technology promises to connect all our surrounding things to a network and communicating with each other with less human involvement. Still internet of things is in beginning stage and there is no common architecture exist still today.

II. RELATED WORKS

Robin Grodi [1] has done that how the vehicle will occupy in the particular allocated place. RFID sensors detect the presence of a vehicle or other objects. Once a vehicle is detected, the system needs a way to notify drivers, or a parking spot being occupied. The disadvantage is the parking place will be detected only to the nearby places there is no GPS sensor to search the parking slots from the far place.

Alirezahassani [2] had implemented this system using a mobile application that is connected to the cloud. The user will set the time for when he is going to allocate the place. If he didn't occupy later the alarm will be given to the user. The app will show the number of allocated and the empty spaces in the parking slots. The disadvantage is, after allocating if another user request for the same place, then he is unable to allocate that place, so it is the waste of space if the first user cancel later, waste of time and money.

Mingkai Chen [3] developed a parking guidance and information system based on wireless sensor system and the information is transmitted between the nodes and

processing the data, and the information passes to the display drivers. In this the constraint is, if the main node of

the sensor system fails means the total block is failed.

Huang Cai-Mei. [4] Presented an idea for reserving the parking slots and reversed cars look for the intelligent terminals to achieve the parked position of vehicles and get the guide route, so that user can quickly find the parking area.

Bhosale Swapnali [5] developed an idea for generating the multiple images using a fixed camera capture under different variations. Multiple images detection & recognition is important in the analysis of video data and higher-level security system.

Vanessa W.S. Tang [6] presented an idea on WSN-based intelligent car parking system and the sensors are deployed into a car park field, with each parking lot equipped with one sensor node, which detects and monitors the occupation of the parking lot. The constraint of the project is that they deploy only sensor node if it fails means total lot information is lost.

Basavaraj S R [7] implemented a smart parking system which uses the cloud based IoT architecture for smart parking system which contain cloud service provider which provides cloud storage to store the information about the status of parking slot in a parking area. The centralized server which manages to store entire smart parking system information such as number of slots, availability of vehicle etc.

Georgios Tsaramirsis [8] make use of the wired sensors systems. There are two categories intrusive and non-intrusive sensors. Intrusive sensors are most installed directly on pavement surfaces or holes in the roads surface. In turn, on-intrusive sensors can also be described as above ground sensors, which are mounted above the traffic lane and are monitoring on either side of the road. The disadvantage is, intrusive sensors type are the decreases of pavement life due to the requirement of pavement cut for installation.

III. PROPOSED SYSTEM

The proposed system is used by the user to reserve the parking slot. For reserving the parking slot, the user needs to login to their account, then user has an option to reserve the parking slot. The user reaches to the parking space after reserving the slot, then the user needs to open the entry gate by just clicking the open button in the app itself. After the user enters the parking slot, then it is occupied by that user for a particular period. When the user wants to leave the parking space, the user needs to press the hardware button which is placed at the exit gate. After pressing the hardware button user needs to enter the username and password. After entering the correct username and password, then the user needs to pay the parking amount. The exit gate opens only after paying parking fees.

A. *System Architecture*

The goal of this design is to produce a module of the system which is used to build the system. Fig 1 shows the proposed system block diagram:
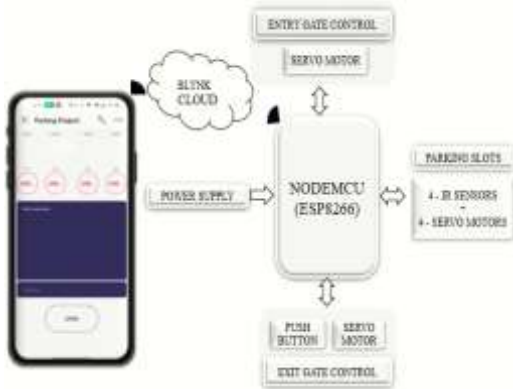
- The user will register to the application, later he gets login into the application by entering the username and password.
- Initially in the homepage he can view the real time slots that are available.
- By viewing the availability of the slots, the user selects the slot area.
- The data is sent into the cloud that slot gets allocated to the user.
- Later the user leaves the parking slot area after paying the parking amount.
- Later the availability of the slots will get updated in the homepage to view.

B. *System Algorithm*

Algorithm can perform calculation, data processing, and automated reasoning tasks. This Algorithm describes about the user and the staff relationship about allocating the parking slot.

Step 1: Start
Step 2: If user not registered
           User register into the system
     Else
           Login into the system
Step 3: User sends the request.
Step 4: Node MCU will receive the request.
Step 5: If parking space is available.
           Node MCU will reserve the parking slot.
     Else
           Node MCU will sends the message that slot is not available (Unavailable space...!) Go to step 3.
Step 6: User enters the parking slot.
Step 7: System detects the vehicle using IR sensor.
Step 8: Node MCU sends the request to Mobile application (Slot reserved).
Step 9: Updates the application.
Step 10: If vehicle is leaving.

Step 11: User presses exit button.
If user enters correct credentials and parking Amount Exit gate opens.

C. *System Flow Chart*

Here the figure represents the flow chart from which the registered user enters the parking area till he successfully parks and leaves the vehicle in the parking slot.
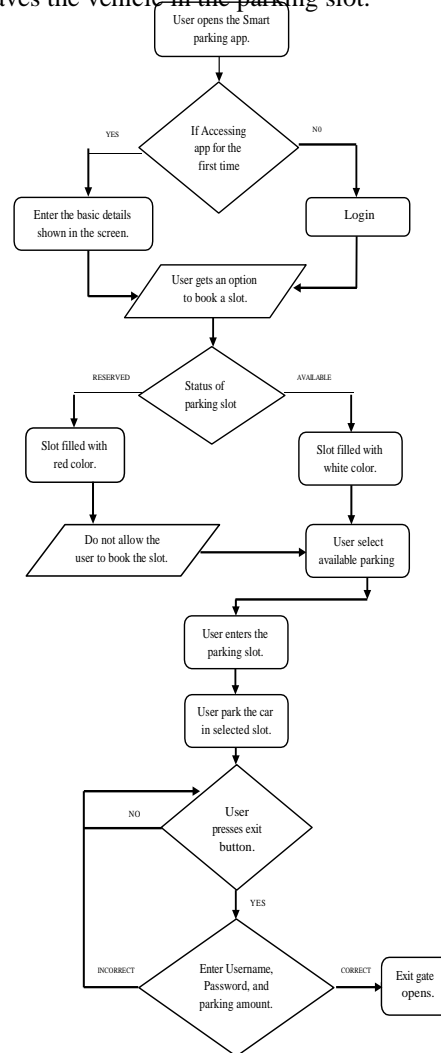

Fig: System flow chart

IV. APPLICATIONS

The importance of smart parking is:
1. Accurately sense and predict spot/vehicle occupancy in real-time.
2. Guides residents and visitors to available parking spot.
3. Optimize Parking Space Usage.
4. Simplifies the parking experience and adds value for parking stakeholders, such as merchants and drivers.
5. Helps the free flow of traffic in the city leveraging IoT technology.
6. Enables intelligent decisions using data, including real–time status applications and historical analytics reports.
7. Smart Parking plays an important role in creating better urban environment by reducing the emission of CO_2 and other pollutants.
8. Provides tools to optimize workforce management.

Else Step 12: End
Goto step 11

To make the smart parking system to be available, we must improve the existing infrastructure.

1. IoT devices consume more power. So, the maintenance cost will be high.
2. If the free parking slot has any other object other than the vehicle, the sensors may detect and think that the particular slot is not free.
3. The installed apparatus is very expensive and can be stolen.

V. FUTURE SCOPE

1. Replacing push button at exit gate by placing simple payment button in mobile application.
2. Making collection of parking charges through some secure digitalized platform.
3. Interfacing the mobile app with any other online ticketing platforms such as movie tickets, railway stations etc.
4. By using Image Processing, the car can get into the parking slots without any actions.
5. We can send a notification to applicant phone with unique parking number, after slot booking.

VI. CONCLUSION

The problems which would arise while working with smart parking system as well as the solutions has been described which gives a good platform for all the users. With the implementation of smart parking system, it assures the ease of life for individuals who struggle in daily routines of their day-to-day life. The system that we propose provides real time information regarding availability of parking slots in a parking area. Users can book a parking slot for them using our mobile application. So, the users can save their time from searching for parking slots.

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