Billing Based Smart Car Parking and Maintenance System Based On IoT

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ABSTRACT: Facilitating mobility which is sustainable is one of the most important goals of the smart city aspect where the development of a parking system which is intelligent represents a key aspect. Parking space monitoring and allocation is the solution to the parking problem faced in cities. Through this survey we have analyzed . This has led to the need for an efficient parking management system. With the help of a computerized system we can deliver a good service to citizens who wants to park their vehicle into the any organizations premises using Internet of Things (IOT) based on parking management system. In this context, Internet of Things (IOT) uses sensors to connect physical parking space infrastructures with information and communication technologies, where cloud-based smart management services are provided. To implement this concept a mobile based application would be developed. This mobile application will allow an end user to check the availability of parking space and book a particular parking lot accordingly. Each parking lot would be equipped with a control system that enables monitoring of the number of free and occupied parking places and informing users about the parking lot status (open with/without free available parking spaces or closed) Additionally the application would display parking service payment according to parking time duration. Also it will sense if a vehicle has arrived on the gate for automated gate opening. This allows users to check for available parking space online from anywhere for hassle free parking. Thus, the system solves the parking issue. A small single-board computer, distance sensor, camera, LED indicator, buzzer, and battery and devoted to obtain the status of a parking space. This smart mobility project involves three main elements, namely the SPIN-V, a mobile application, and a monitoring center, working together to monitor, control, process, and display the parking space information in real-time to the drivers. In addition, the design and implementation of the three elements of the complete architecture are presented.

I. INTRODUCTION

More than half of the world population lives in the urban areas so the cities have reached its full occupancy. As a result number of vehicles in the cities has also increased. In a recent survey conducted there has been an increase of 7.64% of usage of cars per year. Hence, continuous problem of traffic congestion exists. It is found that 22% of traffic is due to cars. This increase in the usage of cars has resulted in a serious parking problem. A survey of drivers found that 81% say, it often takes them 20 minutes or more to find a parking slot, with 45% describing parking as their biggest monitoring headache. A lot of time is wasted in searching for parking slot and while searching, unintentionally it effects environment by the emission of harmful and dreadful gases. Hence, monitoring of parking is an important solution. A major factor through which the solution for this problem can be achieved is by implementing a system which can obtain information regarding the available parking space in a particular geographic area and process the data in real time to facilitate easy vehicle parking at available positions. Section II discusses the various technologies, advantages and disadvantages of the existing parking systems. Section III gives an overview of the author's proposed model. Section IV concludes over-all survey conducted.

II. LITERATURE SURVEY

A. CLOUD-BASED INTELLIGENT CAR PARKING SERVICE FOR SMART CITIES

ZhanlinJi .et.al, [1] proposes a generalized concept for car parking in smart cities using cloud-based platform. It mainly focuses on the key purpose to search, allocate, withhold, and provide the best parking space for cars. The system is based on an automatic threshold algorithm to detect the free car parking slot. This system has presentation tier, a web

tier and a persistence tire that follows the top-down approach. The paper explains the implementation and the design of a smart parking system for cars within a university campus. The car parking is constructed with three layers: application, communication, and sensor layer. Here each car parking lot is provided with a sensor, which senses the presence of the car. The information about the presence of the car is collected in close proximity by a parking meter by a set of sensors. When a user is nearing to the university campus, an automatic requisition through the user's smartphone is sent to OSGI car parking web server requesting for a vacant slot for the car parking. The server locates the best place for the car to be parked and will also guide the user to the place through maps. This system is best suited for a large university campus and also, it helps the user to efficiently find the parking lot within the campus. But, the service cannot be provided if there is no smartphone and the system cannot be implemented for parking cars on roads in the city

B. SMART PARKING: PARKING OCCUPANCY MONITORING AND VISUALIZATION SYSTEM FOR SMART CITIES

Robin Grodi .et.al, [4] presents a smart parking system using WSN (Wireless Sensor Network). It provides an optimal solution to reduce searching time and ecenomical cost associated with, time searching for empty parking space, traffic jams and cost associated with wastage of fuel. In this paper, it divides the whole parking system into two fundamental parts: detection of empty parking space and notification to the user. The paper discusses a variety of sensors that can be used to detect the empty parking space like the Induction Proximity Sensor, Active Ultrasonic Sensor, RFID Sensor, LIDAR Sensor, and Camera Detection. The sensors used need to be connected to the notification system of the user which can be done in multiple ways. The user can get the notification by directly wiring the sensor to the notification system or by connecting all the sensors to a central coordinator, this cental coordinator is capable of displaying the information or by allowing the central coordinator to place the information on the web. The system makes use of an Arduino Uno that controls the ultrasonic sensor, MySQL database, XBee devices, and Node.js Webserver. The proposed model is economical and it efficiently monitors the available slots and still is able to give real-time information about parking spot to commuters. This system can also provide service even without the use of mobile application. The disadvantage of the system is that it cannot be implemented for streets parking and is confined only to large university campuses.

C. AUTOMATIC PARKING SPACE DETECTION SYSTEM

Nazia Bibi et.al, [12] presents a system that will detect the total number of parking spaces available and passes the information to the drivers enabling easy parking for cars. The system makes use of a web camera to get the images of the parking area and image processing techniques are made use of to check the presence or absence of a car. Status of the parking lot is updated whenever a car enters or leaves the space.

The framework involves videos which are acquired from the top view of parking lot. This video is segmented into frames from which a key frame is selected from each segment. The motion of the car either entering or leaving the parking arena is estimated by this keyframe subtraction. These captured RGB images are converted to grayscale and then calibrated giving separate coordinates for both parking area and cars. The parking lot is divided into equal-sized blocks based on these coordinates. Each grayscale block is converted to binary and then inverse binary to get the car in white color and parking area in black color. The threshold value is calculated in each block to detect whether that particular block has a car or not. If the value is less than the threshold the block is free and if greater the block is occupied. This system is more efficient when compared to ROI detection technique and edge based detection technique. But, the accuracy of captured images vary due to weather conditions.

D. IOT BASED SMART PARKING SYSTEM

One important issue that relates to the smart city is parking facilities and traffic management. Abhirup Khanna et.al, [3] demonstrate an IoT based cloud integrated smart parking system. Monitoring of parking space, signalizing the availability of parking lot and booking accordingly is achieved using an on-site deployement of an IoT module.

The system makes use of a mobile application that is connected to the cloud which acts as an intermediary between things and applications to hide the difficulties necessary for smooth running of an application. Mobile application connected with cloud helps the user to know the vacancy of lots on real-time basis. Storage capacity, computation power, communication resources, scalability, interoperability, and availability are the factors that led to the combination of cloud and IoT.

Three types of sensors like infrared, passive infrared and ultrasonic sensors are used in this parking system. It helps in determining the slot is vacant or not. The system made use of raspberry pi processor unit which acts as an intermediate between cloud and sensors. Wifi module acts an intermediary in sending the data to the controller collected from various sensors. The controller uses a protocol over a single channel to transmit the data to the server. The mobile application developed in ApacheCordova (runs in both Android and IOS) and angular js framework helps in providing the information and allows the end user to book a slot. Data transfer between the server and mobile application is performed using JSON format. The server, hosted on the cloud serves as a database to save all the documents associated to the parking area and end users that have approach to the system. In case of any failure in the system, Continuous backup of data is made in the cloud for easy and quick recovery. But, the non-availability of on spot registration if the user doesn't have mobile application is a disadvantage.

A SMART PARKING SYSTEM TO MINIMIZE SEARCHING TIME, FUEL CONSUMPTION AND CO2 EMISSION

Mujeeb ur Rehaman et.al, [9] presents a type of Smart Parking System (SPS) which is based on Global Positioning System (GPS) placed in a car. The main objective endorsed by them is to reduce the searching time, fuel consumption and CO2 emission by the vehicle during parking in big cities, organizations and congested areas. This system is not based on sensors which means that the proposed system has low maintenance cost. The system is easy to use because there are two types of using this system. One is manually and the other is automatic. The working model will consists of three main parts i.e. server side, client side and parking location. Usage of no sensors facilitates low cost of maintenance. There is no need for the user to use additional components to make use of this system. This system does not provide proper security to vehicles. The implementation of this model for the real world in large scale is not possible.

I. SMART PARKING WITH RESERVATION IN CLOUD BASED ENVIRONMENT

Karthi M et.al, [8] introduced a cloud-based SPRS (smart parking reservation system) employing internet of things (IoT). The proposed system inquires the vacancy of the parking slot using the ultrasonic sensor in order to determine the existence of a vehicle. Arduino Uno board receives the information collected from the sensor. The Ethernet card associated with the Arduino Uno board forward the data to the Amazon Web Service (AWS) - Relational Database Service (RDS). The information regarding the vacancy of the free slot in that particular parking lot is issued to the driver when the request is made through a mobile app and the same is indicated using LED lights. These lights assist the other users in finding the availability of lots. Buzzer starts alarming if in case an unreserved user parked in the reserved parking slot. The alarm can be switched off only by the reserved user i.e, by using the password code which is generated during the reservation of the slot. Amazon RDS collects the code entered on the keypad and checks with the correct code and provides the notification to Arduino Uno which will make the buzzer unalarmed and modifies the lights for the parking status. Cancellation of slots & parking map is made available in mobile application, which is an advantage. The user can only monitor the status of the parking lots but cannot proceed for reservation until he creates account in the mobile application.

III. EXISTING SYSTEM

The main motivation for making Car Parking System is because of the huge amount of time people have to take in order to park their cars in malls, multiplex systems, hospitals, offices and super markets. In the existing system

PROPOSED FRAMEWORK

Through the survey few gaps have been observed. The authors have come up with few solutions to overcome these gaps which are discussed further in this section. One of the drawbacks of these proposed systems involves the absence of an on-spot registration facility which has been added to our project. A well designed and powerful security system is added which lacks in other proposed systems. In addition to the above features that have been included, the system also involves a mobile application through which pre-booking of parking slots within a radius of 2km can be made which is absent in other systems. Most of the systems that have been implemented are in reserved areas such as malls, university campuses, hospitals and offices and does not provide provision for Safe Street parking facilities. Proposed model overcomes these problems. It is ideal for smart cities.

IV. BLOCK DIAGRAM
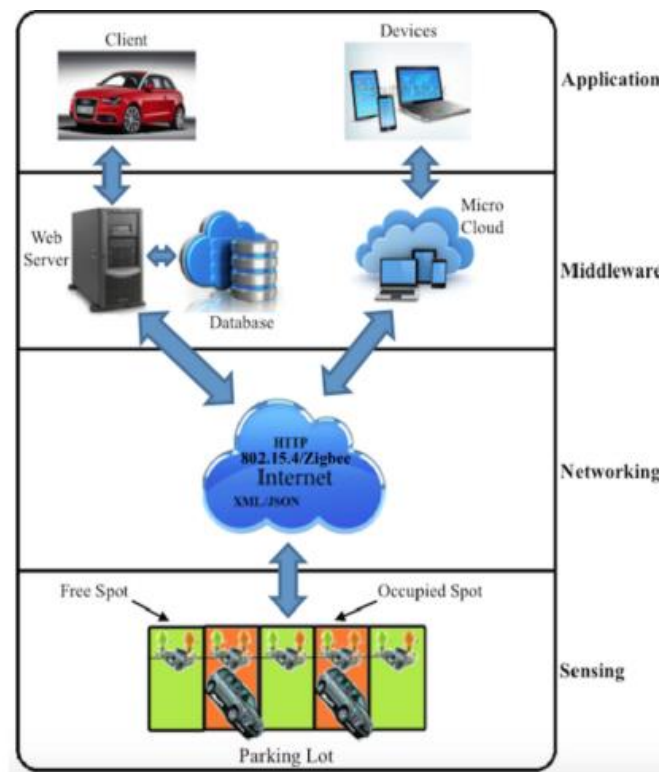
Description: The model of Smart Parking system has 6 parking lot and one entry and exit gate. For future maintenance, If any sensor doesn't work properly, an extra lot number 7 which is been kept disconnected. Each parking lot has a sensor which detects the object whenever any countable object passed around the range. All the sensors are connected with the Arduino Uno kit which supplies power. Arduino uno kit is connected with Node Mcu ESP 8266. ESP 8266 has instructions for sensors which has been imported from Arduino IDE. Arduino IDE is a software uesd for coding.

Description: As show in diagram six infrared sensors are connected with the Arduino pins 4 to 9. The infrared sensor VCC pins are connected with the Arduino's 5v. Grounds are connected with the Arduino's Ground while the out pins of all the infrared sensors are connected with pin 4 to9. The Node mcu module tx and Rx pins are connected with pin2 and pin3 of the Arduino. while the Vin pin of the Node mcu module is connected with the output of the voltage regulator. This is a regulated 5v power supply based on the lm7805 voltage regulator. But you can also power up the Node mcu module using your laptop USB port. Two USB cables will be used, cable will be used for powering up the arduino and the other usb cable will be used to power up the node mcu.

IR Sensor: This is the IR sensor which will be using for the cars detection. As show in diagram the three male headers are clearly labeled with the VCC, GND, and OUT. The VCC pin is connected with the Arduino's 5 volts. The ground is connected with the Arduino's ground. While the OUT pin is connected with Arduino's IO pins. which will explain in the circuit diagram. While the black and white leds are the IR leds "one is the Tx while the other one is the Rx".

Nodemcu ESP8266: This is the Nodemcu ESP8266 wifi module, with the help of this module we can monitor the car parking slots from anywhere around the world. As you can see clearly all the pins are clearly labeled. Never power up the Nodemcu esp8266 wifi module using the Arduino's 5 volts. If you power up this module using the arduino's 5 volt then this wifi module we will keep reseting. To solve this problem you can design a separate power supply of this module using the LM7805 voltage regulator.

V. CONCLUSION

This paper includes a survey on various techniques used for smart parking system. The main contribution of the study is to analyze the pros and cons involved in each technique and to propose a better solution which has been explained in section III. The proposed model is well suited for implementation in smart cities is an effective solution for illegal parking.

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