Cloud Based Efficient IoT Model for Intelligent Parking System

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Abstract — In this quickly developing economy, the quantity of vehicle clients increments dramatically requesting really parking spot. Navigating a parking spot in a Metro city especially at downtown parking lots, malls or amusement parks can be a buzzing and frustrating experience. This problemcan be resolved by using IOT Based Smart parking system. Unavoidable presence of cutting-edge cell urges client to incline toward versatile application-based courses of action. Improvement of IoT has gotten a way for compromise free from cells, distant correspondence advances and Mobile Applications. This System is used to monitor the status of the parking slots available and provides a better parking experience to the user. It helps in saving time and full utilization of parking spaces. This paper elucidates how the data collected from devices using sensors and IOT can be integrated, analyzed and finally shared with other devices using Cloud Technology. Availability of a free opening with its area information is sent using WIFI module development, microcontroller and distant correspondence advancement to the server and is recuperated anyway a compact application. This system proves to improve optimality and efficiency by providing smart parking solutions.

Keywords — *Cloud, Smart parking, IoT, Mobile Application, Raspberry pi computer, WiFi.*

1.Introduction

Finding a place to park our vehicles is one of the common problems faced by us every day. The availability and control of parking space make people waste a large amount of time. Recent study show that an average time spent by a person in finding a parking space is about 40 hours a year, not to say about fuel waste and air pollution [1]. Technology has changed many aspects of our life. Nowadays we rarely search for taxi on the street, then why searching for a parkingspot be still manual and a stressful experience. We could make parking more data driven using the concept of Internet of Things. [2] The empty parking slots available in a particular area can be computed and updated with the help of IOT. Thisprovides the user a better parking experience is a massive organization of associated gadgets.

These devices collect and offer data about how they are involved and the environment in which they are worked. This is totally done using sensors that are introduced in each real device like PDAs, vehicles, traffic lights and practically all that we go over in our day-to-day existence. The information radiated by these gadgets are put away in a cloud and afterward can be gotten to by different gadgets. The data emitted by these devices are stored in a cloud and then can be accessed by other devices [3]. In the proposed system we make use of the same concept. The user can navigate the empty parking spots through an

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application in his mobile phone. Initially the destination is entered by the user, the sensors in the parking spots deduct if it's occupied or not by updating information in the cloud by using Raspberry pi and internet. This information is viewed by the user using IOT and the appropriate space is devoted to the user. Thus, IOT is influencing our lives to make it easier and the goal of smart parking is optimally achieved using the proposed model.

This paper is organized in a format, such that section I has introduction, the detailed explanation of Automator Raspberry version is explained in section II, about role of cloud technology in section III, comparative analysis on existing models is discussed in section IV, proposed system in section V, experimental analysis on section VI, results & discussion were expressed on section VII and finally conclusion is listed in section VIII.

2. Automator Raspberry Pi Version 3.0

The integrated circuits such as the Raspberry pi help us to build smart equipment's according to our needs. Theraspberry pi has greater capabilities than other integratedcircuits [4]. They can be used to implement IOTs that we build easily and can perform more complex tasks. It also performs multitasking. It has a complex architecture of hardware and software to perform the complex tasks. It uses the powerful Broadcom BCM2837B0 SoC control unit. It has an inbuilt graphics card which can do multimedia processing. Several complex mathematical computations can be done by raspberry pi as it has better logical processing of data [5]. It has Bluetooth and WIFI connections which can easily be connected to the network. The raspberry pi 3B+ is better than all the previous versions and currently the most powerful developed board. The proposed thought utilizes the raspberry pi to associate with the

sensors used to recognize the opening of the space in the parking areas and to assess the distance of the stopping region from the current area of the client searching for a spot to stop. The raspberry pi is connected to the proximity sensors at first to detect the presence or absence of a nearby object of a vehicle is present or not and the information is stored [6]. It uses distance sensors to estimate the distance of the destination parking.

The sensors can be programmed by the use of the mostefficient python scripts to perform the needed tasks to locate spaces. In the event that there happens accessibility for a parking spot, the sensors are customized to convey messages to the CPU and pass data to the client about the accessibility which can be followed the assistance of an android or Smartphone application convenient with the client. This application operates with a cloud storage so that they can be accessed from anywhere easily and to keep better track of all the spaces available in the parking lots. These sensors are placed in areas of authorized parking spaces and appropriate parking spaces only [7,8].

3. Cloud Technology

Various cloud platforms can be used to store the information obtained from the sensor and also to establish a better user experience. More number of users can access the cloud for details of the nearby parking spaces at the same time easily. Any cloud specialist organization like AWS, Azure or Google cloud stage can be utilized to store the data from the single board PC or the raspberry pi [9]. All the platforms make use of the simple cloud computing techniques to keep track of the data in the cloud.

The data with the availability of the parking space is maintained in thecloud database and each time a user requests a query for availability of a space the cloud retrieves the number of vacancies in the parking spaces available near the user's destination. Thus, the cloud acts creating better suitable user-friendly methods for the user to access the parking lots available swiftly and more efficiently [10].

4. Comparitive Analysis on the Existing Models

i) Parking Management Based on RFID - TAGPARK

This model contains an RFID tag which contains the details of the car specifications like car model, car number, color, etc. This information is already stored in a DB and thisparticular car is said to be authorized [14]. When an authorized car approaches the parking lot, a camera is used tocapture the image of the car and scan the RFID tag and checks whether the car details are matched and allows the car opark. When a car which is unauthorized with an RFID tag approaches the parking lot, the camera captures the image of the car and details of it. Since it does not contain a tag, it is not allowed in that particular parking lot to park.

ii) BV-LED Intelligent Lighting and Parking Management System

This parking system displays the available parking slots in a mall or complex or any parking lot [15,16]. It displays the total available slots and gives the number of vacancies in each level. When a car enters the parking slot an electromagnetic detector is used to detect the arrival of thecar and decrements the count of the available parking slots and directs the driver in which direction is the lot free using the LED displays. when a

car leaves the parking lot the value of vacancies gets incremented as it again passes through the electromagnet detector at the entrance and exit [17,18].

➢ **Advantages Of The System**
- To Optimize parking
- Enhanced user experience
- Real-Time data and trend insight
- IoT assumes a significant part in associating the general climate to the organization and made simple to get to those things from any area.

➢ **Disadvantages Of The System**
a. It is a complex system protocol to domains of commercial interest.
b. It is efficient for urban environment only

5. Proposed System

The Proposed System makes use of the concept of Internet of Things which acts as the common architecture for information exchange between various devices. Initially we exploit the use of mobile technology in viewing the parking spaces. The user is able to access this information and is guided to make smart choices, thereby improving the efficiency.

The user creates a user Id and specifies the essential information needed. This Id is unique for every user. When the user needs to find a parking spot, the destination is typed. The free parking spot available are validated by obtaining information from the cloud and provides the real time vacancy. The routing to the car park is also indicated. The user is provided the facility to make a reservation in advance. On the other hand, this real time prediction is done by using parking spaces [12]. The proposed model is shown in Fig.1 for smart parking system.

Figuge 1: Model of the smart parking system
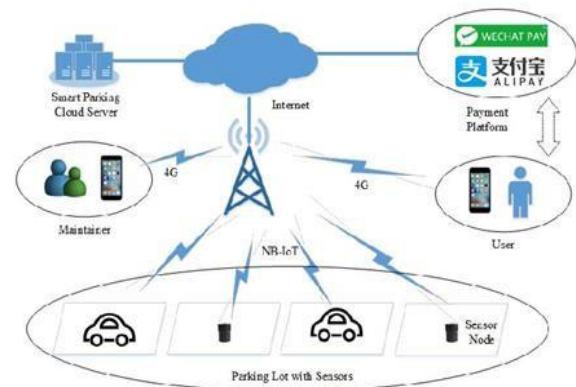
Closeness and Distance sensors put close to the parking spot. A closeness sensor is a sensor ready to distinguish the presence of neighboring articles with next to no actual contact. IR sensors are also used to measure the distance between objects. This information that is collected isput together for evaluating free spaces by using the concept of IOT. Raspberry pi is one of the main components used in the IOT platform [11]. This is connected to the cloud by using an internet connection. Cloud computing is a model enabling on demand network access to a shared pool of configurable computing resources. The configured data is accessed in the user end thus solving the problem of solving the problem of finding parking spaces [12].

6. Experimental Results - User End Implementation

A) Mobile Parking App

The versatile application is created utilizing Android Studio application. Application modules are Registration, Login, choosing date and timing or how long, stopping opening choice. Application likewise upholds current booking and progressed booking choices. Figure 2 and 4 portrays the screen capture of Android Mobile telephone application login/register page [13 [14].
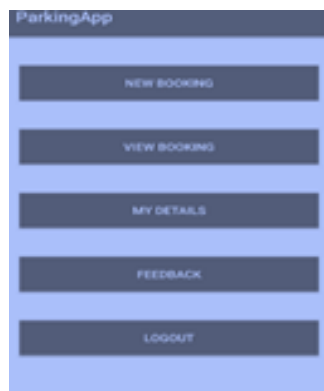

Figure. 2: Login   **Figure 3:** Application options

B) Identifying Free Parking Slot

Free opening ID is affirmed using closeness sensors. The closeness sensor is an electronic sensor that can recognize the presence of things inside its area with essentially no authentic genuine contact. The closeness sensors are used for each halting space. To recognize objects, the sensor communicates or delivers a light outflow radiation, normally as infrared light, and resources the appearance to choose the article's distance or closeness [15] [16].

Figure 4: Register   **Figure 5:** Parking Duration

C) Navigation

One of the principal highlights of this application is route administration assigned to stopping space. Portable application would begin exploring from the current area to the apportioned stopping space. Google map is connected with GPS and to give way route to the stopping space [17].
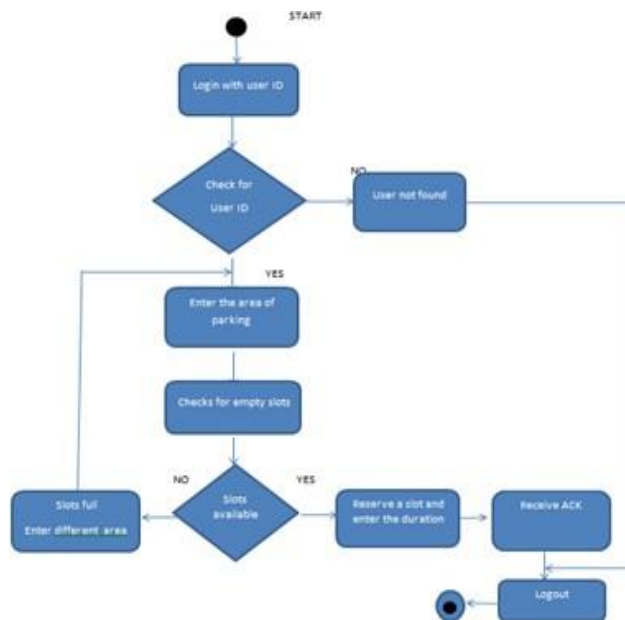

Figure 6: Activity Diagram
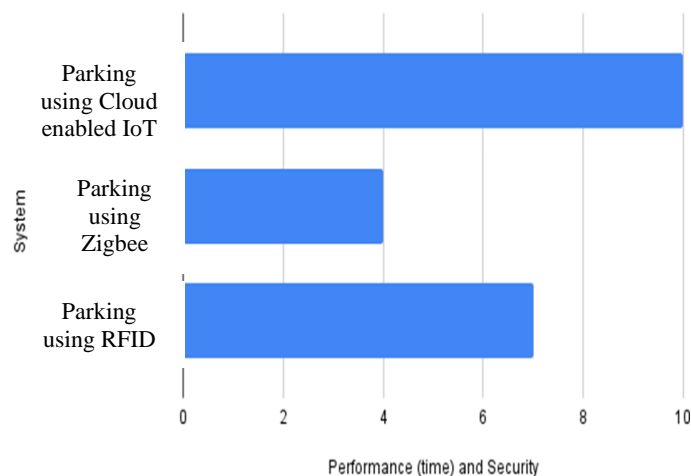
7. Results And Discussion

Figure 7: Performance analysis of various parking system

We use the Arduino Uno microcontroller, which helps to control the sensors of the electronic circuit. Different technologies like RFID sensors, Arduino Uno, Zigbee, RFID Reader, parking Cart, Cloud Application for storage embedded together to create an innovative automation parking system. These proposed model technologies are never embedded together in related systems. Bar-code technologies are used in most parking instead of RFID technologies that are a very time consuming process to scan every single car in the line of sight position. RFID technologies are used in related works but they do not provide a friendly environment to the customer. ZigBee modules are also used to trace the vehicle and share parking information with each other that increases the security risks and cost of the system. The Proposed system is implemented on wireless communication and provides different software-based modules that make it more reliable and flexible to the customer as well as to the car owners and drivers. Figure 7 elaborates the various parking system techniques and their performance analysis with respect to time

and security [18]. We arrive at a conclusion at parking model enabled with cloud and IoT provides better time and security performance metrics.

Use Of Sensors

    a. The proximity sensor permits distinguishing the presence of vehicles left in the parking spot by transmitting an electromagnetic field or a light emission radiation and searches for changes in the field or bring radiation back.

    b. The technology tracks the changes in the earth's magnetic field generated by the presence of a calibrated iron mass of an object such as a vehicle.

    c. The free/busy status is then transmitted by radio, by a communication network to the central server.

    d. From the central server POLIS management software will process by combining data with any payment transactions and make them available to allstakeholders.

8. Conclusion

Thus, an idea of a user-friendly system is used to makeparking easier is proposed. The user can save time in searching for parking area in their destination. The use of IOTs implemented in the parking area does a great job of maintaining availability record of spaces efficiently. The use of Raspberry pi computers which has been widely used nowadays is to automate the parking areas and the data with availability information is passed to a cloud database and it isfurther elaborated. The working of the user application to track the parking spaces is also demonstrated.

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