

IoT based Smart Parking System

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Abstract— In recent times the concept of smart cities have gained grate popularity. Thanks to the evolution of Internet of things the idea of smart city now seems to be achievable. Consistent efforts are being made in the field of IoT in order to maximize the productivity and reliability of urban infrastructure. Problems such as, traffic congestion, limited car parking facilities and road safety are being addressed by IoT. In this paper, we present an IoT based cloud integrated smart parking system. The proposed Smart Parking system consists of an mobile application which allows an end user to check the availability of parking space and book a parking slot accordingly. It also involves using low-cost sensors, real-time data collection, and mobile-phone-enabled automated payment systems that allow people to reserve parking in advance or very accurately predict where they will likely find a spot.

Keywords— Internet of Things; Cloud Computing; Smart Parking; Smart City; Cloud of Things

1. INTRODUCTION

The concept of Internet of Things (IoT) started with things with identity communication devices. The devices could be tracked, controlled or monitored using remote computers connected through Internet. IoT extends the use of Internet providing the communication, and thus inter-network of the devices and physical objects, or ‘Things’. The two prominent words in IoT are “internet” and “things”. Internet means a vast global network of connected servers, computers, tablets and mobiles using the internationally used protocols and connecting systems. Internet enables sending, receiving, or communicating of information. IoT, in general consists of inter-network of the devices and physical objects, number of objects can gather the data at remote locations and communicate to units managing, acquiring, organizing and analyzing the data in the processes and services. It provides a vision where things (wearable, watch, alarm clock, home devices, surrounding objects with) become smart and behave alive through sensing, computing and communicating by embedded small devices which interact with remote objects or persons through connectivity. The scalable and robust nature of Cloud computing is allowing developers to create and host their applications on it. Cloud acts as a perfect partner for IoT as it acts as a platform where all the sensor data can be stored and accessed from remote locations.

Physical Object + Controller, Sensor and Actuators + Internet = Internet of Things

The smart parking system that we propose is implemented using a mobile application that is connected to the cloud. The system helps a user know the availability of parking spaces on a real time basis.

2. NEED FOR IOT-CLOUD INTEGRATION

Cloud computing and IoT have witnessed large evolution. Both the technologies have their advantages, however several mutual advantages can be foreseen from their integration. Below are some of the factors that led to the amalgamation of Cloud and IoT:

Storage capacity:

IoT comprises of a large number of information sources (things), which produce huge amounts of non-structured or semi-structured data. As a result IoT requires collecting, accessing, processing, visualizing and sharing large amounts of data. Cloud provides unlimited, low-cost, and on-demand storage capacity, thus making it the best and most cost effective solution to deal with data generated by IoT.

Computation power:

The devices being used under IoT have limited processing capabilities. Data collected from various sensors is usually transmitted to more powerful nodes where its aggregation and processing can be done[18]. The computation needs of IoT can be addressed by the use of unlimited processing capabilities and on-demand model of Cloud. With the help of cloud computing, IoT systems could perform real-time processing of data thus facilitating highly responsive applications. Communication resources. The basic functionality of IoT is to make IP-enabled devices communicate with one another through dedicated set of hardware. Cloud computing offers cheap and effective ways of connecting, tracking, and managing devices from anywhere over the internet. By the use of built-in applications IoT systems could monitor and control things on a real-time basis through remote locations.

Scalability:

Cloud provides a scalable approach towards IoT. It allows increase or decrease in resources in a dynamic fashion. Any number of “things” could be added or subtracted from the system when cloud integration is provided. The cloud allocates resources in accordance with the requirements of things and applications.

Availability:

Any time any where availability of resources becomes very easy with cloud integration. Many of the cloud providers assure 5 nine availability. With cloud, the applications are always up and running and continuous services are being provided to the end users.

Interoperability:

IoT involves the use of devices that are heterogeneous in nature. These devices may have different hardware or software configurations as a result causing compatibility issues. It becomes very difficult in an IoT environment to ensure interoperability among these devices. Cloud helps in addressing this problem as it provides a common platform where various devices can connect and interact. Devices are allowed to share and exchange data in a format that is acceptable to them.

3. LITERATURE REVIEW

The author Khanna A. (2016) described in their research paper entitled "Smart Parking System" about Smart Parking in the city. The researcher has focused on introduction of IoT, Need for IoT-Cloud integration, System architecture and its implementation and has also given conclusion about the whole topic.

The researcher has basically talked about using IoT in order to maximize the productivity and reliability of urban infrastructure.

In his paper, he presented or talked about an IoT based cloud integrated smart parking system. The proposed Smart Parking system consists of an on-site deployment of an IoT module that is used to monitor and signalize the state of availability of each single parking space.

4. CONCLUSION

The concept of Smart Cities have always been a dream for humanity. Since the past couple of years large advancements have been made in making smart cities a reality. The growth of Internet of Things and Cloud technologies have give rise to new possibilities in terms of smart cities. Smart parking facilities and traffic management systems have always been at the core of constructing smart cities. In this paper, we address the issue of parking and present an IoT based Cloud integrated smart parking system. The system that we propose provides real time information regarding availability of parking slots in a parking area. Users from remote locations could book a parking slot for them by the use of our mobile application. The efforts made in this paper are indented to improve the parking facilities of a city and thereby aiming to enhance the quality of life of its people.

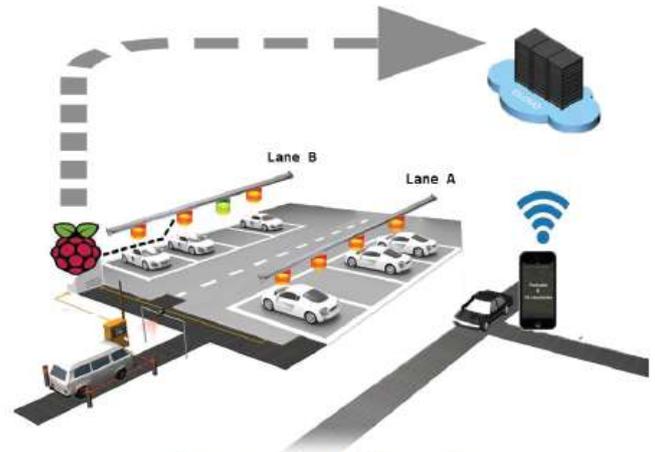
5. SYSTEM ARCHITECTURE

Figure 1: Smart Parking System

This section describes the high level architecture for the smart parking system.

Talking of the above mentioned figure, it depicts a parking area where our parking system is implementation along with the way in which communication happens between various actors. The primary actors that constitute the parking system are:

Parking Sensors:

For our parking system we have made use of sensors like Infrared, Passive Infrared(PIR) and Ultrasonic Sensors. The work of these sensors is the same i.e. to sense the parking area and determine whether a parking slot is vacant or not. In this case we are using ultrasonic sensors to detect the presence of a car. The ultrasonic sensors are wirelessly connected to raspberry pi using the ESP8266 chip. An ESP8266 WiFi chip comprises of a self contained SOC with integrated TCP/IP protocol stack that allows any microcontroller to access a Wi-Fi network. The sensors are connected to a 5V supply either from raspberry pi or an external source. External source being more preferable.

Mobile application:

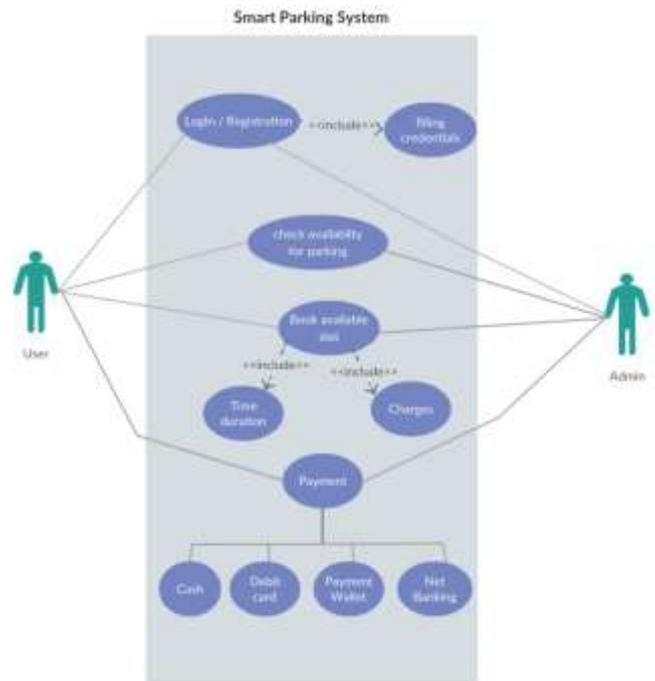
The mobile application acts like an interface for the end users to interact with the system. The application is developed in Apache Cordova and Angular Js framework using Javascript as a programming language. The purpose of using Apache Cordova is to create applications that can run on both android and iOS platform with the same source code. The application is connected with the IBM MQTT server through a secure channel and a 2 factor authorization. The purpose of this mobile application is to provide information regarding availability of parking spaces and allowing the end user to book a slot accordingly. Transfer of data takes place in JSON format between IBM MQTT server and the mobile application. In order to ensure proper communication both the Raspberry pi and mobile application must be subscribed to a particular channel on IBM MQTT server.

6. IMPLEMENTATION & WORKING

In the previous section we discussed about the architecture and technical stack related to the smart parking system. In this section we talk about the implementation and working of the system in a real world scenario.

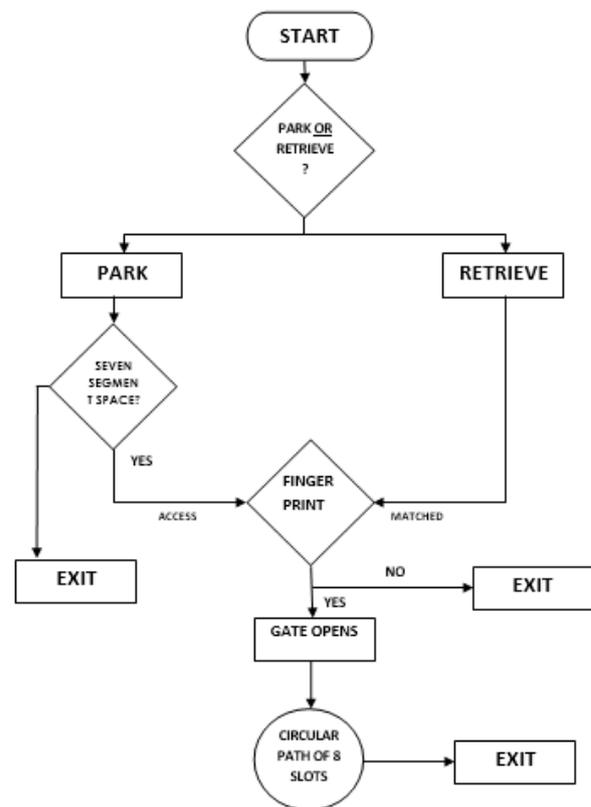
How It Work's :-

- Step 1 :- Users Needs To Register On Mobile Application.
- Step 2: - After The Registration User Can Find Nearby Parking Zone With Availability Of Parking Slot.
- Step 3: - After The Selection Of Parking Slot User Can Book That Parking Slot With Their Requirements.
- Step 4: - User Can Pay Bill By Online/Offline.

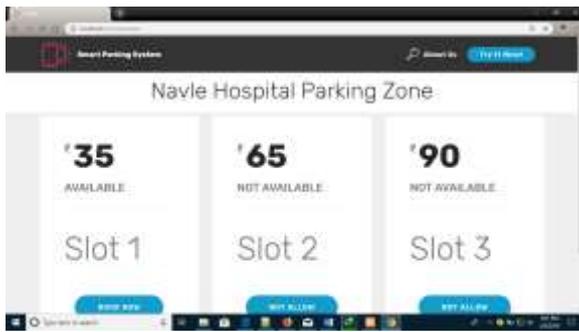


How Our System Architecture/Algorithm Works :

- When Vehicle Enters Into The Parking Slot, Sensor Sense The Object And Generates The Data.
- After That The Data Will Be Updated On The Cloud.
- Then Our Mobile Application Will Behaves According To That Data.
- There Is Also Barcode Scanning Feature Is Available For Security Purpose.
- There Is Also Security Clearance Cabins Are Available At The Time Of Entry/Exit Point.
- If Anyone Try To Break The Security System, Then Security Alarm Starts Beeping.
- If Time Duration Exceeded Then User Have To Pay The Remaining Amount Of Parking Charges.



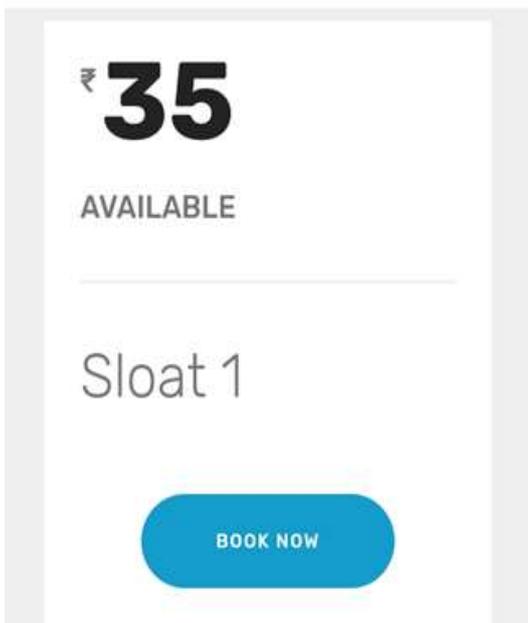
6. Results



Desktop View



Navle Hospital Parking
Zone



Mobile View



Working Model

7. REFERENCES

- [1] Anthony Mwebaze International Journal of Scientific and Research Publications, Volume 2, Issue 10, October 2012 IISSN 2250-3153)
- [2](Chandni Patel, Monalisa Swami ,et.al)
- [3] Shietan B.Dhoti, 1B.E Scholar, Dept of Computers, SSBT COET,Bambhori, Jalgaon, MH, India, International Journal of Scientific Engineering and Technology Research Volume.04, IssueNo.07, March-2015, Pages: 1379-1382
- [4] Abdul Ahad, et.al World Journal of Engineering and Technology, 2016, 4,160-167
- [5] Wikipedia website,
<https://en.wikipedia.org/wiki/MQTT>.