

Smart Parking for Smart Cities

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Abstract: - In recent times the concept of smart cities has gained great 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 on-site deployment of an IOT 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. The paper also describes a high-level view of the system architecture. Towards the end, the paper discusses the working of the system in form of a use case that proves the correctness of the proposed.

Keywords: - Cloud Computing, Cloud of Things, Internet of Things, Smart City, Smart Parking.

I. 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. Thing in English has number of uses and meanings. Dictionary meaning of ‘Thing’ is a term used to reference to a physical object, an action or idea, situation or activity, in case when we Do not wish to be precise 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. These factors gave rise to the amalgamation of both technologies thus leading to the formation of a new technology called Cloud of Things (COT). In COT the things (nodes) could be accessed, monitored and controlled from any remote location through the cloud. Due to high scalability in cloud any number of node could be added or removed from the IOT system on a real time basis. In simple terms IOT can be explained in form of an equation stating:

$$\text{Physical Object} + \text{Controller, Sensor and Actuators} + \text{Internet} = \text{Internet of Things}$$

The ideal of creating a Smart City is now becoming possible with the emergence of the Internet of Things. One of the key issues that smart cities relate to are car parking facilities and traffic management systems. In present day cities finding an available parking spot is always difficult for drivers, and it tends to become harder with ever increasing number of private car users. This situation can be seen as an opportunity for smart cities to undertake actions in order enhance the efficiency their parking resources thus leading to reduction in searching times, traffic congestion and road accidents. Problems pertaining to parking and traffic congestion can be solved if the drivers can be informed in advance about the availability of parking spaces at and around their intended destination.

Recent advances in creating low-cost, low-power embedded systems are helping developers to build new applications for Internet of Things. Followed by the developments in sensor technology, many modern cities have opted for deploying various IOT based systems in and around the cities for the purpose of monitoring. A recent survey performed by the International Parking Institute reflects an increase in number of innovative ideas related to parking systems. At present there are certain parking systems that claim to citizens of delivering real time information about available parking spaces. Such systems require efficient sensors to be deployed in the parking areas for monitoring the occupancy as well as quick data processing units in order to gain practical insights from data collected over various sources.

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. The rest of the paper is organized as follows: Section II talks about the factors responsible of Cloud-IOT integration. Section III presents the

state-of-the-art in smart parking system. Section IV describes the implementation and working of the system. Section V concludes the paper.

II. SMART TRAFFIC CONGESTION CONTROL

A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies This paper provides a unique algorithm which increases the capability of the current cloud based smart parking system and it also develops a network architecture based on the Internet of Things technology. This system helps the users to find a free parking space with minimal cost based on new performance metrics which is automatic. This metrics will calculate the user spaces in each car park. To enhance the parking management, an intelligent parking system was developed which reduced the purpose of hiring people to maintain the parking system . In this paper it proposes an effective cloud-based Smart parking system based on the Internet of Things. The data that includes the vehicle GPS location and distance between car parks and number of free parking space in car parks will be sent to the data centre. Here the data centre is presented as a cloud server which calculates the costs of a user parking request and this information is regularly updated and is made available to the vehicles in the network at any time. In this proposed system, each car park is an IoT network and it operates independently as a regular car park. This paper implements a system model with wireless access in an open-source physical computing platform based on Arduino with RFID technology. It uses smartphone that acts as a user interface between the cloud and the vehicles to check the feasibility of the proposed system.

III. PROPOSED MODEL

The main aim of this project is to check whether there is an empty slot available for the vehicle to park. we use sensors to check the empty slot .if vacancy is available data is uploaded to the cloud .the empty slot is shown on the web page with different colours if the slot is empty then displayed as blue if not then red is displayed on the web page. here by using the uploaded data in the cloud we develop an app where we can check the availability of the slot.

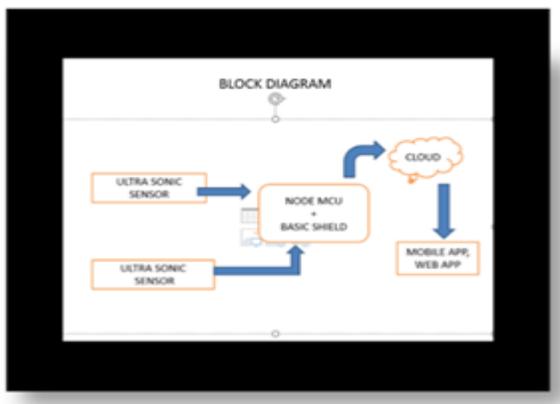


Fig 1 Block diagram

IV. 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. The complete process of booking a parking slot, parking a car in that slot and leaving the parking area is explained with the help of the following algorithm

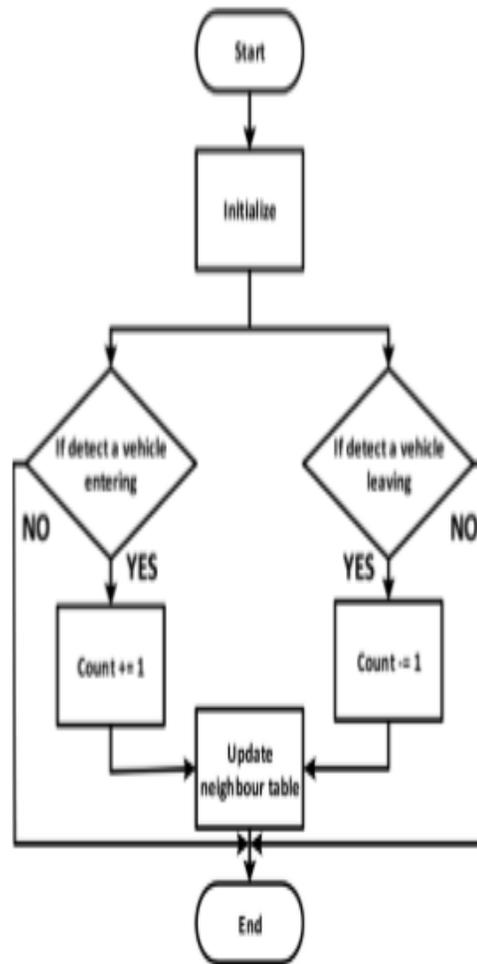


Fig 2 Flow chart

We propose an algorithm to describe the operation of the system.. We conducted an experiment in order to depict the working of our system at every stage from checking the availability of parking space to actually park a car in a vacant parking slot. This is done by implementing the smart parking system in the parking area of a shopping mall. Below are the steps that a driver needs to follow in order to park its car using our parking system.

Step 1: Install the smart parking application on your mobile device.

Step 2: With the help of the mobile app search for a parking area on and around your destination.

Step 3: Select a particular parking area.

Step 4: Browse through the various parking slots available in that parking area.

Step 5: Select a particular parking slot.

Step 6: Select the amount of time (in hours) for which you would like to park your car for.

Step 7: Pay the parking charges either with your e -wallet or your credit card.

Step 8: Once you have successfully

would then have an option of extending its parking time and pay accordingly for the extra time. In case the driver fails to do so, the parking attendant would make a note of this and charge money for the extra time in form of a fine. This fine would be collected from the driver at the time when the car would be leaving from the parking area.

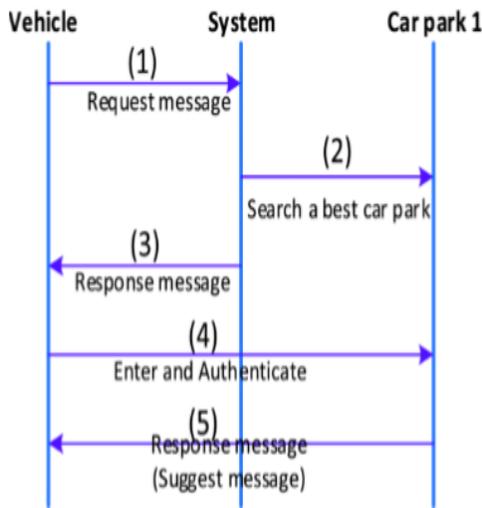


Fig 3 Rough sketch

In this case parking slots named A1 and A3 are vacant whereas slot A2 is occupies. The driver chooses the A1 parking slot. Selecting the amount of time The above figure depicts the scenario when a driver needs to specify the amount of time for which it needs the selected parking slot. In this case the driver selects the 1 hour option. Occupancy check 269 Once the driver has parked its car in the selected slot it needs to confirm its occupancy. depicts this very scenario in which the driver has to specify its presence.

V. APP INVENTOR2

This feature is added so that only a genuine driver can park its car in a particular parking slot. If a driver fails to confirm his occupancy in the next 30 seconds of parking its car, an alarm would start ringing causing the authorities to know that a car has been parked in the wrong place. If by any chance a genuine driver fails do so he can stop the alarm any time by confirming his occupancy. In case the driver over shoots its parking time, a notification stating this scenario would be sent to the driver as well as to the parking attendant. The driver



Fig 4 App designer window

VI. RESULT ANALYSIS

Whenever, the push button is pressed it activates the Node mcu module through the wifi. then it enables a request to connect to the android device. the android device uses the MIT app and sends the SMS to the predefined numbers from the global contact list as mentioned

- Step 1: press the button.the on the android.
- Step 2: the front end of the app is shown on the screen.
- Step 3: select the phone numbers and get the location.

Step 4: the user will be given the information whether the slot is empty or not

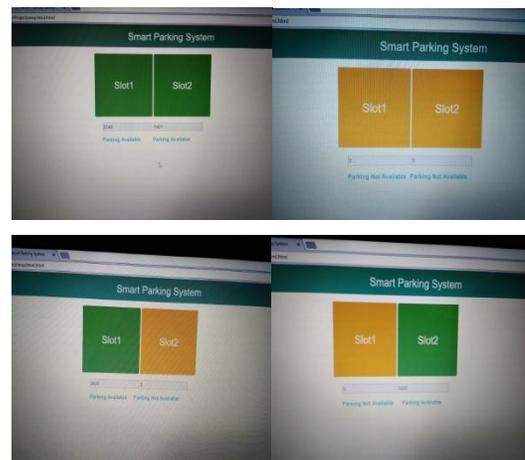


Fig 5 Results

VII. 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.

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