A Review of IOT Based Vehicle Parking

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Abstract: One of the important considerations of being a smart city is the Smart Parking facility. Finding a particular space to park our vehicle becomes an annoying issue. Besides, number of vehicles in like manner rapidly grows once every day. It has been seen that the drivers struggle to find a halting extent without thinking about where parking space is open Problems such as, traffic congestion, limited car parking facilities and road safety are being addressed by IOT. We created a prototype of a novel smart parking framework for an urban domain in light of reservation utilizing Internet of Things (IOT) by using Raspberry-pi. Proposed system provides optimize usage of parking space and get considerable revenue generation.

Keywords- IOT, Raspberry pi

I INTRODUCTION

Finding a parking slot to park their vehicle has ended up being a disappointing issue to the drivers all the time. It has paved the way for traffic congestion which has turned out to be an alarming problem on a global scale .Searching for a parking space is a routine (and often frustrating) activity for many people in cities around the world. This search burns about one million barrels of the world's oil every day

.IOT is enabled by Raspberry Pi world's first open source hardware project capable of connecting with computing devices, digital & analogue machines using GPIO-General Purpose Input / Output Pins. Since Raspberry Pi comes with inbuilt ARM processor which runs Debi an Linux as OS, it could host high level programming languages such as Wiring Pi for processing data transformed through GPIO Pins.

Delhi has the highest number of four wheeler vehicles at 7.35 million, which is followed by 4.1 million in Bangalore,
3.7 million in Chennai, 3.3 million in Hyderabad and 2.2 million in Pune. In busy cities like Hyderabad and Pune, it is near to impossible to find a vacant parking slot easily during peak hours. The drivers tend to move around in search of parking slots which indirectly leads to traffic jams and traffic congestion. Our proposed system presents an Autonomous car parking that regulates the number of cars that can be parked in a given space at any given time based on the parking space availability. According to a report, Smart Parking system could benefit in saving 2, 20,000 gallons of gas till 2030 and 3, 00,000 gallons of gas by 2050.

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. Idea could be implemented using a mobile application so the drivers could get their parking information and reserve the vacant spaces of their wish as per their vehicle's width via Wi-Fi or Internet because today almost everyone can possess a smart phone with them.

II INTERNET OF THINGS

Moving towards smart city, smart parking is a very good example for a common citizen of how the Internet-of-Things (IOT) can be efficiently and effectively used in our day to day life to provide different services to different users. Proposed application is user friendly and even non-technical person can use it through mobile device. Through this application user can search a free parking slot from anywhere in the world. Proposed system provides well-organized car parking management through isolated parking spot localization. Conventional reservation based car parking method has a limitation of space and time. Proposed smart parking system providing the free parking slot efficiently that saves time and fuel and reduces atmospheric pollution and congestion in cities. IOT based new Parking platform enable to connect, analyze and automate data gathered from devices, and execute efficiently that makes smart parking possible[5]

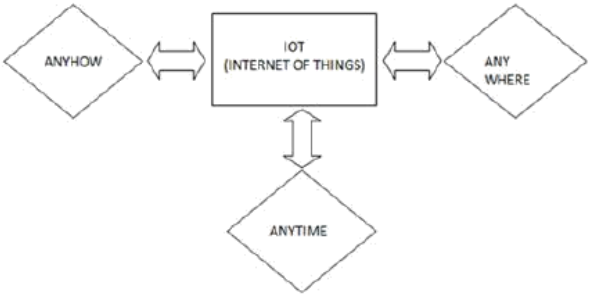

Fig 1 Architecture of IOT

III 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. On one hand, IOT can address its technological constraints such as storage, processing and energy by leveraging the unlimited capabilities and resources of Cloud. On the other hand, Cloud can also extend its reach to deal with real world entities in a more distributed and dynamic fashion by the use of IOT. Basically, the Cloud acts as an intermediate between things and applications, in order to hide all the complexities and functionalities necessary for running the application. 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 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 anywhere 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. [2]

IV METHODS FOR ENTRY RECOGNITION

FACIAL RECOGNITION

When the car enters the parking lot, the face recognition of the driver is done for security purposes. The Raspberry pi camera uses Open CV to create the dataset of the driver's face and then it is trained with the dataset to recognize the driver's identity. When the driver comes out of the parking slot, his face is again recognized at the barricade to provide complete security and only if the face matches with the trained dataset he is allowed to exit out of the parking lot. To develop this model we have used Eigen faces method based on Principal Component Analysis and Support Vector Machine algorithm [3]

QR CODE SCANNER

Quick Response Codes are a type of two-dimensional barcode that can be read using smartphones and dedicated QR reading devices, the square code is distinct and easily visible on any surface that it is printed on. As a result, people do not have to be notified separately about the existence of QR code. even generating a QR code is cheaper and easier as compared to RFID, one can generate a QR code on their smart phone itself QR code are a much more financially viable option The QR code generator can either be stuck on the wind shield of the car or an image of the same in the customers mobile phone application can be shown at the entry gate of the parking system.This is scanned by the Raspberry pi camera module and the details of the customer corresponding to the QR code will be retrieved For RFID, Special RFID chips have to be deployed that transmit the relevant code For using QR code one just have to print it and stick on the surface QR code is used for product tracking, item identification time tracking, document management, general marketing etc. QR code has white Background on which black squares are arranged in a grid hitch can be scanned or read imaging device such as a camera and processed until the image can be approximately interrupted Then the data is extracted from the patterns that are present in horizontal and vertical direction [5]

V SYSTEM ARCHITECTURE

In many cities, people would appreciate their luck if they could find a parking slot smoothly. People keep roaming around in search of vacant parking slots, and after a lot of struggle, they find one. Due to lack of a proper mechanism to identify free parking slots, they move randomly in search

of parking space wasting a lot of time. This problem can be solved if the drivers could check the availability of parking spaces in and around their intended destination.

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 spot 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. The sensors are connected to a 5V supply either from raspberry pi or an external source. External source being more preferable.

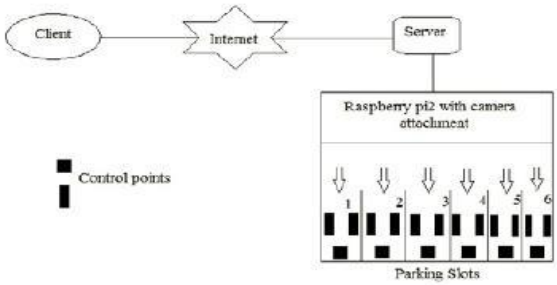

Fig 2 Structure of smart parking system

Processing Unit: It comprises of Raspberry pi which is a processor on chip. The processing unit acts like an intermediate between the sensors and cloud. All the sensors are wirelessly connected to the processing unit. A single raspberry pi unit comprises of 26 GPIO pins i.e. 26 different sensors can be connected to it. However we can increase this number by attaching a multiplexer (MUX) to it. It is essential that the ground of raspberry pi and sensors must be connected in order to transfer data using the GPIO pins. There is a python script running on the chip that checks the status of various GPIO pins and updates this information onto the cloud. Data collected from various sensors is sent to the raspberry pi through the esp8266 chip. The raspberry pi then transmits this data to the IBM MQTT Server through MQTT protocol over a channel. MQTT (Message Queue Telemetry Transport) Protocol is a publish -subscribe based "light weight" messaging protocol that is used on top of the TCP/IP protocol.

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 Jess framework using Java script 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.

Fig 3 Flow diagram of Entry & Exit

VI INTEGRATING RASPBERRI PI WITH ULTRASONIC SENSOR

HSC-SR04 is the commonly used ultrasonic distance sensor which operates to find the distance between 2 to 400 cm distances. This ultrasonic distance sensor module contains four pins such as • VCC – Input Power of 5V • TRIG – Trigger Input • ECHO – Echo Output • GND – Ground Upon triggering the TRIG pin with minimum required High signal of at least 10 S duration, it will transmit eight 40 KHz ultrasonic burst through the sender. The ECHO pin will get high voltage for the duration of time taken for sending and receiving ultrasonic sound signals. Based on the distance of obstacle the pulse width will vary Entire operation of ultrasonic control such as to initiate the sender to trigger sound waves, listening the receiver to calculate the distance will be controlled through Raspberry Pi and Python scripts as below will handle these operations through Wiring Module[3]

VII *INTEGRATING RASPBERRI PI WITH CAMERA*

The Raspberry Pi Camera Module is specifically designed extension hardware to work in connection with Raspberry Pi. Raspberry Pi Camera connects with the Raspberry Pi device through the dedicated CSI interface bus which is capable of transmitting high volume of pixel data. The transmission of data to the camera and Pi device will happen through BCM2835 processor embedded to the Camera board. The Camera board is a tiny, at around 25mm x 20mm x 9mm and weights just 3g making it portable of mobile like applications and other digital devices where size matters in specific. The camera board connects to Raspberry Pi by the way of a short ribbon cable Once the camera module is integrated then the raspberry pi should be installed with camera module to access the camera by any of the high level programming languages. The prototype establishes here uses Python Script for controlling the camera, that is to take to take the capture of number plate details of car being parked. The camera module code will be activated once confirmed that the vehicle is in specific distance from the sensor and this will be intimated by the ultrasonic sensor to the camera module to activate[3]

IX *CHALLENGES OF SMART PARKING SYSTEM*

The challenges for the proposed system are wide from protecting the system from environmental conditions and harsh weather so as to making it operational in all weather. Integration of the devices amongst various hardware and software modules Protection can be provided by using a proper insulator case for the hardware module which will not affect the functionality of the device and also provide durability, resistance against external weather and mechanical forces. The major challenge in Parking Systems is of system integration due to wide variety of hardware and software platforms involved and hence possess a great concern to the system scalability. The technology platform supporting P&E, PARC and PUCRS systems comprises of dynamic messaging systems, a myriad of hardware sensors and traffic control devices, wireless and wire line. Telecommunications systems, computer clients, servers and hardware drivers and application interfaces. Enabling all these devices from thousands of different vendors to communicate with each other and tying them together into one platform is the greatest challenge in reducing the complexity and cost of smart parking. The variety of infrastructure hardware and software systems that need to be integrated is enormous and an add-on to it the conventional older hardware making investment in Smart Parking solution. It is highly risky and fragmented. Another major pain point comes from the electronic payment vendors. These payment processors provide permit based electronic payment, typically for a convenience fee. Scalability is the key to many of these hosted solutions which is the ability of the transaction processor to support over wide geographical market and service areas with minimal cost. Income based Market evaluation [5]

VIII CONCLUSION

This designed automatic smart parking system which is simple, economic and provides effective solution to reduce carbon footprints in the atmosphere .Smart parking technology is used for enhancing the productivity levels and the service levels in the operations .It also benefits in terms of lowering operating cost and increases revenues and facility value. The growth of IOT and cloud technologies have given rise to new possibilities in terms of smart cities
.The efforts made in this review paper are intended to improve the parking facilities of a city and thereby able to enhance the quality of life of the people .To be a smart city, smart parking facility is an essential service. Previous technologies were exploited which proved to be either not efficient or too expensive. Here we have employed raspberry- pi which seem to be cost efficient with easy installation and maintenance .The components used for the implementation of the system provide efficient output at various stages of implementation. Thus the system functioning is efficient and is recommended for commercial implementation.

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