



# INTELLIGENT PARKING BY MERGING CLOUD AND SENSORS

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## ABSTRACT

The aim of the project is to develop an Internet of Things (IOT). We propose Internet of Vehicles (IoV) by the combination of sensors and microcontrollers in the vehicles and cloud server to form an intelligent vehicle parking slot booking system. In this, Sensor will measure physical characteristics of the vehicle and converts them to digital signals and the microcontroller will handles the operations of electrical systems and processing. In the recent world, number of vehicles has been increased and so, a traditional roadside unit (RSU) which is responsible to respond cannot manage the increasing amount of information requests thrown by vehicles. Therefore, we introduced cloud, which plays a major role in providing efficient services. We process the requests in our web applications hosted in the cloud.

**Keywords:** internet of things (IOT), internet of vehicles (IOV), road side unit (RSU).

## 1. INTRODUCTION

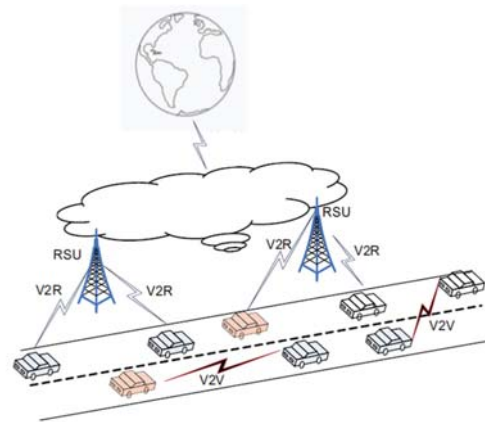
As part of our academic project, we are going to develop an Internet of Things with vehicles specifically Internet of Vehicles (IOV). Internet of Things is connecting various things in the world together using internet, Internet forms the backbone of IOT. In our project, IOV means connecting many vehicles together to extract various useful services via internet. Large-scale sensor productions makes it effective to use in home appliances, automobiles, etc. we propose roadside unit (RSU) and a cloud environment which is the backbone of Internet of Vehicles(IOT). Roadside unit (RSU) are roadside infrastructure bridges between the vehicles and the cloud. It transfers the data between vehicle grid and the vehicular cloud. The computing services provided through the internet is called cloud computing. With the increasing number of vehicles in the modern world traditional RSU data centres are not capable of processing all the requests from numerous vehicles. To solve this problem we are using cloud environment.

[1] Cloud application to maintain vehicle information and to process the requests. The numerous numbers of vehicles provides large amount of data to the cloud. It is difficult to process the request from large amount of data. Here data mining concepts can be used to extract appropriate information from the cloud database. Cloud offers various services such as Platform as a Service (PaaS), Software as a Service (SaaS), and Infrastructure as a Service (IaaS). All these services are deployed by cloud providers. We use these services in our project to form an intelligent parking system.

## 2. EXISTING SYSTEM

In existing system, the combination of sensors and microcontrollers present in vehicles with the fixed infrastructure creates an effective vehicle grid [4]. The vehicular grid is a vehicular ad hoc network (VANET) of the on-board unit (OBU) in vehicles and roadside unit (RSU). [1] Propose a vehicular cloud architecture known as RSU cloud. The frequently changing demands are processed by the services hosted in the RSU cloud. [1]

Provides SDN software defined networking, having two communication planes. The data plane and control plane are the two planes used in SDN. [2] The dynamical reconfiguration is done by deep programmability of SDN, which is achieved through decoupling of control and data plane. SDN's de facto communication protocol is made open flow [3].



**Figure-1.** Vehicular adhoc network.

Visualisation is enabled by low level middle ware known as hypervisor [5]. Its job is allowing abstraction of number of Virtual Machines VMS. RSU cloud can be reprogrammed to dynamically update hosted services, but it is very costly to get the RSU cloud to be reprogrammed. The service provider also charges a high amount for service migration, etc. The traditional data centres widely uses the technique of hypervisor [9]. To perform real world network reconfiguration analysis we emulate RSU cloud with SDN in mininet. [6] Propose that RSU is the gateway to traditional clouds or to design a cloud formed by OBU.

## 3. PROPOSED SYSTEM

In the proposed system we use RSU the fixed roadside units and cloud environment to form an



intelligent parking system. As there is a steady increase in the number of vehicles in modern world it is not easy to process the enormous amount of requests by traditional data centres. In existing system we have RSU's having their own clouds hence when a vehicle sends a request and if it moves out of the range of RSU, it does not receive the response from the RSU which becomes a big disadvantage of the existing system. In this project, we use many RSUs in various places. These RSUs form the roadside infrastructures. Each RSU is connected to a sub server of a cloud, these sub servers are connected to the cloud.

In the activity diagram, we have used admin login. The cloud admin has the ability to view all the information contained in the cloud. The data of cloud are stored in a database which can be accessed by the admin anytime. The RSUs receives information and requests from number of OBUs, these data are taken to the cloud database through internet.

Since all RSUs are connected to a common cloud, even if the vehicle moves out of the RSU range, it can receive the response of its request through any of the implemented RSU.

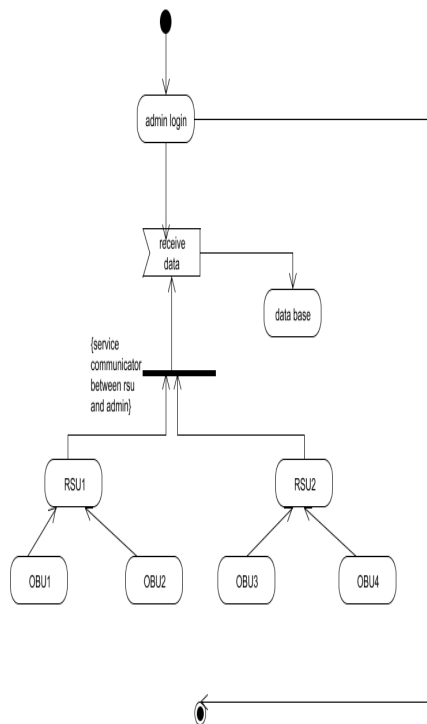


Figure-2. System architecture.

#### 4. MODULES

The proposed system can be divided into four main modules. They are as follows:

- Registration.
- Path selection.
- Parking slot maintenance.
- Parking slot booking.

#### A) Registration

The users should first register to the cloud with help of a specialised Web application, to access the services hosted in the cloud such as, path tracking, intelligent parking, etc. Refer Figure-3.

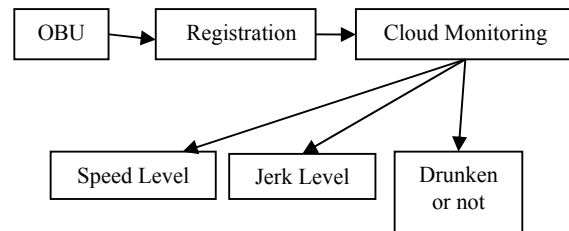


Figure-3. Registration of the users.

#### B) Path selection

Using this path selection service, user can request the path that is suitable for different types of travels. Data mining concepts can be used to retrieve the path for various travels. As user requests the path, it is added to the database travellers list. The path selection is based on the distance and the time taken to cover a particular area.

This obtained path can be paired with a device in order to view other services through any devices such as smart phones.

#### C) Parking slot maintenance

To present the service of parking slot booking, we should get the available parking slots from various organizations, and the cloud should maintain the information of available parking slot. This can be used by the cloud user to book a parking slot.

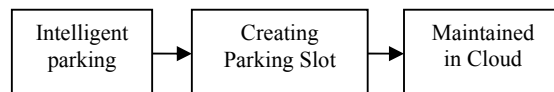


Figure-4. Working of intelligent parking system.

#### D) Parking slot booking

Using a device, we can mine various places such as, hotels, theatres, malls, etc and also we can use the parking slot booking application on our device. The initial stage is to book a parking lot and to choose source and destination, the time taken to reach the parking is calculated to provide the sufficient grace time to the booked user to arrive at the destination parking slot.

The monitoring of the vehicles is done through a specialised web application, which contains all the information about travelling vehicles. It has all information such as speed, status of driver, etc.



S.No	Vehicle ID	Driver Loc	Time	Place	Travel	Jkm	Speed	Status
1	VE009	not	12/04/2016 17:28	Ennore	Anna Auto-Hosur	32	100	not
2	VE009	not	12/04/2016 17:28	Anna Auto	Ennore-Hosur	50	75	not
3	VE009	not	12/04/2016 17:28	Chennai Trade Center	Anna Station-Chennai Trade Center	30	60	driving
4	VE009	not	12/04/2016 17:28	Indira Nagar-Ajay	Chennai Trade Center-Indira Nagar-Ajay	33	65	not
5	VE009	not	12/04/2016 17:28	Tiruvallur	Indira Nagar-Ajay-Tiruvallur	42	79	not
6	VE009	not	12/04/2016 17:40	Ankalam	Tiruvallur-Ankalam	47	90	driving
7	VE009	not	12/04/2016 17:40	Tiruvallur	Ankalam-Tiruvallur	122	69	not
8	VE009	not	12/04/2016 17:40	Pallavaram	Tiruvallur-Pallavaram	27	62	driving
9	VE002	not	12/04/2016 11:23	Ennore	Anna Auto-Hosur	25	100	driving
10	VE002	not	12/04/2016 11:23	Ramen	Ennore-Hosur	108	61	driving
11	VE002	not	12/04/2016 11:23	Chennai Trade Center	Ramen-Chennai Trade Center	29	60	driving
12	VE002	not	12/04/2016 11:23	Indira Nagar-Ajay	Chennai Trade Center-Indira Nagar-Ajay	40	86	driving
13	VE002	not	12/04/2016 11:23	Chennai Airport	Indira Nagar-Ajay-Chennai Airport	48	86	driving
14	VE002	not	12/04/2016 11:23	Ankalam	Chennai Airport-Ankalam	57	72	driving
15	VE002	not	12/04/2016 11:24	Tiruvallur	Ankalam-Tiruvallur	60	100	driving
16	VE002	not	12/04/2016 11:24	Ankalam	Tiruvallur-Ankalam	80	72	driving
17	VE002	not	12/04/2016 11:24	Wankulam	Ankalam-Wankulam	42	112	driving
18	VE002	not	12/04/2016 11:24	Indira Nagar-Ajay	Wankulam-Indira Nagar-Ajay	79	79	driving
19	VE002	not	12/04/2016 11:24	Chennai Trade Center	Indira Nagar-Ajay-Chennai Trade Center	59	86	driving
20	VE002	not	12/04/2016 11:24	Ramen	Chennai Trade Center-Ramen	49	62	driving
21	VE002	not	12/04/2016 11:23	Chennai Airport	Indira Nagar-Ajay-Chennai Airport	46	60	driving
22	VE002	not	12/04/2016 11:23	Tiruvallur	Chennai Airport-Tiruvallur	51	72	driving
23	VE002	not	12/04/2016 11:24	Ankalam	Ankalam-Tiruvallur	40	100	driving
24	VE002	not	12/04/2016 11:23	Ennore	Ankalam-Hosur	29	100	not
25	VE002	not	12/04/2016 11:23	Madhav (Chennai)	Ennore-Madhav (Chennai)	124	77	not
26	VE002	not	12/04/2016 11:23	Chennai Trade Center	Madhav (Chennai)-Chennai Trade Center	50	100	not
27	VE002	not	12/04/2016 11:23	Ajay Bus Depot	Chennai Trade Center-Ajay Bus Depot	55	77	not
28	VE002	not	12/04/2016 11:23	Ankalam	Ajay Bus Depot-Ankalam	55	100	driving

Figure-5. Information obtained by vehicle mining.

In Figure-5 screenshot shows our specialized web application used to monitor the vehicles travelling in the range of the implemented RSUs. By this we complete the task of intelligent parking system with the help of sensors in the vehicles and cloud environment.

## 5. CONCLUSIONS

Thus, the intelligent parking system has been performed with many benefits thereby reducing traffic. Many other services are also performed to enhance road safety. By the combination of sensors and microcontrollers in the vehicles and cloud server to form an intelligent vehicle parking slot booking system.

The idea can be further improved by increased number of bandwidth.

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