# Automatic Smart Parking System using Internet of Things (IOT)

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***Abstract***- Internet of Things (IOT) plays a vital role in connecting the surrounding environmental things to the network and made easy to access those un-internet things from any remote location. It's inevitable for the people to update with the growing technology. And generally people are facing problems on parking vehicles in parking slots in a city. In this study we design a Smart Parking System (SPS) which enables the user to find the nearest parking area and gives availability of parking slots in that respective parking area. And it mainly focus on reducing the time in finding the parking lots and also it avoids the unnecessary travelling through filled parking lots in a parking area. Thus it reduces the fuel consumption which in turn reduces carbon footprints in an atmosphere.

***Index Terms***- Internet of Things (IOT), Smart Parking System (SPS), Raspberry pi, pi-camera, Raspbian OS.

## I. INTRODUCTION

Internet of things was first introduced in 1999 at auto-ID centre and first used by Kevin ashton. As evolving this latest burning technology, it promises to connect all our surrounding things to a network and communicating with each other with less human involvement. Still internet of things is in beginning stage and there is no common architecture exists till today [1]. There is lot of researches and implementations are currently being going on in all the respective areas. Thus there is no guidelines or boundaries exists to define the definition of internet of things. So depending on the context, application the internet of things has different definitions. Shortly it is defined as the things present in the physical world or in an environment are attached with sensors or with any embedded systems and made connected to network via wired or wireless connections [2], [3]. These connected devises are called as smart devices or smart objects. And it consists of smart machines which communicating interacting with other machines, environment, objects etc. And also it incorporates to connect any two machines, machine to human and vice-versa etc. this communication is called as M-M communication. As M-M communication is developing by the various standardization bodies such as Open Mobile Alliance (OMA), European Telecommunication Standards Institute (ETSI), Institute of Electrical and Electronic Engineers (IEEE), 3rd Generation Partnership Project (3GPP) organization have performed some activities on M-M communication [4]. It makes daily life things to equip with transceivers, sensors, actuators and microcontrollers etc. for communication. Some important benefits of internet of things includes 1) tracking behaviour; 2) enhanced situational awareness; 3) sensor driven decision analytics; 4) instantaneous control and response. Etc.

IOT technology grows in various fields of smart applications but we have not yet found boundary constraints of this technology. Some smart applications which it has implementing currently such as on smart grids, smart lighting, smart energy, smart city, smart health etc. This is broadly classified into three categories such as sensing, processing and connectivity. Whereas sensing includes sensing the speed of vehicles and humans or any objects (accelerometer), sensing of temperature, pressure etc. [9]. And these can be processing by using some processors such as network processor, hybrid processor MCU/MPU etc. And the devices are connected by using some technologies called GPS, Wi-Fi, BT/BTLE, RFID etc.

More than half of the world's people are living in the cities. So the cities have reached full of its occupancy. As people uses vehicles for transportation so there is large number of vehicles exists for people convenience. Most of the time people spend their precise time on searching parking lots to park their vehicles. Thus congestion occurs in the traffic it leads to a hectic job to find the parking space to park their vehicle. The most traffic occurs only because of vehicle congestion in the urban areas thus people are wasting time in searching the parking area abnormally to park their vehicles.

Our system is a Raspberry pi based parking sensor which contains pi-camera to detect the empty parking spaces and sends this data to server, this stored data is accessed by users [5], [6]. This enhances the user to check the status/availability of parking spaces before setting their journey. Here the challenge is to use the existing resources in optimum level to reduce the searching time, traffic congestion in the city. Some embedded systems such as auridino, raspberry pi, Tsgate, Tsmote etc. are used to develop internet of things applications.

A few existing parking system which uses sensors to collect the information but using sensors like video sensors in a parking system are expensive so our aim is to develop a system with less cost with more performance [7], [8].

## II. RELATED WORK

The Smart Parking System is designed by making use of some IOT supportable hardware's such as raspberry pi, auridino boards etc. here we focussing on less power consumption and more performance device so raspberry pi is the suitable microcontroller for our implementation. And NOOBS installer is loaded into the storage device of

microcontroller. This installer which consists of various hardware supportable operating systems such as mac os, tiny os, openelec, raspbian os etc. where these operating systems which basically consumes less power.

## III. IMPLEMENTATION

The parking system is designed in such a way that it is applicable for covered parks, open parks and street side parking. The fig.1 shows the cloud based IOT architecture for smart parking system which contains cloud service provider which provides cloud storage to store information about status of parking slots in a parking area and etc. [10]. The centralized server which manages to store entire smart parking systems information such as number of slots, availability of vehicles etc. And these information will be accessed through some secured gateways through network.

This smart parking system which consists of several components. And theirs functionality includes:

- Centralized server: maintains databases which contain information about parking spaces present in the city.
- Raspberry pi: the microcontroller which is used to implement our parking system and it is attached with raspberry pi camera.
- Image capture: Pi-camera is used to capture the picture of parking area continuously to validate the slots which either filled or empty.
- Navigation system: signals the availability of parking slots to the users and navigates to the exact location of nearest parking area from current location.
- Display device: a monitor or tab is used to display the admin side interface and he is capable of modifying the parking lots by observing the device.
- User device: user can connect with the smart parking system with their smart phones or with some browsers.

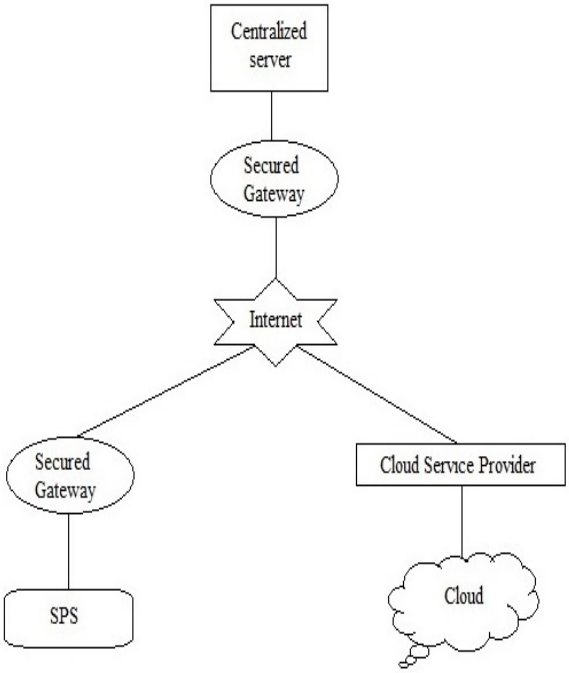



Fig.1. Architecture of proposed System

The SPS which incorporates the features of raspberry pi 2 and which is attached with pi camera. Where pi camera is mounted on the top of street light lamp posts or at the ceiling of indoor parks. Thus camera is capable of making survey on each parking slots in parking lots continuously to check whether the particular slot is filled or empty. The fig.2 presents the structure of smart parking system and it contains some control points on each parking slots which will be used as reference points for the camera. The central server presents information about multiple slots in a single parking area and multiple parking areas in a single city and it is accessed through some protocols such as HTTP, CoAP [12] etc. from any browsers, by which the website is built with basic JSON interface.

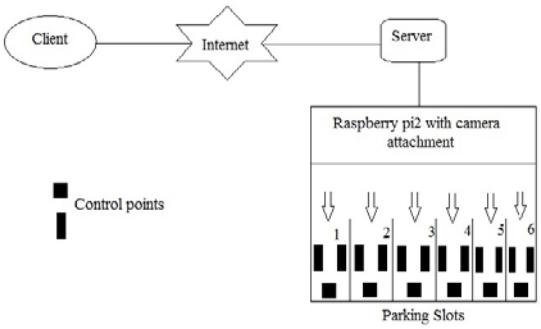



Fig.2. Structure of Smart Parking System.

When the availability of parking slots changes, immediately the information is updated to the central server. Then user can access this stored information using internet

from any location. And this information is used by parking operators to determine free parking areas and statistics can be measured at different times in a day on each parking space. The fig.3 shows the communication between two or more clients and SPS with server. Such that single client can access the information of many parking areas in the city. So by observing the availability of parking slots the user can choose their convenient parking area. Thus particular parking area is navigated from client's current position [10], [13].

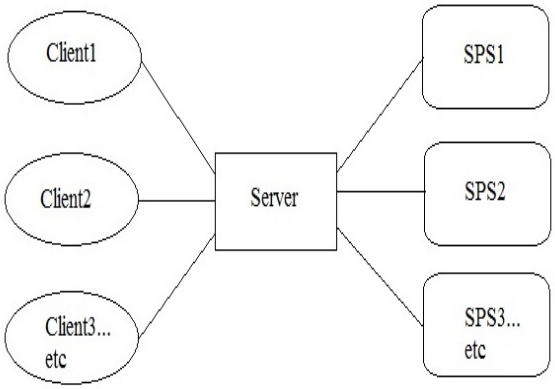


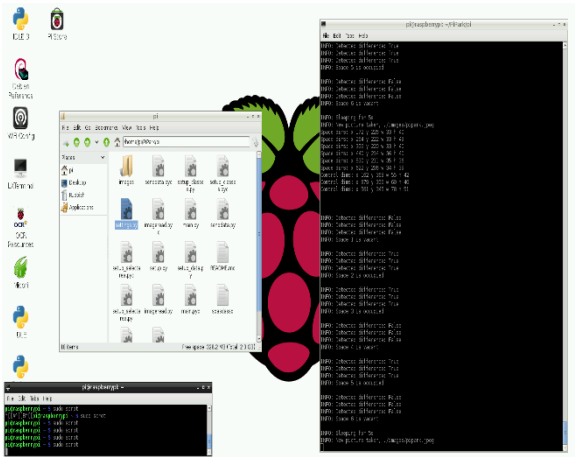

Fig.3. Communications between SPS, Client and Server.

The sufficient user interface is provided to the client so that client can access the clear information about the system. The administrator is capable of creating new parking areas by providing the description or information about the parking area and also manages to add number of parking slots in any particular parking area and even further remove the existing parking slots in a parking area. The updated timing of each parking slot is shown along with unique number. And more importantly this user interface provides the navigation to their destination.

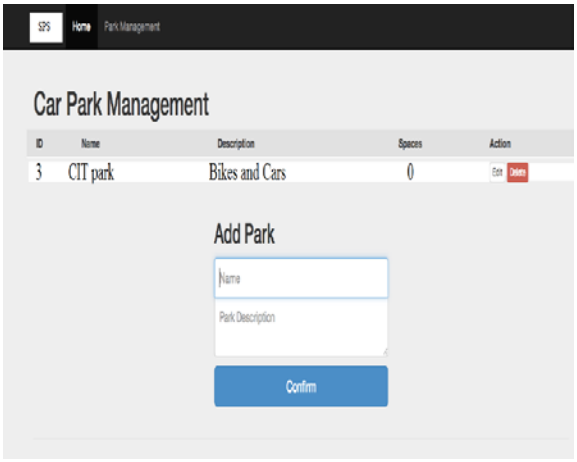
Steps involved in setting the Smart Parking System:

- Appropriately mount the camera such that the image captured by it is clearly shows the parking slots.
- The parking spaces are marked on to the captured image by an administrator.
- The control points are drawn according to their convenience of parking slot.
- The setting were saved and registered with the server and finally run the system.

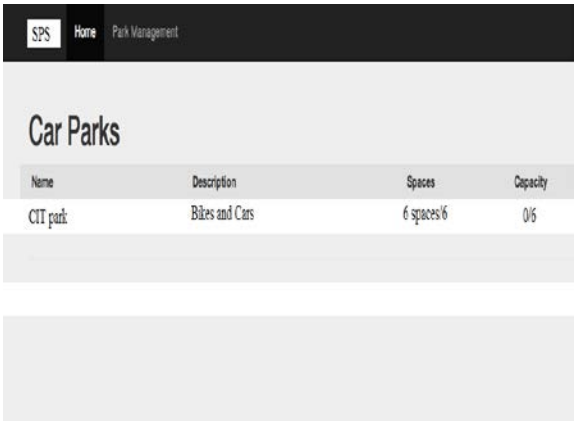
## IV. RESULTS



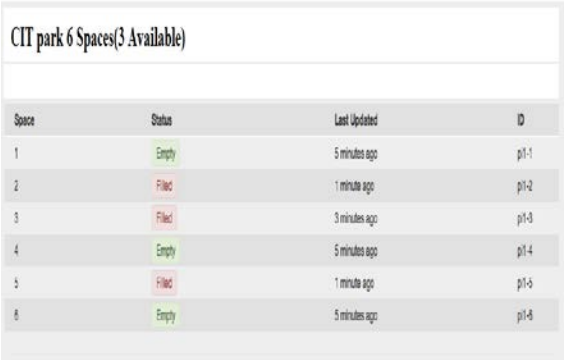
*A. Setting up Pipark*




*B. Creating Car Park*




*C. Registering Spaces on Server*




*D. Filling Spaces 2, 3 and 5*

## V. CONCLUSSION

This designed automatic smart parking system which is simple, economic and provides effective solution to reduce carbon footprints in the atmosphere. It is well managed to access and map the status of parking slots from any remote location through web browser. Thus it reduces the risk of finding the parking slots in any parking area and also it eliminates unnecessary travelling of vehicles across the filled parking slots in a city. So it reduces time and it is cost effective also.

## FUTURE WORK

The future scope to adopt this automatic Smart Parking System (SPS) so that availability of spaces could be displayed on a smart phone Application or even to satellite navigation device so that drivers will always aware of whether there are free spaces are not. And also enhance to send some notifications to users smart phone when vehicle enters to particular shopping places and some streets in a city etc.

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