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System for Smart Parking using Internet of Things (IoT)

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Abstract: ***Internet of Things (IOT) plays an important role in connecting the surrounding things to the network and these things could be easily accessed from any remote location. In the modern world generally people are facing problems on parking vehicles in parking slots in a city. In this paper a Smart Parking System (SPS) is designed to enable the user to find the nearest parking area and gives availability of parking slots in that respective parking area. The major focus is to reduce the time in finding the parking slots and also to avoid the unnecessary travelling through filled parking slots in a parking area which in turn the fuel consumption and 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 technology connects all our surrounding things to a network and communicate with each other with less human involvement. Depending on the context, application of internet of things has different definitions. Shortly it is defined as, things present in an environment are attached with sensors or with any embedded systems and are connected to a network via wired or wireless connections . These connected devices are called as smart devices or smart objects. It consists of smart machines interact 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. M-M communication is being developed by 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) .They have performed some activities on M-M communication. It makes things used in daily life to equip with transceivers, sensors, actuators and microcontrollers etc. for communication. Some important benefits of internet of things include 1) tracking behavior; 2) enhanced situational awareness; 3) sensor driven decision analytics; 4) instantaneous control and response. etc. IOT technology has been growing in various fields of smart applications and no boundary constraints exist for this technology. Some smart applications in which it has been implemented are smart grids, smart lighting, smart energy, smart city, smart health etc. This is broadly classified into three categories , sensing, processing and connectivity. Sensing includes sensing the speed of vehicles, humans or any objects (accelerometer), temperature, pressure etc. And these can be processed 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.

Most of the time people spend their precise time on searching parking lots to park their vehicles. Thus congestion occurs in the traffic. Our system is a Raspberry pi based parking sensor which contains pi-camera to detect the empty parking spaces and send the data to server. This stored data is accessed by the users . 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.

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 , more performance.

II. RELATED WORK

There are number of applications that provide information about free parking slots to users. They mainly focuses on finding the cheapest and nearest parking lot through Google maps but they do not give data about the spot availability. There are different models for parking management like RFID based model. In this model RFID tags are put on the vehicles to take the in-out time of the vehicles but the disadvantage here is it is expensive to keep track of RFID tags. In this paper the Smart Parking System is designed making use of raspberry pi keeping the idea of less power consumption.

III. IMPLIMENTATION

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. 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.

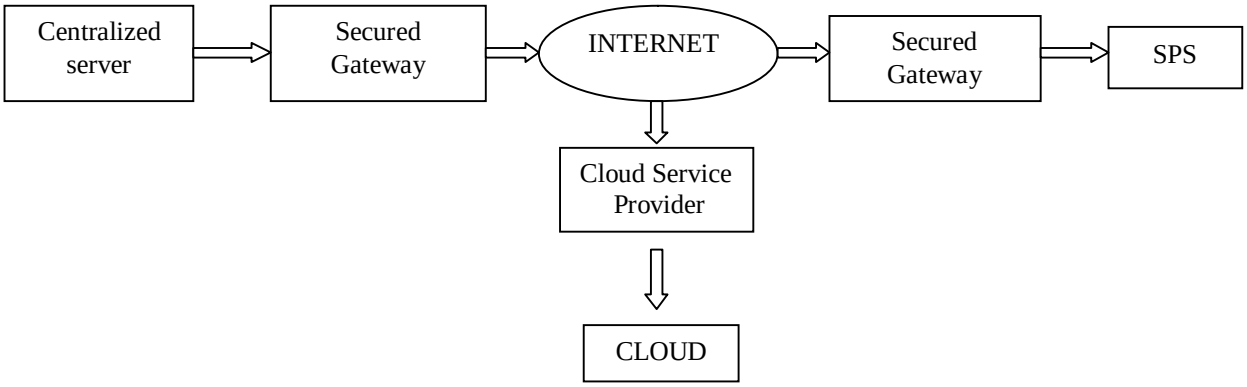
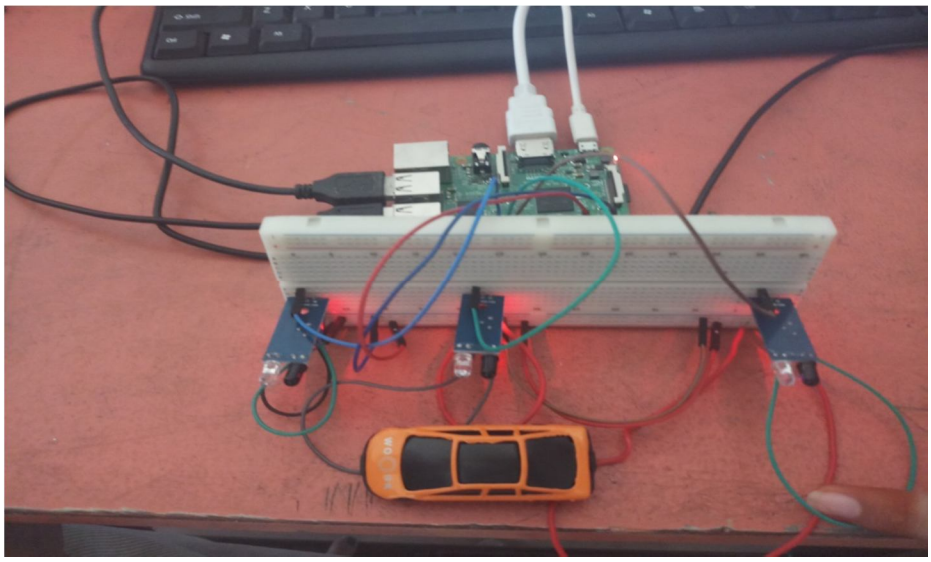


Fig.1. Architecture of proposed System



In our Implementation the sensors sense the information about the parking slot whether it is empty or occupied and that data is posted on the cloud called Thing speak and this information can be accessed by the user from anywhere.

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.

1) *Navigation system*: signals the availability of parking slots to the users and navigates to the exact location of nearest parking area from current location
2) *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
3) *User device:* user can connect with the smart parking system with their smart phones or with some browser

The SPS incorporates the features of raspberry pi 2 and is attached with pi camera. 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

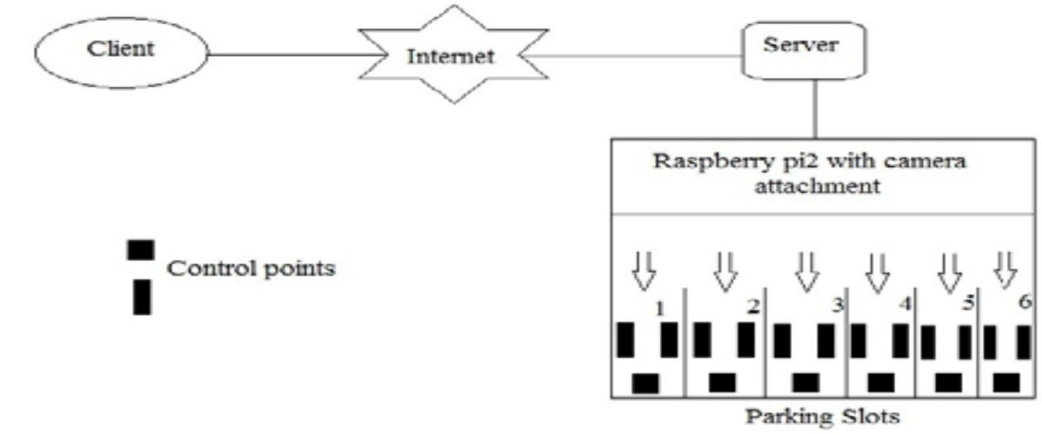


Fig.2. Structure of Smart Parking System.

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 .

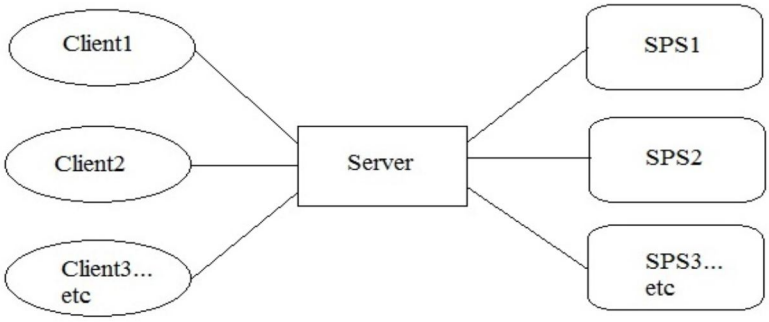


Fig.3. Communications between SPS, Client and Server.

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 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:

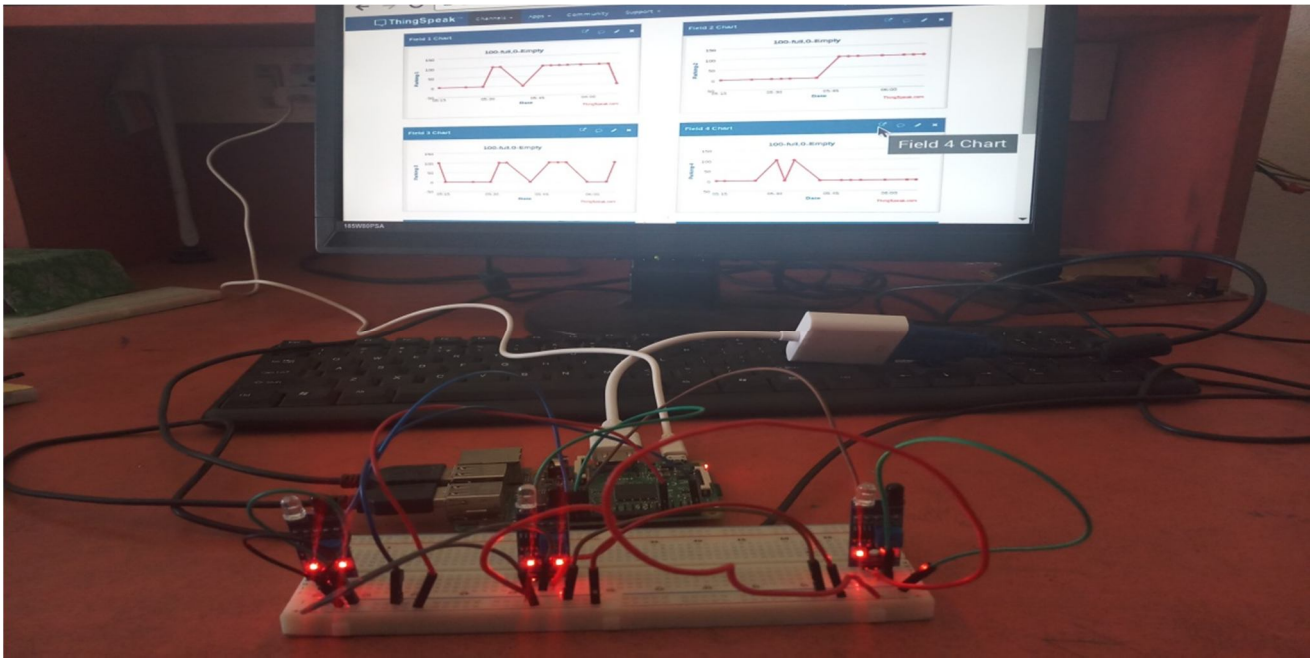
Appropriately mount the camera such that the image captured by it is clearly shows the parking slots.

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



CIT park 6 Spaces(3 Available)

Space	Status	Last Updated	ID
1	Empty	5 minutes ago	p1-1
2	Filled	1 minute ago	p1-2
3	Filled	3 minutes ago	p1-3
4	Empty	5 minutes ago	p1-4
5	Filled	1 minute ago	p1-5
6	Empty	5 minutes ago	p1-6

V. CONCLUSION

In building smart cities the major hurdle we are facing is parking and traffic congestion . With the enhancement of technologies like Internet of Things it is being possible to design smart parking system. In this paper the issue of smart parking is discussed. This system proposes to provide the real time information regarding the availability of parking slots in a parking area. Our design is intended to improve the parking facilities of a city and thereby aiming to enhance the quality of life of the people in the cities.

VI. ACKNOWLEDGEMENT

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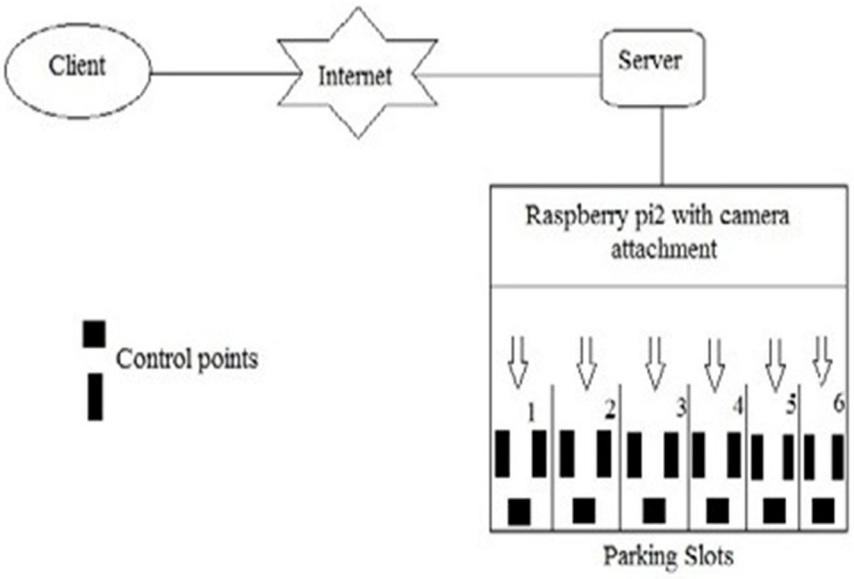

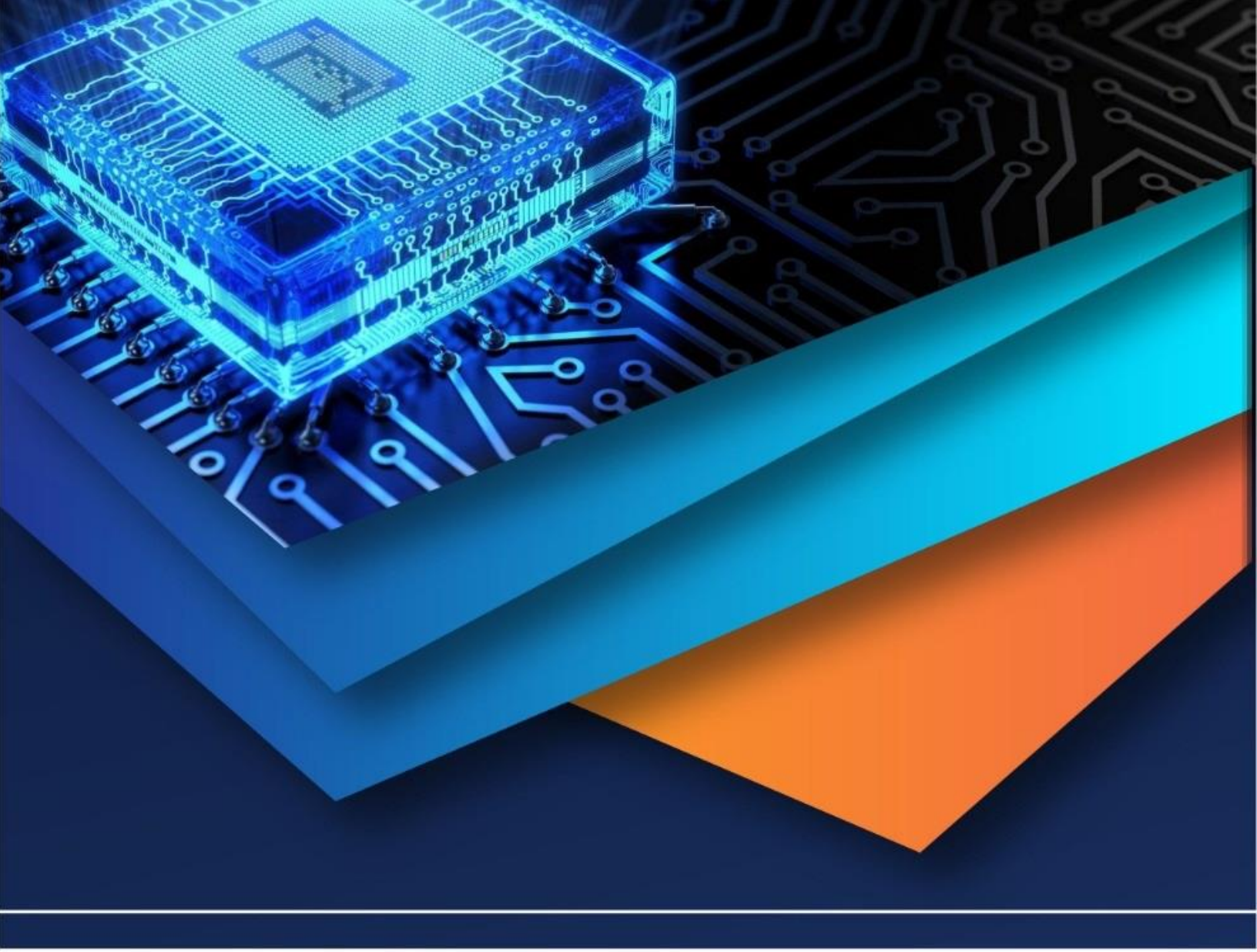

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