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Background Subtraction Method based Smart Parking System using Image Processing

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Abstract: ***Now a day's population is increasing day by day. Due to increase in population usage of vehicles and the traffic at parking lot also increases. For this reason getting a parking spot is very difficult and time consuming for the car drivers. So to reduce this difficulty we are proposing a system called "Baground subtraction method based smart parking system using image processing". This paper is mainly concerned to develop smart parking system on a credit card sized computer and camera is fitted at a parking lot to show availability of a parking place. The image processing can be performed on a Raspberry pi interface with Things view cloud platform through an API to detect cars. Rasperry Pi posts data to the Things view cloud, Showing that the internet of things(IOT) based parking system. Availability of parking slot can be viewed in drivers mobile and they can book the parking slot from their mobile by using an app.***

Keywords : Raspberry pi, Image Processing, Car detection, Background Subtraction, Availability of parking slot.

I. INTRODUCTION

The worlds urban population is increasing rapidly and it is expected to exceed more than five billions. Most of the urban growth will take place in developing regions particularly in smart cities. Currently, over half the global population live in cities for moneymaking and to lead a luxury life which increases the pollution and traffic conditions at parking spaces.

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In heavy populated cities which become more problematic. Mostly in public places few parking slots lead drivers to put huge effort and time taking process to park their vehicles.
The limited parking area is still to be decided problem. Enhance parking lots is one solution to minimize the problem.
But for Enhancing parking lots we have to use large number of sensors or image processing. Image processing can be used in enhancing but is kept under the control of light. But by using sensors in the parking area system will easily detect non-vehicles but are counted as vehicle objects.
Identifying empty parking slots is the main task for smart parking system but by using sensors reliability in identifying the empty slots is less and also by using image processing system becomes less accurate due to shadows.

To reduce the above mentioned problems we use background subtraction method for detecting vehicles and identifying empty spaces in a parking lot. By fixing the pi camera and lights at parking lot we can reduce shadow problems and also we can produce high accuracy in detecting empty slots.
The application of Background Subtraction method for detecting vehicles and empty spaces in parking area using smartphone application is discussed in this paper. We also enquired experimentally and tested different camera view angles for accurate results. We present the use of this method on still images from a single camera node. It is scalable for use with large parking facilities.

II. HARDWARE AND SOFTWARE REQUIRED

Hardware Required:

- Raspberry pi
- Camera
- Servomotor
- LCD

Software Required:

- Raspbian sketch OS

III. HARDWARE PLATFORM

The hardware used in this paper is raspberry pi and a camera. Raspberry pi is a on board minicomputer that plugs into a monitor, TV or Laptop using HDMI to VGA cable. Raspberry pi also uses a standard keyboard and mouse. It is small in size and cost is very less compared to a computer. In this paper we use a Raspberry pi3 model B in which an SD card is inserted into a slot provided on backside of the board. Image processing is performed on the Raspberry pi interfaced with the Things view cloud platform through API.

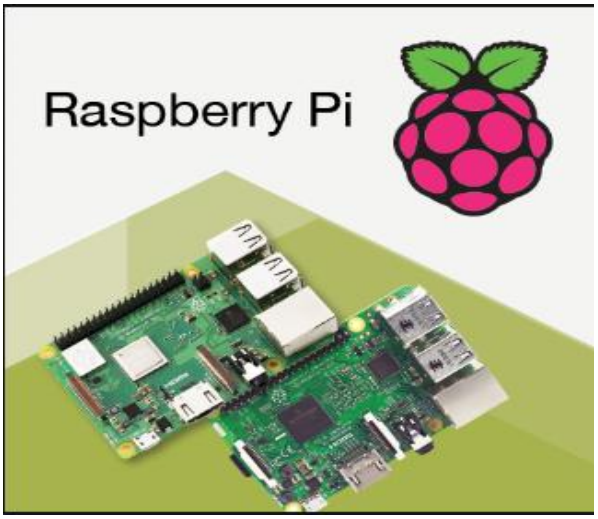


Fig: Raspberry Pi

Servo Motor:

Servo motor is made up of servo mechanism, it is used in airplanes , elevators, walking robots and operating gripper for position control.

Servomotor is small in size and produces good power . It is three wire device known as power, ground and control. Inner part of servo motor consists of four main components they are gear box, potentiometer, Dc motor, and control circuit. gearbox is used to reduces the speed around 60 RPM and at the same time increases the torque. Servo motor turn through about 170 degrees.

In this paper we mainly use servomotor for automatic opening and closing of a parking lot gate. If all parking slots are full it automatically closes the gate. If anyone parking slot is empty it automatically opens the gate when vehicle arrives at the parking lot. In this paper we tested the system using eight parking slots. In case if anyone parking slot is booked and other seven slots are full then the gate is automatically closed and if one slot is booked and one slot is empty and remaining six slots are full then it automatically opens the gate.

Fig: Servo motor

Image Processing:

Digital image processing is the process of manipulating of digital images with the help of computers. Some of the applications of image processing are It improves the quality of image, the process of gaining or recovering the obscured images, the process of gaining fine edges in the image and the process of doing compression or reduction of data. The images are classified into two types. They are continuous and discrete. We are obtaining the continuous images from systems that are accepting analog signals such as humans and cameras, and the discrete images are obtained by digitizing the continuous images.

We use thresholding process to adjust the brightness of an image. In this paper we use image processing to detect the parked cars and empty slots. In this work, two conditions are analyzed. At first we analyze camera view angles and next we analyze how distance between parked cars and their shadows affect the detection accuracy . By connecting lights we can reduce the detection errors due to shadows.

Things view cloud platform:

The Things view cloud platform is used to store the data for a place when it is sent to the displayed smart phone then it creates a smart phone applications

All cloud platforms like firebase cloud, Things view cloud etc., are owned by the Google. It also supports platforms like Linux and androids in these devices linked with python and some other device is Arduino fire ware it can be used REST API when this consistent is especially useful in time limited cycles. It 1st protects trouble into the centralized service instead of using various time and the engineer focused on the system to be developed .

In 2nd it allows communication between various hard ware systems with low trouble and shorter learning curve is available for the software development circuit or kits. In various platforms of software development kit or circuit, admin is used for the environment to implement python application.

Raspberry pi and Things view cloud application are connected together by using web socket protocol. It is a two way communication protocol build on TCP. When raspberry pi boots up, it sends a connection request to the cloud along with its ID and authentication key.

Things view cloud is the combination of many Google services, including real time databases, storage and hosting. Based on Things view cloud, the controller connects directly to its database to read and write data.

There is an mobile application provided for the users and it can be named as things view free app. By using thing view free app users can see the occupied and unoccupied slots in a parking lot

IV. BACKGROUND SUBTRACTION METHOD

It is a method used to recognize an moving objects like humans and cars. In this method first we take the background image of empty parking lot as a reference image and next we take the real time image of parking lot with some parked cars. Then subtract the two images for identifying an object. Background subtraction method is also known as Foreground detection method. It is mainly used in the field of computer vision and image processing to detect the changes in image sequences.

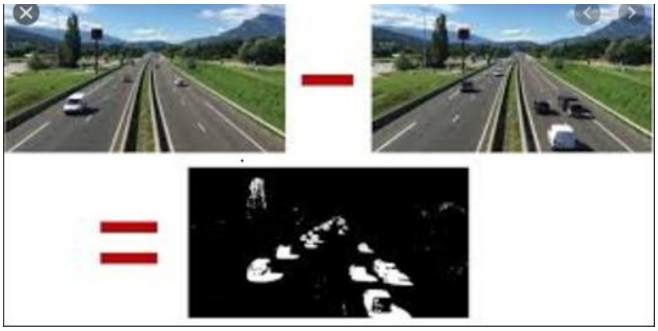


Fig: Baground subtraction method

V. SYSTEM ARCHITECTURE

The architecture of a baground subtraction based smart parking system is shown in below fig. In which data captured by the camera can be posted into the Things view cloud through raspberry pi. The data from the Things view cloud platform can be pushed into the mobile app from which drivers can see the availability of parking slots and also they can book the slots using a mobile app.

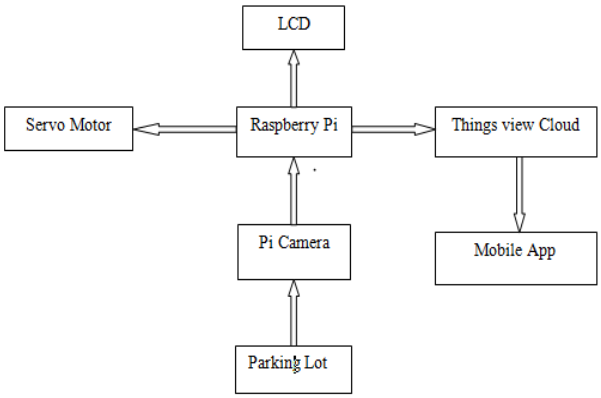
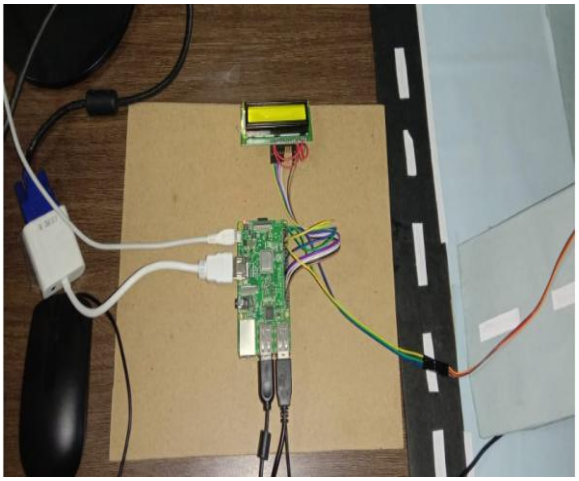
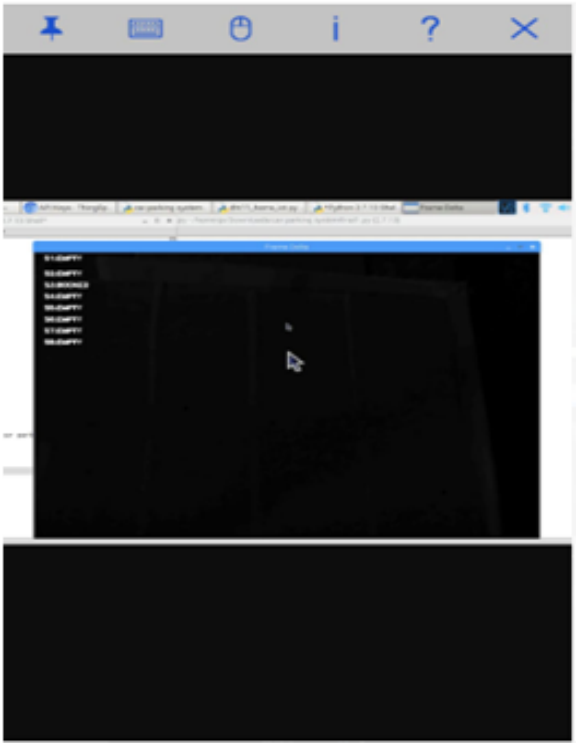


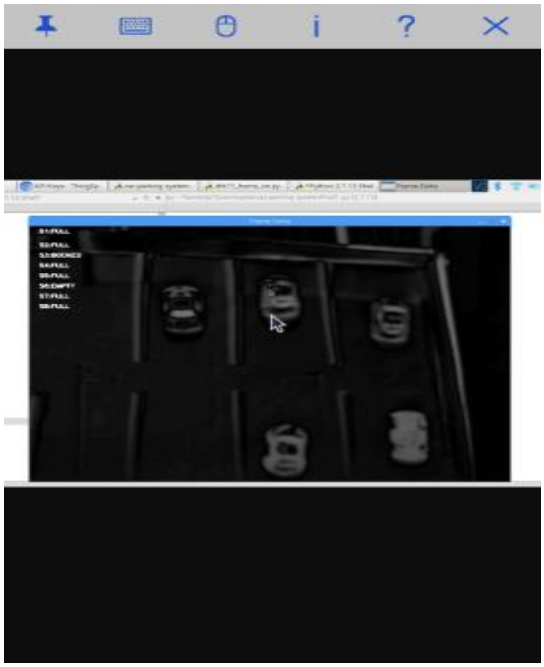
fig: Architecture of smart parking system

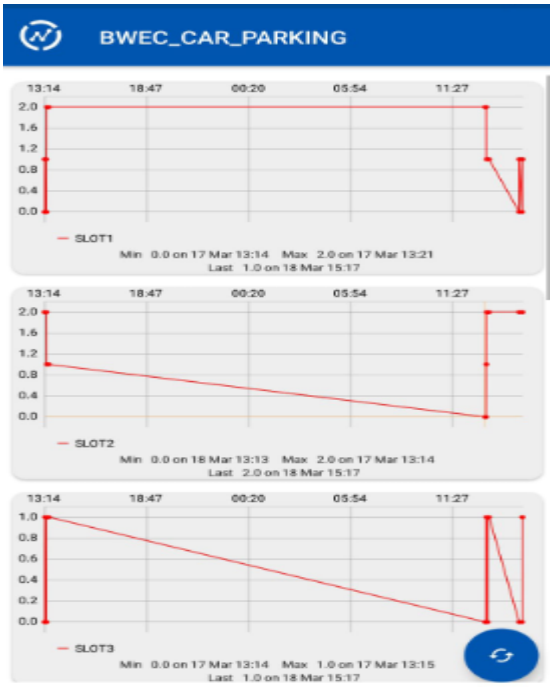
VI. RESULTS AND DISCUSSION

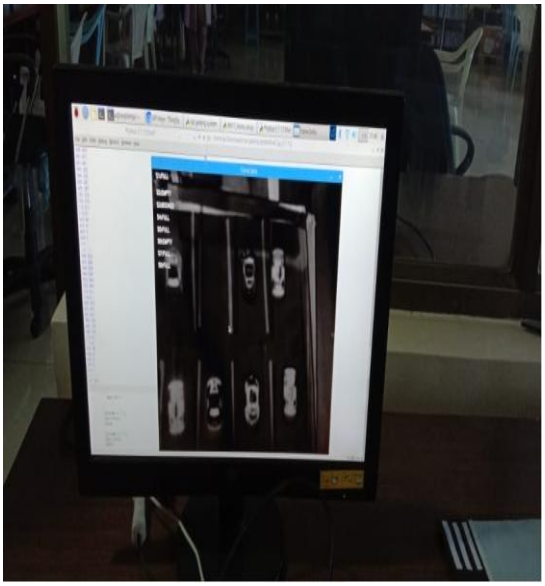
From the above discussion it is clear that a smart parking system is implemented on a small onboard sized computer (i.e. Raspberry pi) and a pi camera is fixed at the parking lot and a servo motor is fixed at the entry of parking lot for automatic opening and closing of a gate. An LCD is connected to the raspberry pi. When we give power to the raspberry pi then LCD becomes ON and it displays 1 to show that the slot is full, It displays 0 to show that the slot is empty and it displays 2 to show that the slot is booked. The system is tested at eight slot parking lot. When we run the python code in a raspberry pi, a python shell and frame delta are opened. In frame delta the background subtraction method is performed to detect the available and filled parking slots. In background subtraction method, At first it take the background image of a parking lot and in second it take the real image with some filled slots and in the next step it subtracts the two images and detects the objects. when frame delta is opened it displays the booked, filled and empty slots. This information can also viewed in things speak app. Drivers can install this app to use the information and also they can book the slot from book slot app. Only one slot can be booked by the one user i.e. they cannot book multiple slots at a time. In book slot app there are eight slots provided an user can book the slot by simply clicking on the empty slot then the booked slot will be displayed in green color and remaining slots are displayed as red color.

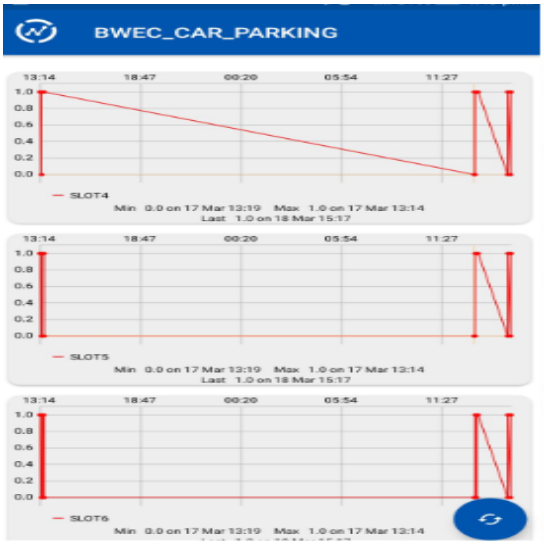


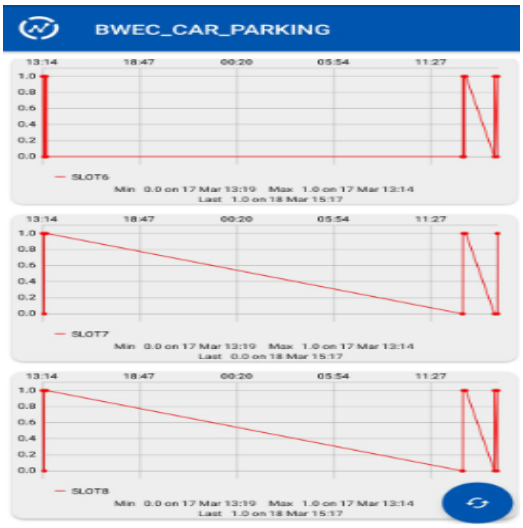












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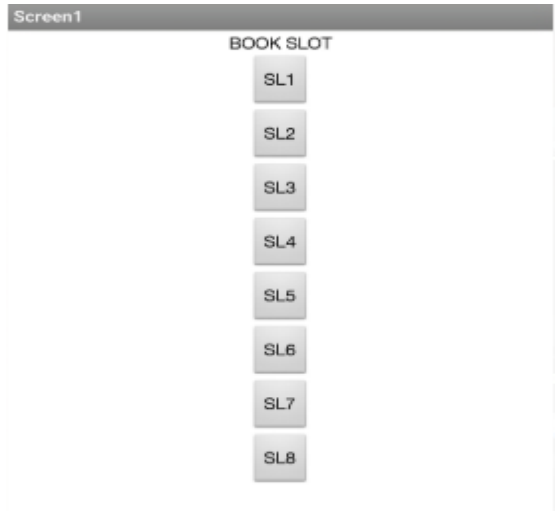

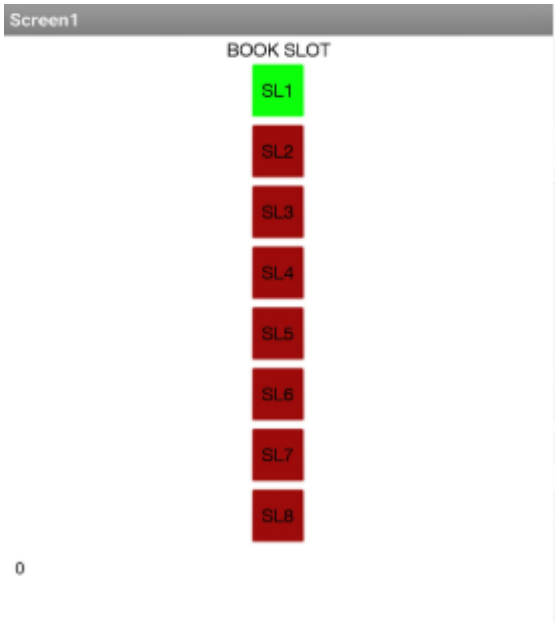

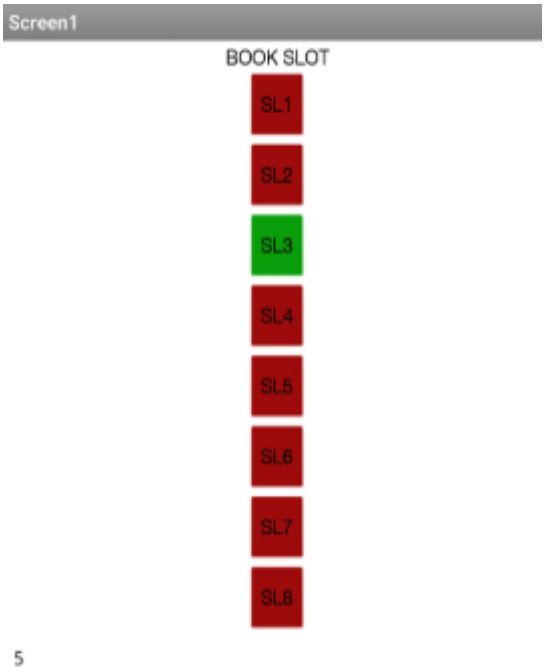

VII. CONCLUSION

The baground subtraction method based smart parking system is implemented and discussed in this paper. The system is based on image processing and supports the IOT concept. The data can be available on internet using Things view platform and can be accessible through a mobile application. Information is about the number of slots available in the parking lot. By using this system drivers can easily book the slot by using book slot app and also an automatic opening and closing of a gate is fixed to reduces the time and traffic congestions at the parking lot.

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