

Analysis of Parking Guidance System Using Raspberry PI

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Abstract: - In recent years the growing problems of car parking in urban areas are due to growing population. Due to this number of vehicles are on roads and traffic jam, parking problems are arrived on large scale. The solution to such problem is to present the parking guidance system based on image processing with the help of raspberry pi and camera module. With the help of image processing technique will easy to find out the empty parking slot in public areas. After detecting the empty slot the detail information of empty slot is provided with printed slip to the car driver with the help of thermal printer hence one can able to park the vehicle at right place by showing the panel in parking areas. This intelligent system will reduce the time required to find vacant slot and wastage of resources .It also used to reduce fuel consumption and pollution which occur due to circulate vehicles for finding the parking areas.

Index Terms— Image Processing; Raspberry Pi; Camera module; Thermal printer.

I. INTRODUCTION

Development in the parking guidance system has becomes a necessary consideration in the public areas and at crowdie locations. The improper parking of vehicles at the public places may results in the serious problems like accidents, traffic jam and pollution. The proper parking of vehicles in systematic manner has great importance to reduce the scale of accidents. This is possible only when the system of parking guidance is very technical and in sophisticated manner. The big cities in India are normally crowded. Searching for parking space is one the major issue in metropolitan cities which required more time and fuel consumption. And therefore the driver circulate for finding empty space for parking vehicles .The paper proposes an intelligent way of parking guidance to the vehicles in the public places such as malls, multinational companies, theaters, luxurious hotels, airports etc. instead of parking it at incorrect locations and hence a way to decrease the traffic problems at the social places [1]. Technology is increasing rapidly and parking guidance system has tends to be more reliable. Reliability can be achieved by using a proper controller which performs accurate control operation during parking guidance for proper parking.

II. EASE OF USE

In the recent years the conventional methods for parking guidance is space detection using ultrasonic sensors, LED lamp panels and wireless sensor networks [6]. But cost

of Sensors and other equipment will increase installation cost of overall parking guidance system [9]. To overcome this drawback the attempt has made to use image processing technique for parking guidance system [1]. This will definitely reduce the cost of system and increases accuracy. Raspberry pi is the central unit of total parking guidance system which performs control operation and provides appropriate direction to the car driver to where the car should be park. The image processing technique helps to obtain empty slot by using camera module .At the output of raspberry pi the total information of parking location is printed with the help of printing machine, hence driver can easily find out empty place for parking the car.

III. BASIC CONCEPT

Image Processing is manipulation of any image with the help of computer. The image from the camera module is given to the computer where algorithm is set for processing the image. With the help of MATLAB software the various operations on the captured image are perform. In the easier words image processing is an operation where various noises and irregularities in the raw images which taken from camera module are removed and a clear image can be obtained. The various operations on image like image enhancing, image segmentation, image acquisition, and thresholding are performed with the help of MATLAB programming on computer [2].

Image processing is used to detect empty slots present in the parking area. First image is captured from the camera

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module and is given to the raspberry pi module. Then the captured image is converted into gray scale image. Now the gray scale image is converted into black and white image for that thresholding technique is used. To detect empty parking slot from the entire black and white image, we make segmentation of the image and find out the slot which has maximum number of black pixels, which shows the parking slot is empty. This will be helpful for proper and safe parking for society and human kind.

IV. BLOCK DIAGRAM

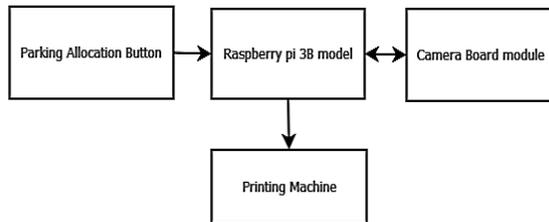


FIGURE 1:-BLOCK DIAGRAM

V.COMPONENTS

A. Raspberry Pi



FIGURE 2: RASPBERRY PI

The raspberry pi is used as backbone. In this system we use the raspberry pi 3 Model for performing image processing operations. It is a third generation raspberry pi having credit card sized single board computer. This is useful for many applications. It is more powerful than Raspberry pi 2 model with 10* faster processor than first generation raspberry pi. Additional feature of this pi than other is it has wireless LAN B LUETOOTH connectivity. The Raspberry pi 3 model has following specifications;

Processors: Broadcom BCM2387 chipset. 1.2GHz Quad

ARM cortex-A53 802.11b/g/n wireless LAN and Bluetooth 4.1(Bluetooth Classic and LE)
GPU: Dual Video core IV® Multimedia Co-processor. Provides open GL ES 2.0, hardware accelerated Open VG, and 1080p30 H.264 high-profile decode. Capable of 1Gpixel/s, 1.5Gpixel/s or 24FLOPs with texture filtering and DMA infrastructure.
Memory: 1GB LPDDR2
Power: Micro USB sockets 5V, 2.5A
Operating system: Boot from Micro SD card, running a version of the Linux operating system.

Connectors:

Ethernet: 10/100 BaseT Ethernet socket
Video output: HDMI (rev 1.3 and 1.4) composite RCA (PAL and NTSC)
Audio output: Audio output 3.5mm jack, HDMI USB
4*USB 2.0 connector
GPIO connector: 40-pin 2.54mm (100mil) expansion header 2*20 strip providing 27 GPIO pins as well as +3.3V, +5V and GND supply lines
Camera connector: 15-pin MIPI camera serial interface (CSI)
Display connector: Display serial interface (DSI) 15 way flat flex cable connector with two data lanes and a clock lane
Card slot push/pull micro SD
The GPIO connector of Raspberry pi have 40 pin 2.54mm providing 27 GPIO pins as well as +3.3V,+5V and GND supply lines.

B. Camera Module



FIGURE 3: CAMERA MODULE

In this Parking Guidance system the camera module is attached to the raspberry pi by way of 15 pins ribbon cable to dedicated 15 pin camera serial interface connector. It carries extremely high data rates and exclusively carries pixel data to BCM2835 processor. Camera module record the continuous video of the parking slot in which it can be used as a CCTV to monitor the area. But by the help of the camera module we take the still image/snapshot. This image is taken and

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sends to raspberry pi for further process. This 5MP camera module capable of 1080p video recording and still images and connect raspberry pi to CSI connector. The camera module is capable of 2592*1944 pixel static images, and support 1080p 30fps, 720p 60fps and 640*480p 60/90fps video.

Features:

Compatible to all models of raspberry pi, 5MP Omni vision 5647 camera module ,Size is 20mm*25mm*9mm, Light weight.

C. Thermal Printer



FIGURE 4: THERMAL PRINTER

The printer which utilizes the heat to print an image on the paper. The quality of print is better than conventional printer and also speed of printing is faster. They do not use ink or toners or cartridges in it. They are popular for noise free operation and available in various sizes and models. They are durable and largely inexpensive. Although they are working on heating effect, the heat rise should not be exceeds over a safe limit to ensure life of the equipment. The raspberry pi performs operation on still image of parking area and find empty slot. This information of empty slot is given to the thermal printer by using GPIO pins. The thermal printer is used for printing the information of nearest empty parking slot present in the parking area.

Features: Flawless finish, Easy to operate, Durable print
Specifications: Small dimensions, 60mm/s high speed printing, RS232/serial, TTL/USB interface, 58mm paper width easy-loading, With WinXP, Win7 Drive and API. Thermal printer is used for many applications such as designed for industrial instrumentation, medical equipment, cash register, measuring instruments, and hand held terminals.

VI. DESIGN AND WORKING

A. WORKING:

Whenever the driver is comes in parking area he first press the parking allocation button. The Raspberry pi sends the message to camera module to take the current picture of parking area. By following the command of raspberry pi the camera module will capture the current

picture and send it back to raspberry pi. After accepting the image from the camera module raspberry pi will perform various image processing operation on that image. These can be done with the help of MATLAB software. After processing the image raspberry pi will find out exact vacant locations for parking and generate a printed result with the help of thermal printer which is connected at GPIO pins. The thermal printer is print the slip of nearest empty slot in parking area.

B. ALGORITHM

Algorithm to find nearest empty slot in parking area as follows:

- Step 1: Start
- Step 2: Stored image in variable I
- Step 3: convert image in three different colors i.e., R,G,B values
- Step 4: convert image in binary values
- Step 5: Stored all values in variables A
- Step 6: Crop image as per sequence S1, S2 and so on
- Step 7: If $S1 > \text{Threshold value}$
Then slot is not empty
- Step 8: If $S1 < \text{Threshold value}$
Then slot is empty
- Step 9: Printer prints the slot S1 is empty
- Step 10: Stop

C. FLOW CHART:

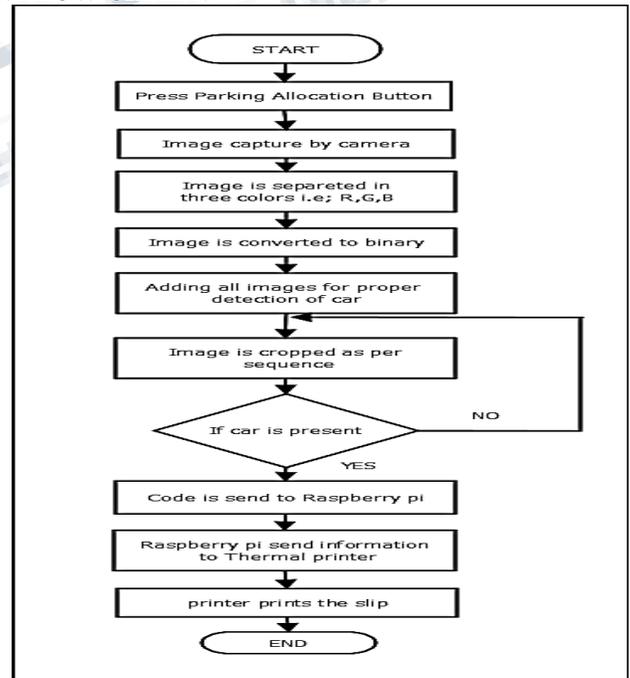


FIGURE 5: FLOW CHART FOR EMPTY SLOT DETECTION

By the press of the button the raspberry pi send the message to camera and camera take an immediate picture

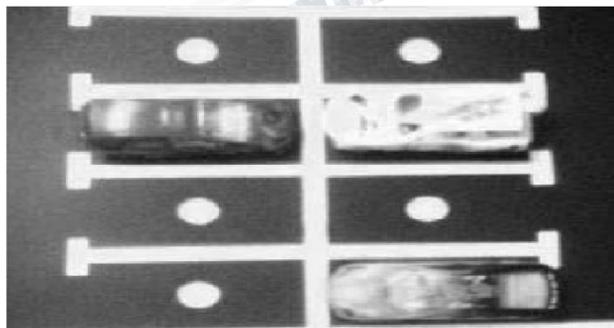
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of the parking area and send it to the raspberry pi for processing of image. First the image is separated in three primary colors i.e. Red, Green, and Blue. Then the images are converted into binary image which is also called as black and white image. All the three images are added which gives the clear image .It shows the proper detection of car. After adding, the image is cropped by imcrop command. The image is cropped as per the sequence given for slots like 1, 2, 3, 4... in parking area. If the white pixels are more in first slot than it shows the car is present in that slot. And it moves towards the second slot. This process is continuously working till the desired empty slot is identified. When empty slot is detected the raspberry send the nearest empty slot information to thermal printer which is connected to raspberry pi GPIO pins. After sending information from raspberry pi the thermal printer prints that information on thermal paper. After printing the information the process is stop. The users will easily get the empty parking slot by showing LED panels in parking areas with the help of printed slip.

VII. RESULTS



(A)



(B)



(C)



(D)



(E)

Figures 6: (A) Original Image (B) Gray Scale Image (C) Binary Image (D) Cropped Image Of Slot 1 Shows Slot Is Not Empty (E) Cropped Image Of Slot 2 Shows Slot Is Empty

The above figures show the results of image processing technique using MATLAB software. From above results we can find the nearest empty parking slot. And this information is printed with the help of thermal printer.

VIII. CONCLUSION

The parking guidance system is conceptualization of image processing technique instead of using various sensors. It detects the empty slot by reference image and guides the user for parking the car. The propose system reduces time consumption and efforts of human being. Also it is affordable for the user in crowded areas. Future

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research will be focused on security parking system as a complement of this parking space detection.

IX. FUTURE SCOPE

By using application we can notify the space for parking in the malls [7]. And also by this we can reserve our space for parking by advanced booking. Instead of allocation button we can use the car plate scanner and link this information with the server and RTO it can also be used for security purpose.

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