Smart Vehicle Parking System Using Raspberry-Pi

Priyanka Gholap[1], Sagar Gawande[2], Bablesh Kumari[3], Shubham Sinnarkar[4]
[1, 2, 3, 4] Department of Information technology
[1, 2, 3, 4] AISSMS Institute of Information Technology, Pune, INDIA

Abstract-*The growth in low-cost ,communication technologies and low-power sensing is creating a pervasive network infrastructure called the Internet of Things (IOT), that enables a wide range of physical objects and environments to be monitored in temporal detail. IOT is the most trending technology for building smart cities, in order to increase the productivity and reliability of urban infrastructure. The proposed system provides vehicle parking with slot availability updated through IOT. Conventional vehicle parking systems do not have any intelligent monitoring system, this leads to wastage of time and cost. There is a need to develop a smart vehicle parking system for parking a vehicle. Internet of Things could be the potential solution for resolving this issue. The system solves the issues using Raspberry-pi controller and Internet of Things. The person entering in parking area is given a notification on LCD screen about the free slots to park the vehicle. Obstacle and environment of parking is managed through sensors and LED. Thus using automated parking system for vehicle monitoring and parking reduces human effort and makes the parking management efficient.*

Keywords-Smart parking system, IOT, Raspberry PI, OCR image processing, sensors etc.

I. INTRODUCTION

One of the key services that cities need to manage is vehicle parking facilities and traffic. It is always troublesome for drivers to find an available parking slot in cities, and it tends to become harder with the increasing number of private vehicle users.It has been observed that 40% of the congested traffic in the city is contributed by cars that are searching for parking spots. The traffic congestion can be efficiently controlled if the drivers are properly informed about the available parking slot[1]. This requires intelligent sensors to be placed in the parking lots for monitoring the occupancy as well as intelligent data processing to make the parking facility efficient [2].

The proposed system involves wireless in-ground sensors that have been installed in parking lots, which record parking events or availability. In the first stage when the vehicle enters the parking area ,the entry point senses the vehicle and automatically opens the gate. The camera installed in the parking area captures the image of the number plate of the vehicle. The characters present in the image are extracted using image processing. This captured image is emailed to the administrator using IoT. The system involves infrared sensors installed in parking lot which are interfaced with Raspberry-pi controller for detection of the empty slot. The information about the available slots is then displayed on the LCD screen by the administrator. Every parking lane involves gas sensors installed which senses the harmful gases emitted from the vehicles.

In the second stage , ultrasonic sensors interfaced with the Arduino controller are placed in the parking area for obstacle detection. The ultrasonic sensor calculates the distance of the vehicle from the obstacle and accordingly notifies the driver through LED strips.

II. LITERATURE REVIEW

GPS based parking system:

Mamta Gahlan et.al. presented a study on managing the parking by using the GPS (Global Positioning System). Whether or not on roads, markets, malls parking could be a major issue. Automotive drivers waste lots of your time finding the obtainable parking zone with no detail or direction. Current parking systems rely either on Human Personnel to keep a track on obtainable parking zone or device based system. This paper shows a GPS based system to find and indicate the available parking slot. Coordinates are accustomed to find the available parking slot.

Smart Car Parking System based on IoT concept:

Vrushali D et.al. in their paper presented the fundamental thought of using server or cloud based smart parking services in smart cities as a vital application of the internet of Things (IoT) paradigm. This system will be accessible through a mobile app or through the webpage provided and is used to monitor the empty slots in this space.

Automatic Smart Parking System using internet of Things (IOT):

Basavaraju S R. says within the paper that Internet of Things (IOT) plays an important role in connecting the encircling environmental things to the network .Usually

people face problems in parking vehicles in parking slots in a town. In his study he presented a smart Parking System (SPS) that permits the user to find the nearest parking lot and check availability of parking slots in several parking lot. So it reduces the fuel consumption that successively reduces carbon footprints in an environment.

III. IMAGE PROCESSING THROUGH OCR

Optical Character Recognition(Ocr)

The goal of Optical Character Recognition (OCR) is to classify optical patterns (often contained in a digital image) corresponding to alphanumeric or other characters. Number plate recognition is a form of automatic vehicle identification. It is an image processing technology used to identify vehicles by their own number plates. Automatic number plate recognition has three major parts: vehicle number plate extraction, character segmentation and Optical Character Recognition (OCR). Number plate extraction is that stage where vehicle number plate is detected. The detected number plate is pre-processed to remove the noise and then the result is passed to the segmentation part to segment the individual characters from the extracted number plate.

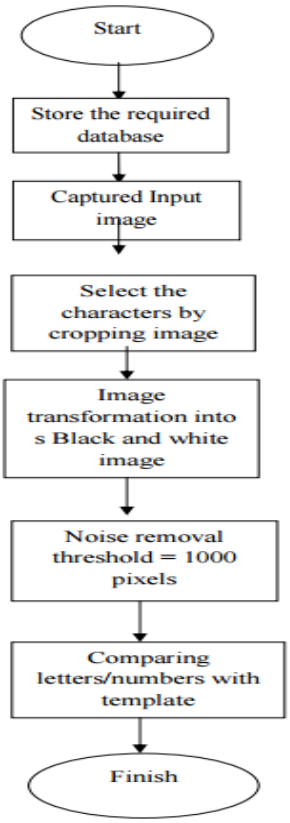

Fig1. Flowchart for OCR Algorithm

The steps involved in the algorithm are as follows:

i. Capture image

The first step is capturing the image of the car number plate. Thus the captured image is stored in jpeg color format.

ii. RGB to Grey scale conversion

In RGB format, each Pixel involves three color components i.e Red, Green, and Blue.

(a) (b)

Fig2. RGB image to Grey scale image conversion

iii. Median Filtering

The median filter is a filtering technique which used to remove noise from image that is under consideration. Thus the median filtering technique is helpful in preserving the edges.

(b)

iv. Character Segmentation

This step involves segmentation of all the characters from the captured image without losing features of the characters. Matlab toolbox function is used in character segmentation. It provides a function called region props.

(a) (b)

Fig4. Dilated image to segmented image conversion

v. Optical Character Recognition

The characters that are extracted after the filtering the image are then matched with the pre-defined characters. The predefined characters consists of the data like Alphabets A-Z, numeric character 0-9. This pre-defined data are in the form of the images. Using these images the template is matched with the segmented characters of the number plate.

vi. Template Matching

In Template Matching, the feature of classification is based on the individual pixels. In this, an image is compared with predefined images, that are referred to as templates.

vii. Number Plate Extraction

The character segmentation algorithm is used to segment the character. Due to this character segmentation process noise is removed using the filter. The noise free character is then matched with template using template matching algorithm and finally the character is extracted in notepad.

IV. SYSTEM DESIGN

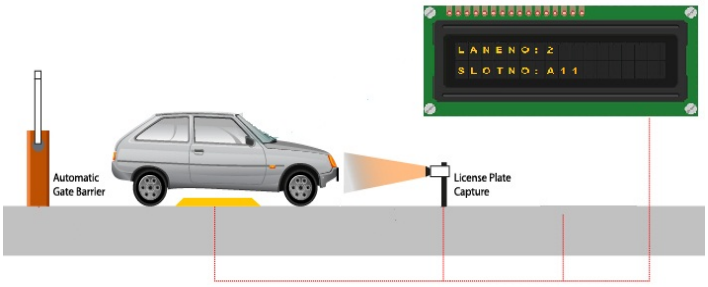

Fig5. System Overview Diagram

As shown within the block diagram(Fig 6) below IR3 sensor is placed at gate that is interfaced with Raspberry pi. The most work of the Arduino in our project is to gather data from sensors connected to parking stations and to send the data to Raspberry pi mistreatment serial port. When IR3 sensor gets cut by vehicle, at that time image of number plate is captured and through image processing it is converted into character which is then matched with database of stolen vehicle. If characters match with stolen vehicle database, buzzer will be activated and mail is sent to RTO office informing them that stolen vehicle is detected at specified location. If characters does not match with database, at that time amount of bill is displayed on the LCD and the empty slot is allocated to the user. IR1 sensor & IR2 sensor placed at different parking slot used to detect slot is empty or not. Also ultrasonic sensors are placed with reference to IR sensor. When IR sensor gets cut by vehicle at that time ultrasonic sensor which is interfaced with Arduino measures distance between vehicle and wall during the time of parking. As vehicle moves towards wall, distance between wall and vehicle decreases due to which LEDs which is placed at led strip starts glowing. When all led's of led strip glows that means user got to stop the car. Gas sensor and metal detector are also interfaced with Raspberry pi. When toxic gas gets detected by gas sensor, buzzer will get activated and message such as "toxic gas detected" is displayed on the LCD. In the same way when metal gets detected by metal detector, sensor, and buzzer will be activated and message as "metal detected" will be displayed on the LCD.

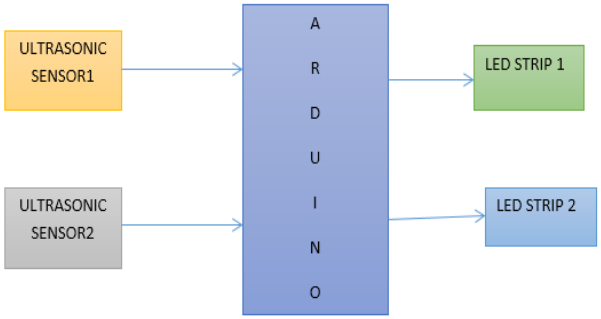

Figure 4.1 Block diagram of arduino circuit

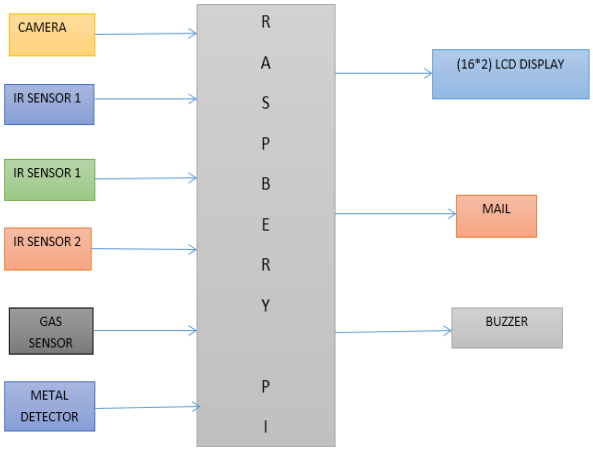

Figure 4.2 Block diagram of raspberry pi circuit

Block Diagram Description:

As shown within the block diagram IR3 sensor is placed at gate that is interfaced with Raspberry pi. The most work of the Arduino in our project is to gather data from sensors connected to parking stations and to send the data to Raspberry pi mistreatment serial port. When IR3 sensor gets cut by vehicle, at that time image of number plate captures and through image process it's converted into character which is then match with database of stolen vehicle. When characters match with stolen vehicle database, buzzer will be activate and mail is sent to RTO office that, stolen vehicle is detected at specified location. If characters not match with database, at that time amount of bill displayed on the lcd and the empty slot allocate to the user. IR1 sensor & IR2 sensor placed at different parking slot used to detect slot is empty or not. Also ultrasonic sensors are placed with reference to IR sensor. When IR sensor gets cut by vehicle at that time ultrasonic sensor which is interfaced with arduino wont to measure distance between vehicle and wall. As vehicle moves towards wall, distance between wall and vehicle decreases due to which leds which is placed at led strip starts glowing.When all led's of led strip on that means user got to stop the car. Gas sensor and metal detector interfaced with raspberry pi. When toxic gas gets detected by gas sensor, buzzer will be activate and message "toxic gas detected" displayed on the lcd. Within the same way when metal gets detected by metal detector, sensor, and buzzer will be activate and message "metal detected" displayed on the lcd.

IV. CONCLUSION

This designed smart parking system 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 IOT. 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.

ACKNOWLEDGMENT

Authors want to acknowledge Principal, Head of department and guide of their project for all the support and help rendered. To express profound feeling of appreciation to their regarded guardians for giving the motivation required to the finishing of paper.

REFERENCES

[1] Gahlan, Mamta, Vinita Malik, and Dheeraj Kaushik. "GPS BASED PARKING SYSTEM." Compusoft 5.1 (2016): 2053.

[2] Ichake, Vrushali D., et al. "Smart Car Parking System Based on IoT Concept." International Journal of Engineering Science Invention, Volume 5, Issue 3, March 2016.

[3] Ndayambaje Moses1, Y. D. Chincholkar2 "Smart Parking System for Monitoring Vacant Parking" International Journal of Advanced Research in Computer and Communication Engineering, Vol. 5, Issue 6, June 2016

[4] Mr. Basavaraju S R, "Automatic Smart Parking System using Internet of Things (IOT)", International Journal of Scientific and Research Publications, Volume 5, Issue 12, December 2015 629.

[5] Hans, Vaibhav, Parminder Singh Sethi, and Jatin Kinra. "An approach to IoT based car parking and reservation system on Cloud." Green Computing and Internet of Things (ICGCIoT), 2015 International Conference on. IEEE, 2015.

[6] Khanna, Abhirup, and Rishi Anand. "IoT based smart parking system." Internet of Things and Applications (IOTA), International Conference on. IEEE, 2016.

[7] Suresh, M., P. Saravana Kumar, and T. V. P. Sundararajan. "IoT based airport parking system." Innovations in Information, Embedded and Communication Systems (ICIIECS), 2015 International Conference on. IEEE, 2015.

[8] Ji, Zhanlin, et al. "A cloud-based car parking middleware for IoT-based smart cities: Design and implementation." Sensors 14.12 (2014): 22372-22393.