

Vision based Automatic Parking System

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Abstract: This paper explains the approach to make easy to monitor and manage a parking area using a vision based automatic parking system. To find the available parking space in the most efficient manner and to avoid traffic congestion in the parking area, it is very necessity to manage the car parking. Nowadays by human personnel also we do manage, the car parking area and by using Sensors, we do monitor the availability of car park spaces. Even though in both we get to know the number of free parking spaces, but we don't get the actual location available. The installation and maintenance cost of a Sensor based system varies as per the number of Sensors required. This paper shows that the performance has a more accuracy for a model of 4 space car park. The model indicated that the application of a vision based car parking management system would be able to detect and indicate the duration of car parking in the given space.

Keywords: Object classification, Color detection, Car Park, Vision based, region of interest.

Introduction

Parking of cars in a parking area is a very difficult task as the number of cars are getting increased day by day but the number of parking spaces are a finite one. Due to that, we spend more time in looking for parking space, by slowing the speed of the vehicle causing a traffic congestion in the parking area. This problem is mainly due to the non availability of the information about the availability of parking spaces at that time. We are using different systems like [5] wireless Sensor network systems and a vision based system [6] now-a-days.

Background

Now-a-days, parking a car is a serious problem in big cities having more population of cars [3]. Since the normal parking system is not providing the required information about the available empty parking areas, we need to improve the system effectively. The typical car parking system is able to give information about the available parking empty spaces or other system using human effort to get and provide information about the location of the available empty parking spaces. Since these parking systems are not giving required information about the available parking spaces and not giving solutions effectively on time, the drivers are spending a more time in locating the parking spaces.

Sensors can be used to detect and provide the information about the location of available parking spaces and to manage the problem of parking. Wireless Sensor system [5] is one of the solution. But we need to install Sensors for each parking space for giving the information on the status of each car park locations, so that the cost of installation of Sensors in each parking slot is very tedious and its installation cost is proportionally high for the more number of parking slots.

A vision based system is an alternative to the normal system to detect available parking slot locations [5, 6, 7]. The availability of a vision based system would be cheaper or scalable with only with the utilization of a number of cameras. So in this method of detecting and locating available parking locations using a vision based system is robust and cost effective since only one camera is needed at the parking space scanning slots one after another.

The main purpose of this paper is to demonstrate the development of a low cost vision based parking system which can determine the location of available parking slots and to provide feedback on the required parking location.

Feature Extraction

In this paper, the functions of working of the system starts as follows:

- The user reaches the entrance of the car park and gets the information about the empty parking slots available, after punching the passive RFID Tag having some identification number for each Tag.
- The user parks the car where the slot is empty. After parking, again he punches the passive RFID Tag having made entry of parked slot, time like details.

- When the user comes back to retrieve the car back, again he punches the passive RFID Tag and gets the information about the parked slot.
- The user pays the parking fee as per the duration of the parking.

The Implemented System

In this paper, both Hardware and Software Systems are used for parking access and Payment. The Hardware details are described clearly in the given block diagram used for the development of prototype of the Vision Based Automatic Parking System. Each block, is explained in the Hardware section. The overall block diagram is given in the Fig.1 below as follows:

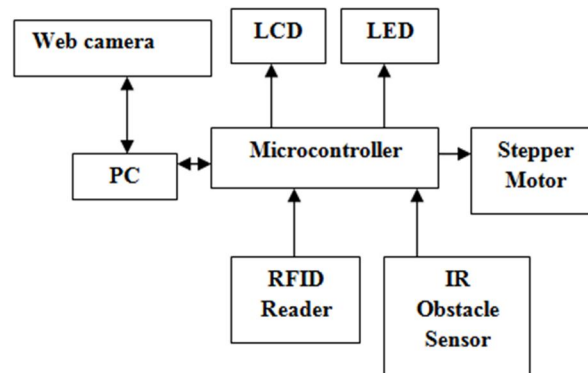


Fig.1 Proposed system Block Diagram

The Hardware

The proposed prototype is composed of different elements of block as shown in Fig.1. Its functions are as follows:

- Web camera is focussed to each parking slot by one at a time. It gives information about the size of the slot and whether it is empty or not.
- PC or Lap Top
- Microcontroller is interfaced with the PC to get the information about the parking space availability.
- RFID Reader which is interfaced with the controller to read the information in the RFID Tag for each car.
- IR Obstacle Sensor detects the entry of vehicle and gives the information to the controller.
- LCD gives the sequence of events starting from establishing the interface between PC and Microcontroller, Parking Space details, Parked Slot details etc.,
- Stepper Motor which controls the entrance gate, opens only if the empty slot is available for parking.
- LED's which is interfaced with the microcontroller indicates whether the respective parking slot is occupied or not.

The Software

Next to the hardware implementation of the prototype, ad-hoc software structure have been studied and developed .The requirements of the software are:

- Embedded C
- KEIL compiler
- Flash Magic
- Microsoft visual studio 2008
- Dot net frame work
- MS Access

First of all, a data base has been realized, to store all the data concerning the parking slots and the information about the time's inside the parking. MS-Access has been employed as a DBMS.

Subsequently the software Dot net computing the Web camera information about the parking slots of the prototype having 4 different slots P1, P2, P3 and P4. P1 and P4 are of bigger size slots whereas P2 and P3 are of smaller ones. Each slot is marked with different colors at particular area, like P1 with Red, P2 with Violet, P3 with Green and P4 with Blue. When the Web camera detects different colors, in the parking slots, it indicates bigger slots P1 or P4 is empty. Similarly smaller slots P2 or P3. On the Dot net output window, we can get details like interface status, Space availability as flag status, Parked slot details with entry parking time stamp and exit parking time stamp, Parking slot details P1, P2, P3 or P4.

Flow Chart

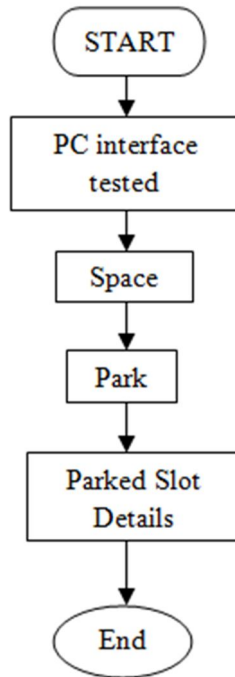


Fig.2 Flow Chart for display

This prototype in coordination with the functions of hardware and software, operates in a program controlled sequences like mentioned in the flow chart shown in Fig.2

The Dot net output window shows the different sequences of functions as per the software written. The snapshots of the output results are shown in the Fig.3. given below

Test Result : For knowing the Parked Slot details
dot net - output

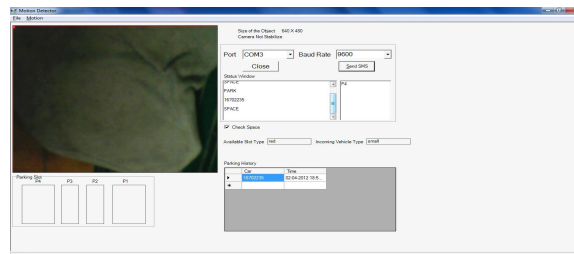


Fig.3 Dot net output window

Conclusion & Future Work

The Conclusion of this prototype has the following comments.

- In this project, the automatic parking of cars are monitored using ARM7TDMI S Microcontroller as the core which has excellent built-in peripherals and operates at CPU operating voltage range (1.65V-1.95.5V). It is communicated with PC which is interfaced to web camera module.
- The information of the parking space having different size slots are monitored.
- As soon as the car enters the area, the entrance gate will be open only if the empty space is available for parking.
- Different sizes of parking slots are available according to the requirement based on the size of the incoming cars.
- For the demonstration model, four parking slots are used. First and fourth slots are bigger type whereas the second and third slots are smaller type.
- The Future Work for this model can be tried with the following comments.

- For further improvement in this project, another web camera can be fitted at the entrance to capture the actual size of the incoming cars, so that the availability of the parking slots can be effectively verified for full satisfaction.

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