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Real Time Car Parking and Light Control Using Embedded Technology

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Abstract

The aim of making this project is to overcome the difficulties which we faces usually while parking our vehicles in parking area and also to maintain the efficient use of electricity in parking.Current car parking management systems utilize human personnel to find available parking areas or use a video based system that collects the information in the form of images and tracks available parking slots. This paper describes an alternative energy efficient system which allots a unique parking 'slot'. The driver has to park in that particular slot allotted without searching for a vacant space thus reducing the time for parking and making an efficient use of available space. The System additionally makes efficient use of energy by switching the lights in the parking area ON only when a car is in motion. The application is developed on PIC16F877A processor and tested on a miniature prototype.It is very essential to automate the system so that we can conserve energy as well as to maximize the efficiency of the system. In this paper a new method is suggested so as to maximize the efficiency of the parking lighting system and to conserve the energy usage the LED lights sensors. Here automation of parking lights is done by LDR sensor.

KEYWORDS: PIC(Programmable Interface Controllers); IR(Infrared); LDR(Light Dependent Resistor)

I.INTRODUCTION

With increasing number of automobiles in the recent days and lack of free parking space, especially in metros, the need for developing an automated car parking system which makes efficient use of space and avoids traffic congestion arises. It creates a challenging design problem to park the cars in close proximity and to operate and maintain such systems. Earlier there were parking areas which required human personnel to track the available parking slots making it time consuming. In this paper, we describe a semi-automated parking system which allots a unique parking slot to every car by the help green and red LED indication, thus obviating the driver to search for a vacant slot and also requires less manpower. Moreover, it is a robust system that accommodates any number of cars entering or leaving the area at the same time instead of stalling the driver at the entrance. The system is made highly energy efficient by switching ON the lights in the parking area only when a car is on the move which makes it distinctive from most parking systems. A study on the existing systems reveals that there are automated systems based on sensor networks or video based systems that track the presence of cars and availability of free spaces in parking areas. They lack the advantage of allotting a unique slot to every car thus creating confusion when many cars arrive simultaneously.

II.BACKGROUND

The concept of the automated parking system was mainly driven by two factors:
A need for parking spaces and a scarcity of available land. With the emerging problem of parking cars, the ordinary parking system which does not provide any information about vacant parking areas would not be able to handle the problem effectively. These systems would get the drivers to search the parking areas on their own and thus create a problem where there would be too many cars in the car park area. This problem is solved by using green and red LED

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indication method.The systems that are in existence consist of two types:

Systems Semi Automated: The available free parking slots are known to the driver without searching for them but the driver has to park in the slot by himself.

Fully automated systems: These are more sophisticated. In such systems the car is parked by itself into an allotted slot through robotic systems. These can save a lot of space and time but would be very costly in practice.

The model discussed in this paper is an efficient version of the traditional semi-automated system. There are several semi automated systems currently in practice. Vision Based Systems Vision based systems continuously monitor all the parking slots through cameras fixed at multiple points thus detecting available free slots. These cameras continuously capture images which are processed and observed for changes in the features thus detecting the presence of a car. The processing includes feature extraction and object identification. The images contain a number of pixels which are captured consecutively. By observing the contrast values between adjacent groups of pixels rather than actual pixel values it is possible to determine common features within an image. Based on the pixel data it is possible to detect the presence of a car.

However, a vision sensor has the following disadvantages; a video based sensor is too expensive and can generate a very large amount of data which could be very difficult to process. The drawbacks with this system are.

1. It only locates all the vacant slots available but cannot allot a slot to an incoming car.
2. It cannot be used in outdoor parking lots owing to atmospheric factors.

Sensor Based Systems

A common type of pavement embedded sensors are inductive loop detectors (ILDs), which are wired loops installed at the entrance/exit to count the number of vehicles entering and leaving or at each parking slot to find vacant spaces. It requires expensive and disruptive maintenance work. Another type of embedded systems uses magnetic field sensors that measure changes in the magnetic flux to detect parking vehicles. These kind of sensors need to be employed at each parking slot which requires sensors attached with a processing unit and a transceiver. Radar sensors perform well in rugged weather conditions, but sometimes need to be equipped with additional sensors to detect parked vehicles. Therefore, it is ideal to install strain based sensors in outdoor parking systems. The sensors are usually connected through relays or programmed in PLCs. This requires a complex hardware and expansion in such systems is highly expensive.

Considering the factors discussed above, a microcontroller based system is modeled which considers several design challenges and the common problems faced in parking garages.

DESIGN AND IMPLEMENTATION

The car parking system allots unique parking slots to the cars and the system utilizes LDR sensors for detecting the presence of cars. The prototype consists of ONE lanes and SIX slots. The slot nearest to the entrance has a higher priority and is allotted first to an incoming car thus saving the time for parking. Figure 1 shows the layout of the parking model containing 6 slots. Each slot is equipped with an indicator LED which is ‘GREEN’ if it is allocated thus indicating the driver to park in that particular slot. When it is ‘RED’ that means slot is full plese move to next slot .If all the slot is full then the gate of the parking area is not open until the operater not give commend through IOT. By help of IOT we can also monitor the parking area.

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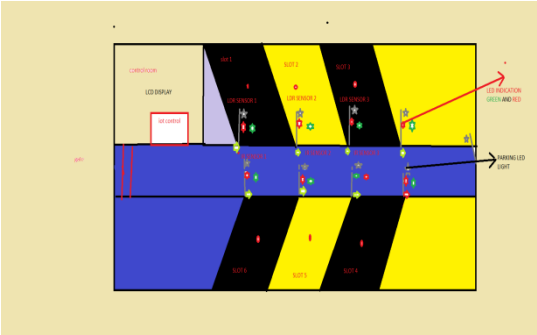


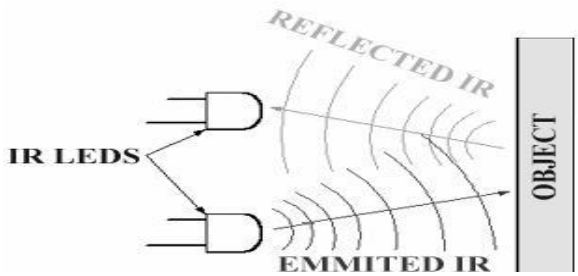
Layout of the prototype

Sensors for detection

The sensors used enable detection of empty parking slots which are to be allotted. LDR sensors are used in the prototype. LDR is a light dependent resistor which is having very high resistance. Whose resistance decreases when light impinges on it. This kind of sensor is commonly used in light sensor circuits in open areas, to control INDICATION lamp. IR sensor senses the vehicles on the street gives signal to the microcontroller. When vehicles are present it gives bright light.
These IR source in the sensor continuously emits infrared rays which upon collision with an object (say, a car) are reflected on to a detector placed adjacent to the source. four IR sensors are used for the prototype; one each at the entrance and at every slot.

The output range for the sensors is processed to 35Volts and the detection range is about 1 to 10 cm.The output of the IR sensors is given to a processor, which does the microcontroller through an interfacing circuit and an amplifier. The output from the microcontroller could be viewed through an LCD display. The microcontroller generates a PWM which is fed to the LED driver circuit which changes the operating cycles of each LED in the LED Array. Presence sensor will detect the presence of any humans or cars. When IR sensor detects the vehicles brightness of the LED will be more when there is no vehicles brightness will be decreased. This is done so as to minimize the power consumption. Here we need light only when it is needed. At sometimes parking lan will be empty and hence there is no use of illuminating all the lamps. So we can lower the intensity of LEDs and can conserve the power.

OBJECT DETECTION USING IR SENSOR



PIC16F877A microcontroller

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects.PIC16F877A also have many application in digital electronics circuits.

The system imple"PIC16F877A" processor for control and automation of the slotallotment and for switching the surrounding lights in the parking garage ON or OFF. It takes 3-5V input from the sensors and gives 3-5V output to drive the surrounding lights and the indicator lamps. This

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operates by plugging the PIC board to an external AC supply of 240V. Program.

The design includes the following functions.

1. Finds the nearest vacant slot available.
2. Allocate the vacant slots as available to any number of cars.
3. Switches the lights ON and OFF according to the position of the car.
4. Switch 'ON' an indicator lamp in the slot that is allocated

The number of cars present is tracked and the free slots are prioritized and allotted to incoming cars. Energy Efficiency The position of the car is tracked using the IR sensors. The lights surrounding the parking area are switched on only when a car is in motion i.e. until an incoming car reaches its assigned slot or until a departing car moves past the exit. These lights are switched ON after the car crosses the entry sensor until it reached the allotted slot. Similarly, when a car comes out of its slot for exit, the lights are switched ON until it reaches the exit. The Processor determines the position of the car based on the inputs from the IR sensors and determines when to switch the lights ON or OFF. PIC16F877A is highly efficient and delivers much better performance than the PLC or Relay based system which utilizes higher power.

Raspberry Pi

The Raspberry Pi is a low cost, **credit-card sized computer** that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.

Advantages

1.Connecting a display
2.composite video
3.HDMI video
4.Connecting audio
5.Connecting a keyboard and mouse
6.Flashing the SD card

In our project we are using raspberry pi for connecting our parking system gate with IOT. In our project gate is moved through servo motor which has two modes of input i.e.

1. Gate can be controlled by directly taking input from IR sensor as vehicle passes from the sensor.
2. Gate can be also controlled using IOT i.e. we can control it remotely from any where in the world by accesing the IP address with LAN connection.

RESULTS AND ANALYSIS

In traditional PLC programming, the cars can only enter one by one. In this system, any number of cars can simultaneously enter or exit at the same time.

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Moreover the Raspberry Pi has the advantage of serial communication which enables several processors to be connected. This enables expansion of the system to many more lanes and slots. Several possible cases of cars entering and leaving were considered for developing the algorithm and are described below.

1. Several Cars exiting simultaneously many cars might leave the slots towards the exit at the same time. The surrounding lights are kept ON until the Vehicles is in motion. The program takes care of allotting the unoccupied slots to the cars arriving later. The cars can leave in any order from any slot.

2. Car entering the parking lot while another car is leaving. The total number of available slot is displayed on the LCD display.

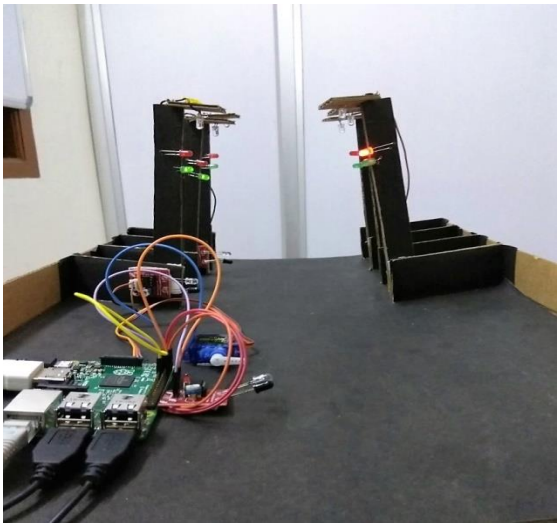
3. As parking slot may or may not be full so,it can be easily expressed through green and red LEDs at just outside of each cabine / parking slots.

4.When car moves in the parking area surrounding light are fully automated as vehicles are detected by the IR sensor then front two LEDS at both end of street starts glowing while other remains off and as vehicles moves further ahead of IR sensor LEDs of back is goes of and front LEDs of next to that starts glowing and the process repeats till the end.

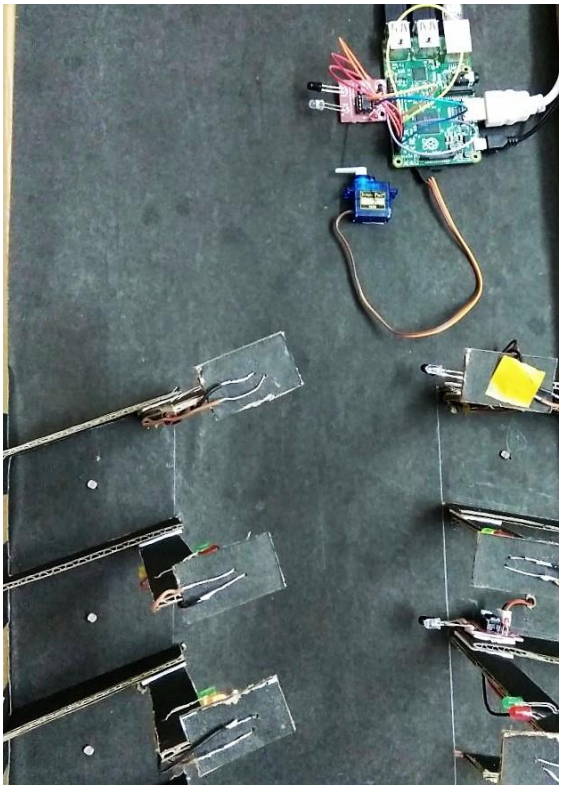
5. “Parking full” is displayed when there is no vacant slot available. The surrounding lights are off when required if IR sensor does not detects any motion.

(because the gate is operated with help of IOT using raspberry pi)

FINAL DESIGN



Front view of model with Raspberry Pi IOT gate control



Top view model layout

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PIC microcontroller connection

CONCLUSION

Model cars have been used for testing and based on the results obtained, it can be understood that this method is very much feasible and efficient. The results suggest that it is a robust system as it worked accurately when tested on a miniature model. This system can be implemented in real time at multi level parking lots with the driver himself parking it manually. It is ideal to install such a system in underground parking areas in Metros, commercial buildings etc. This system can be expanded to more number of lanes and hence be modified when required. This system can further be made space efficient by designing slots of different size. It is possible to measure the breadth of a car and allot a slot according to its size thereby efficiently utilizing the space.

Future Scope

Raspberry pi in our project can be modified to an extreme level at the same time it can be used for connecting many things such as it is easily compactible with cameras and as well as some other sensors also.

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