

Automatic Vehicle Parking Indicator and Traffic Violation Detection System

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Abstract: The parking is limited in almost all the major cities in the world which leads to traffic congestion, air pollution, fuel wastage and driver frustration. Due to lack of space available for parking the vehicles, the driver not knowing the parking slot in malls and many other places, struggles to park his/her car. The major challenges faced by many vehicle owners in big cities are where to park their vehicles. One can save precious time and fuel if the parking slot is known in advance. Many times, driver is not aware of the parking slots that have just become vacant. Finding the parking slot itself consumes too much time. The traffic problems are bound to exist due to the proliferation in the number of vehicles on road. This is due to insufficient and unorganized parking slots. The problem is even critical when there are multiple lanes to park the vehicle. Hence there is a need for an intelligent parking system. In this paper, effective solutions for the Parking system and also Violation detection problems have been proposed. The proposed system also ensures the vehicle is not parked in 'violation areas' and thus avoiding traffic problems in high traffic city roads.

Key words: Automatic parking system Violation detection • Pollution free system • Wireless Networks

INTRODUCTION

A parking violation is the act of parking a vehicle in a no-parking area or for parking in an unauthorized manner. It is against the law virtually everywhere to park a vehicle in the middle of a highway or road; parking on one or both sides of a road, however, is commonly permitted. However, restrictions apply to such parking and may result in an offense being committed. Such offenses are usually cited by a police officer or other government official in the form of a traffic ticket. Traditional parking system consumes more space and increases pollution as the driver keeps searching for a parking space [1]. Different types of parking systems exist today based on the different technologies. Automated Parking systems [2] allow vehicles to be parked without human intervention and also allow more vehicles to be parked within a limited area. S.C. Hanche *et al.*, have proposed an automated vehicle parking system using RFID technology where in the driver is informed about the available parking slot at a particular parking location [3]. Based on secured wireless network and sensor communication, Gongjun Yan *et al.* [4] have proposed a secure and intelligent parking system [5].

The first part deals with the 'Automatic Car Parking Indicator' [6, 7]. The IR sensor component is used to detect the vehicles which are parked in the parking slots. The output is indicated using Light Emitting Diode (LED). This output can further be indicated using an LCD module.

The second part deals with the 'Parking Violation Detection'. The IR sensor component is used to detect the vehicles parked in the 'violation areas' such as no-parking zones [8]. The output of this system is indicated using a 'Buzzer'. Hence using this system we can monitor the vehicles that are flaunting the traffic rules. The paper is organized as follows. Section 2 describes the system design. Section 3 deals with implementation. The paper is concluded in section 4.

System Design: The system design is divided into two parts. The first part is the design of 'Car Parking Indicator' and the second part is the design of 'Parking Violation Detector'. The design and working principles of the system are discussed in the following sections. The sections A and B discuss the system design.

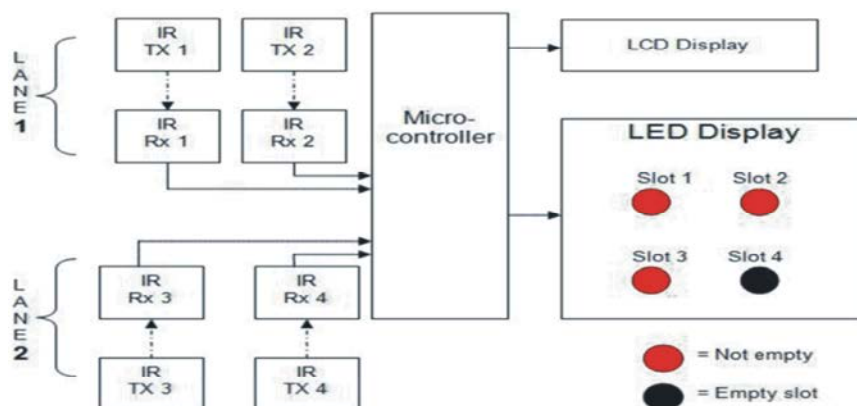


Fig. 1: Block diagram of the parking system

Car Parking Indicator: The Driver not knowing the parking slot many places struggles to park his/her car. Our system helps him to locate the parking slot [9] which is free by indicating an LED (OFF) and when the parking is filled at a slot it indicates the LED as ON. The location of the LED can be known easily in a map and the vehicle can be parked at that particular slot. This detection of a particular vehicle is determined by placing a pair of IR sensors in each parking slot. The block diagram of the parking system is shown in Fig.1. The transmitter section comprises of LEDs which transmit high power light beams. These light beams are incident on the receivers, which produce an output. Whenever the IR line is cut by an obstacle, there is a change in the received output. Considering the difference between the two outputs the distance of the obstacle is calculated.

Parking Violation Detector: The second part of the work is the Parking violation detection. Many times not knowing of 'no parking zone' a vehicle might be parked at that place which causes traffic violation [10]. Thus at these 'no parking' places by implementing our system consisting of same IR sensor module. The output is indicated using a 'Buzzer'. The Infrared (IR) LED is used as transmitter and photo detector is used as receiver to detect the obstacle. In our project the detection of obstacle, then it tells the parking block occupied in car parking indicator system. In parking violation monitor, it indicates the vehicle is parked in no-parking area. LED will glow when obstruction is detected. As shown in Fig.1. the red LED is for the filled parking and black is for empty parking slot. The 4 lane implementation is done here and the inputs from IR receiver go to Microcontroller (Arduino in this case) which processes the signals from IR sensor gives the output at respective LED's. Arduino, an open-source electronics prototyping platform based on

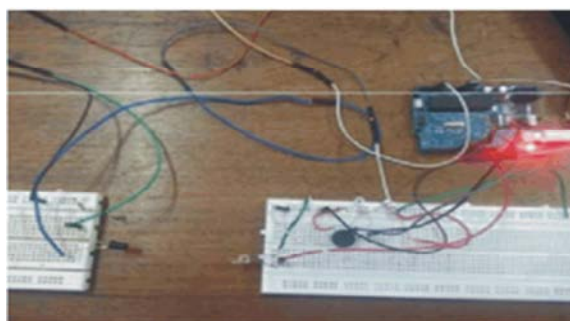


Fig. 2: When there is no obstacle, LED/Buzzer off

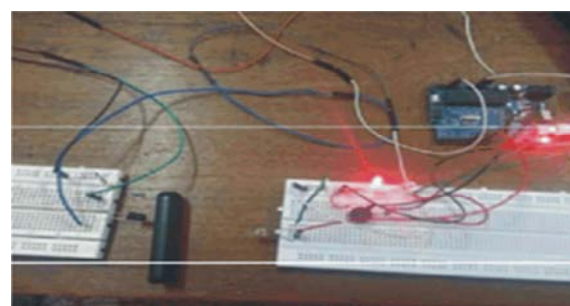


Fig. 3: when obstacle is present, LED/Buzzer on

flexible, easy-to-use hardware and software has been used for implementation. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors and other actuators.

Implementation: The implementation of the system consists of both hardware and software. The Hardware implementation involves connecting of the IR sensor module with the Arduino for sensing the car in the parking slot. The Fig. 2 and Fig. 3 show the hardware implementation for different Cases. The wireless technology is the efficient network in advance

communication system. There are many difficulties to implement the network. The stability and scalability is the important parameters in the networks. Arduino is open source communication for both hardware and software and based on microcontroller kits. The system distributes group of analog and digital input/output pins that can interface to multiple expansion boards. IR sensor module works with nondispersive infrared sensor technology. It is the dual source and dual receivers used in self-compensation of alignment, light source intensity and efficiency. This system obtained for four cases in the operation.

Case 1: When there is no obstacle present

As seen in the Fig. 2, there is no obstacle present between the IR transmitter and the IR receiver. Hence the LED is off indicating the parking slot as free. In case of the Parking Violation, it indicates that no vehicle is parked in the Violation area.

Case 2: When obstacle is present

As seen in the Fig. 3, the obstacle is present between the IR transmitter and receiver. Hence the LED is on indicating the parking slot as occupied. In case of the Parking Violation, it indicates that a vehicle is parked in the Violation area

Case 3: Implementation for 4 lanes

The Fig 4 shows the implementation for 4 lanes. It includes three lanes showing the Parking Indicator and one slot indicating the Parking Violation.

The input is taken from the IR sensor network and the output is given to the LED in case of the parking indicator and the buzzer in case of the parking violation detector. The software design is done using the Arduino software.

The hardware and software are then interfaced to get the final system as shown in Fig 4.

The software implementation is done using Arduino Duemilanove. The flow chart of the software implementation for a single parking slot is shown in Fig 5.

The connections in the Arduino board are done as follows.

The IR emitters are connected to Digital pins 2,4,7,8. The Receiver side of IR sensors are connected to the Analog pins A0, A1, A2 and A3.

The output of the IR sensor pair 1 is given to Pin 11. The output of the IR sensor pair 2 is given to Pin 10. The output of the IR sensor pair 3 is given to Pin 09. The buzzer output for the parking violation detector is in connection with pin 3.

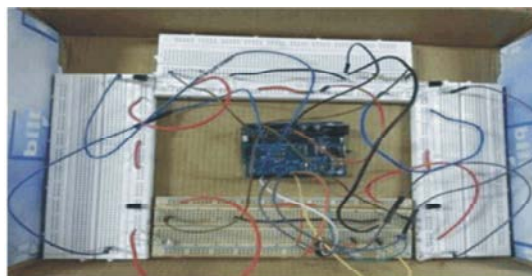


Fig. 4: Implementation for 4 lanes

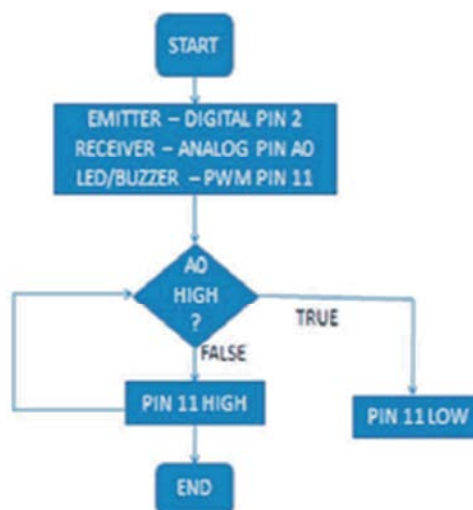


Fig. 5: Flow chart- Software Implementation

There are two important applications that can be developed using the same system design used in this work.

Obstacle Detection: One of the common applications of the IR sensor is the ‘obstacle detection’. It works similar to the RADAR, viz. it detects the obstacle by the reflected IR rays.

Intrusion Detection: The system is very important in security applications. Using the IR sensors we can provide a highly reliable, cost effective and an efficient solution for an Intrusion Detection System.

CONCLUSIONS

Using the IR sensor network for the Car parking monitor provides an efficient and a cost effective solution for the problems faced in finding the parking space. Using the same IR sensor circuit we can detect the vehicles that are parked in the no parking area and prevent the vehicles from flaunting the traffic laws.

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