Automated Barrier Control Car Parking System

Arfa Saleem, Areeba Najm, Fatima Qamar

Department of Electrical Engineering, COMSATS Institute of Information Technology
Islamabad, Pakistan
arfa-saleem@hotmail.com, areeba_najm@live.com, fatimaqamar_17@hotmail.com

Abstract—Automated barrier control car parking system is employed in parking-lot to resolve the growing parking problems, in developing countries. The car parking system is being proposed and designed for developing an intelligent automated and cheaper parking system which greatly reduces manpower, fuel consumption of the vehicle and road problems. Car parking is the major issue of this era in developing countries. With the growing vehicle population the need of efficient car parking system is required. In this proposed model, IR (infra-red) sensors are used in parking-lot which detects and monitors the arrival of the car and controls the occupation of the parking-lot. The LCD (liquid crystal display) is also deployed in the system, which shows the current car count in the parking-lot thus maintains the parking space. The system designed is able to detect a car and open the barrier, only, when the car parking is not full. The proposed system is cheap and easily implementable.

Keywords-Infra-Red (IR), Barrier Control, Liquid Crystal Display (LCD), Parking System, Developing Countries

I. INTRODUCTION

With the increase in world population and the technological advancements, the car parking problem has become the major issue which needs to be solved for the ease and betterment of the people. With the advancement in mobility, vehicle ownership is increasing at a rapid pace [7]. The great cities come with the greater complexity especially when the complexities are not managed effectively [5]. On the other hand, the under-developed or the developing countries face the major road problems as there are no effective road management systems. Most of the, currently, employed parking systems, in such countries, are dependent on manpower and are not fuel efficient as the efficient systems come with high costs. The lack of the cheap and efficient systems causes the road blockage, accidents [5] and wastage of limited resources such as fuel and time.

To help drivers move safely on the roads and to be able to select easily [2] the parking space, efficient and cheap model is developed. In a typical car-parking scenario, for every car entering the parking-lot labor would be required to open the parking gate and close it after the car passes. This does not only require manpower but also wastes a lot of time. The proposed model has an automated barrier which saves both manpower and time. Also if the parking space is full and there is no space for any other car to be parked, the car would not be allowed to enter and the LCD will provide the “Parking full” sign.

IR sensors are used as they are the cheapest solution available to detect an obstacle. IR sensors are used to sense the cars in this case. When the car is sensed an output of 0V is send to microcontroller. Microcontroller analyzes the input i.e. the feedback from the IR sensor. After the analysis the microcontroller controls the relays which operates the motor (in both directions) and it also keeps the record of the car count in the parking-lot and displays it on the LCD. A car limit is set, when the car limit reaches its maximum bound then the barrier does not lifts showing that the parking space is full.

Section II discuss the Related Work for controlling the road problems and providing effective parking solutions and also focuses on the major Motivations for doing this work. Section III provides the detailed working description of the proposed model. Section IV provides the simulation results leading to Sections V which gives the conclusion that IR-based model of car parking system is the cheapest, most effective model.

II. RELATED WORK AND MOTIVATION

Time is the most precious thing in the world and advancements in the mobility are set to save it. According to Rodrigue et al. (2006), cities and their transport systems are
fully complementary [6]. With the increase in population the vehicle population increases; increasing the road problems. Transport systems are put in pressure due to traffic congestions and other negative effects induced by the use of motor vehicles [7]. Finding parking space in buildings, malls, and offices is the most time consuming and hectic job which not only wastes the fuel but requires additional manpower; the available limited resources. For this reason many efficient parking-lot models are presented to the world previously by many great researchers, scientists and engineers.

Most of the systems presented are very efficient but very expensive. The developed countries uses these systems such asRFID based [1], ZigBee based [2], number plate recognition [3] driving path guidance [4], using Sonar sensors and many others. The less developed countries still uses the manual car parking systems as the automatic systems are expensive and complex.

The motivation is to develop an inexpensive and easily implemented system which most of the countries could use easily. IR sensors are very cheap and easy to use. So, such a model is proposed which does the expensive work, done by above mentioned techniques, cheaply.

III. WORKING

The proposed model’s working is dependent upon IR sensor, Microcontroller and Relays:

A. IR-Transmitter

Part of the IR sensor is an infrared LED which transmits continuous IR rays to be received by an IR receiver. The output of the receiver varies depending upon its reception of IR rays. Since this variation cannot be analyzed as such, therefore this output is fed to a comparator. Here operational amplifier UA741 is used as comparator.

B. IR-Receiver

When the IR receiver does not receive signal the potential at the inverting input goes higher than that at non-inverting input of the comparator. Thus the output of the comparator goes low and the LED does not glow. When the IR receiver receives signal the potential at the inverting input goes low. Thus the output of the comparator goes high and the LED starts glowing. Resistor are used to ensure that minimum 10 mA current passes through the IR LED, photodiode and normal LED, respectively. Resistor VR2 (preset=5k) is used to adjust the output. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit.

C. Main Circuitry

Main circuitry starts working upon receiving feedback from the IR circuitry. When microcontroller gets input at P3.6 then it compares and provides the output to relays R1 and R2. The R1 and R2 are connected to motor in a way that common of both relays are provided to the terminals of the motor. The NO path of relays are connected to ground and NC path is provided with power. When the output is provided from microcontroller to relays then the mechanical switch shifts its position and readings such as R1=0, R2=1 or R1=1, R2=0 are observed. This will move the motor.
The diodes are attached with relays to protect the circuitry from fly-back. The motor is connected to the barrier so when it rotates clockwise the barrier opens and when it rotates anti-clockwise the barrier closes. LCD is operated by microcontroller in such a way that when microcontroller gets input from IR it displays the current car count on LCD, until maximum bound is reached.

![Proposed Model](image)

**Fig. 5.** Proposed Model

**IV. RESULTS**

Working of the model was first analyzed on the software. The program written for proposed model was executed on the schematic made on Proteus ISIS. Then the same program was executed on the hardware to check the working of the proposed model practically.

**A. Simulation Results**

When the car arrives it is detected by the IR sensor which is a button in the schematic, as button is pressed the motor starts running to lift up the barrier and after short delay motor starts rotating in counter clockwise direction to close the barrier with which the car count is being displayed on the LCD.

![Scenario: First car entered in parking lot](image)

**Fig. 6.** Scenario: First car entered in parking lot

The IR sensor keep monitoring the incoming cars and increasing the car-count on LCD, until maximum car parking limit is reached. After which, when a new car arrives the barrier does not lifts up for the incoming cars.

![Scenario: Parking lot reaches its maximum (limit set to 3 here)](image)

**Fig. 7.** Scenario: Parking lot reaches its maximum (limit set to 3 here)

**B. Hardware Analysis and Results**

The program implemented on the hardware performed according to the proposed model i.e. barrier opens and closes automatically for an incoming car. The LCD shows the car count in the parking lot and after reaching the maximum space in parking lot, the barrier does not opens and drivers are informed through LCD that parking space is full.
V. CONCLUSION

In this paper we concluded, on the basis of results, that proposed and implemented idea of automated barrier control car parking system is the cheapest and efficient solution to use time, fuel and manpower. The model presented is for the ‘IN’ gate of parking-lot, same mechanism will be implemented at the ‘OUT’ gate to maintain the car count in parking-lot. The parking gate is automatically controlled using IR sensors; saving the manpower. And drivers will have information about parking space before entering into parking as car parking limit is continuously displayed on LCD. This simple yet efficient solution can solve the major car parking problems in developing countries. This model can also be used by the developed countries as it is a cheap solution and can be used widely. This cheap car parking solution reduces the road congestion and the accidents; the major road problems of the world [5].

VI. REFERENCES