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Parking Management System

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Abstract:*The main objective of this project is to avoid the congestion in the car parking area by implementing a parking management system. Normally at public places such as multiplex theaters, market areas, hospitals, function-halls, offices and shopping malls, one experiences the discomfort in looking out for a vacant parking slot, though it's a paid facility with an attendant/ security guard. The parking management system is proposed to demonstrate hazel free parking for 32 cars, with 16 slots on each of the two floors. The proposed system uses 32 infrared transmitter-receiver pairs that remotely communicate the status of parking occupancy to the microcontroller system and displays the vacant slots on the display at the entrance of the parking so that the user gets to know the availability /unavailability of parking space prior to his/her entry into the parking place. In this system the users are guided to the vacant slot for parking using Bi-colored LEDs and the ultrasonic sensors enable the drivers to park the vehicle safely. The parking charges are automatically deducted from the user's account using RFID technology. From security point of view a daily log-book of entry/exit along with the vehicle details is also registered in the computer's memory.Implementation of concept of green communication and exception handling facility make the system concept unique and innovative.*

Keywords: *parking management system, RFID-tags, ultrasonic sensors, green communication.*

I. Introduction

Now days in many public places such as malls, multiplex systems, hospitals, offices, market areas there is a crucial problem of car parking. The car-parking area hasmany lanes/slots for car parking. So to park a car one has to look for all the lanes. Moreover this involves a lot of manual labour and investment. So there is a need to develop an automated parking system that indicates directly the availability of vacant parking slots in any lane right at the entrance. The project involves a system including infrared transmitter- receiver pair in each lane and an LED/ LCD display outside the car parking gate. So the person desirous to park his vehicle is well informed about the status of availability of parking slot.Conventional parking systems do not haveany intelligent monitoring system and the parking lots are monitored by security guards. A lot of time is wasted in searching vacant slot for parking and many a times it creates jams. Conditions becomeworse when there are multipleparking lanes and each lane with multiple parkingslots. Useofparking management system would reduce the human efforts and time with additional comfort. In the proposed system, the display unit and the LEDsindicate the status of the parking lanes viz. a GREEN LED indicates a *vacant slot*and a RED LED indicates the *unavailability*. The system would not only save time but the software and hardware would also manage the Check-in and check-outs of the cars under the control of RFID readers/ tags with additional features of automatic billing, green communication, entry/exit data logging and obstacle indication during parking using ultrasonic sensors.

II. Literature Survey

The concept of the automated parking system is driven by two factors: need for parking space and scarcity of available land.The earliest use of an Automated parking system(APS) was in Paris, France in 1905 at the Garage Rue de Pontius[1].The APS consisted of a groundbreaking multi-story concrete structure with an internal elevator to transport cars to upper levels where attendants parked the cars[2]. In the 1920s, a Ferris wheel-like APS (for cars rather than people) called a paternoster system became popular as it could park eight cars in the ground space normally used for parking two cars. Mechanically simple with a small footprint, the paternoster was easy to use in many places, including inside buildings. In 1957, 74 Bowser, Pigeon Hole systems were installed, and some of these systems remain in operation. However, interest in APS in the U.S. waned due to frequent mechanical problems and long waiting times for patrons to retrieve their cars[3]. Interest in APS in the U.S. was renewed in the 1990s, and there are 25 major current and planned APS projects (representing nearly 6,000 parking spaces) in 2012 [4]. While interest in the APS in the U.S. languished until the

1990s, Europe, Asia andCentral America had been installing more technically advanced APS since the 1970s. In the early 1990s, nearly 40,000 parking spaces were being built annually using the paternoster APS in Japan. In 2012, there are an estimated 1.6 million APS parking spaces in Japan. The ever-increasing scarcity of available urban land and increase of the number of cars in use havecombined with sustainability and other quality-of-life issues[1][5] to renew interest in APS as alternatives to multi-story parking garages, on-street parking and parking lots.

III. Objectives of Proposed Design

Proposed parking system would save time andprovide comfortable hazel free parking experience to the users. Features of the parking management system are as listed below:

- Monitoring of parking space and updated indication of vacant parking slots.
- Assistance to the parking place via displays.
- Safe parking assistance using ultrasonic sensors.
- Automatic record of check-in and check-outs of the cars/vehicles under the control of RFID readers/ tags [6].
- Concept of Green Communication (for energy conservation) [7] i.e. need-based ON/OFF facility of parking floor light.
- Entry- exit log book.
- Printed receipt using thermal printer.
- Parking charges display.
- Automatedpayment of parking chargesfrom the users account.

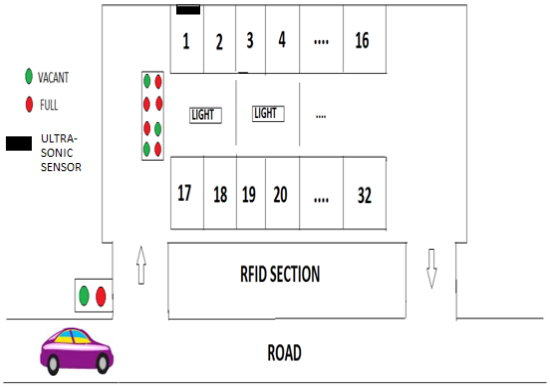

Fig.1 Proposed design layout of parking management system

IV. System Specifications

- Number of parking slots: 32
- Parking Floors : 2
- Green Communication: 6 lights (3/floor).
- Ultrasonic wall distance alarm for: <70 cm
- Data logging capacity/Parking Record- Data: Entry-Exit Log Book (Refresh rate: 1 month)

V. System Architecture

The system architecture, shown in figure 2 consists of 32 Infrared sensor(IR) array blocks at the input and output followed by the latch blocks to hold the signals received from the sensor array in terms of logic1 and logic0.If a vehicle is parked in a particular slot then RED indication is given and if the slot is vacant, GREEN indication is given.The RFID reader/tags will control the check-in and check-outs of vehicle.Output of the latch is given to receive and transmission lines using a microcontroller. At the exit section of the parking area, RFID section and the microcontroller based system would calculate the parking-space usage time and automatically deduct the parking charges from the owner's account and a receipt would be printed using thermal printersas shown in Fig.2. In case of exceptions that there is no balance in the user's account, alarm indication and manual payment provision is made.

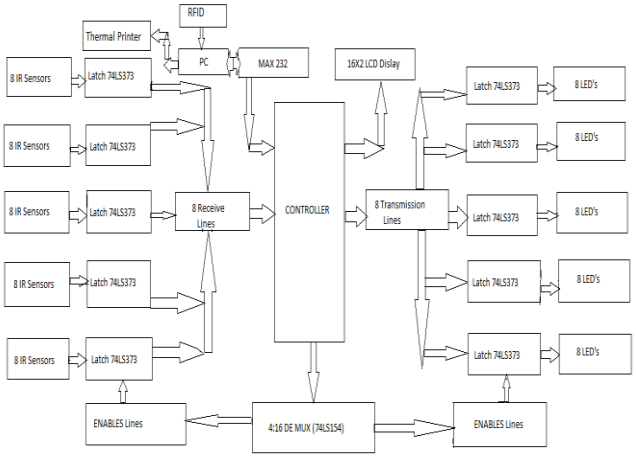

Fig.2 System Architecture

VI. Hardware Unit

The hardware unit consists of array of sensors, latches, De multiplexer, RFID tags/readers, thermal printer and ultrasonic sensors as shown in Fig.2.Each of the blocks are explained in this section.

***Sensors*:**The proposed design consists of IR transmitters and IR receivers for each parking slot. The IR receivers are interfaced to a microcontroller. IR rays are obstructed when a car is parked in any parking slot. Thus AVR understands that the slot is occupied else it is free.The proposed system uses 40 IR sensors,32 for parking slots and 8 for Green Communication.

Ultrasonic Sensors:These sensors are used for the obstacle detection. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

Microcontroller: The proposed design uses Atmega32L microcontroller. It is a low power controller that provides support for high speed communications, with the ability to be programmed using AT commands. Record of vehicles coming in a month would also be recorded. When the vehicle passes the RFID Reader, the Reader reads the RFID Tag and sends the RFID tag information to the database system. The database notes the vehicle information. The Bi-colored LEDmounted on the front panel at the parking entrance indicates the space availability status.

Latches:Latches are the simplest memory units, storing individual bits.The basic function of the latch in our project is that, when the output of the latch is high,implying the car is parked,then the red LED should glow else when the output of the latch is low,implying the parking slot is vacant, then the green LEDshould glow. In all, we are using 10 latches (5 at the transmitter and 5 at the receiver) in our design. For this we have selected 74LS 373.

***RFID*:** The RFIDdetector is located at some distance from the car. As the driver will bring his preprogrammed RFID tag near the detector, the RFID Reader will read the time in and time out, car details, bank account number [6].

***BI-COLOR LED*:** Bi means two, so this is an LED with two colors. This is typically two LED's in a single package, one of each color. They are wired back to back, so one glows for current in one direction, and the other glows for current in the other direction.

DEMULTIPLEXER:Single data input; n control inputs (“selects”); 2n outputs. Single input connects to one of 2n outputs. “Selects” or decides which output is connected to the input. When used as a decoder, the input is called an “enable”. The proposed parking system uses 74LS154 IC.

MAX232: The MAX232 is an integrated circuitthat converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits.

RS 232 PROTOCOL:It is used for serial communication between Micro-controller to PC. In the proposed design the PC and the serial thermal printer is connected to Microcontroller via RS-232.

LCD:LCD is used in a project to display the output of the application. The design consists of 16x2 LCD which indicates 16 columns and 2 rows and can write 16 characters in each line. So, total 32 characters we can display on 16x2 LCD. The design consists ofLCD is used to display the deducted amount and a 'THANK YOU' message.

THERMAL PRINTER:The function of thermal printers in proposed design is to print the receipt with car details-time-in and time-out, the parking charges per hour and total charges deducted.

VII. Flowchart

The parking management system functioning can be well understood from the flowchart shown in figure 3.

The Flowchart of the proposed parking system is as shown

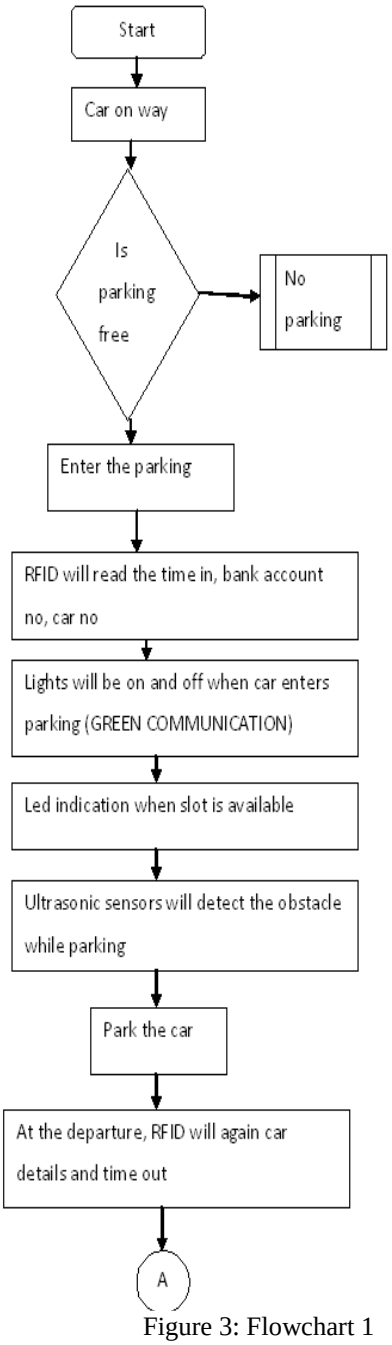

Figure 3: Flowchart 1

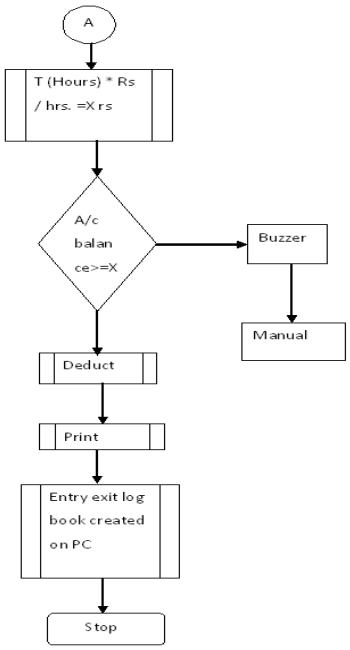

Fig.3 Flowchart of proposed system

VIII. Results

The hardware implementation and simulation results are discussed below.

[A] Simulation of IR sensor using Proteus software

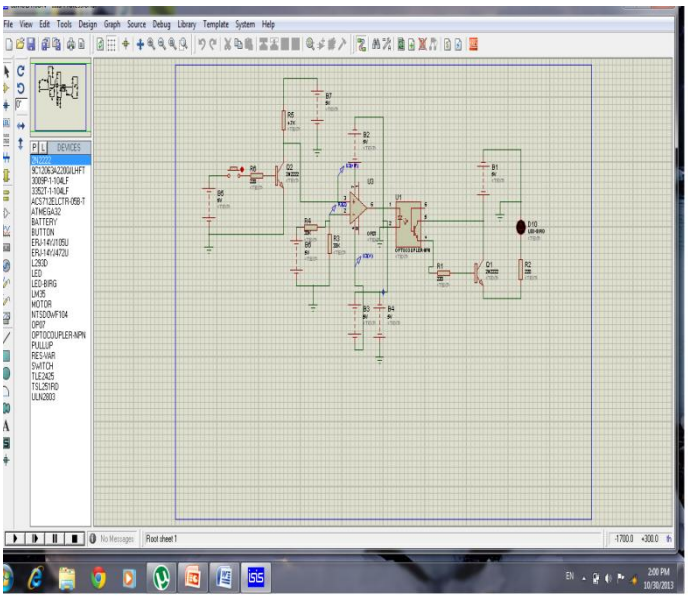

Figure 4: IR sensor simulation

[B] Ultrasonic sensor results: The hardware implementation of the ultrasonic sensor based anti-collision circuit was successfully done. While parking, when the distance between the car and the wall or any other obstacle reduces to 75 cm, the alarm indication turns ON, thus alerting the driver.

IX. Applications

The system can be installed at the

- Parking Lots of Offices
- Malls
- Toll plazas
- Underground parking areas in Metros
- Commercial buildings

X. Conclusion

The proposed parking management system takes into account all possible attributes that is expected from it. This system uses IR and ultrasonic sensors and RFID tags/readers to handle chaos-free and guided parking for 32 vehicles. This system can be expanded to accommodate increased number of vehicles by applying the concept to more number of floors and lanes and parking slots.The project can be customized to authenticating military gate-pass entrants & it could also be improvised with a voice guided system.

Acknowledgement

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