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Smart Car Parking System with Autonomous Car

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***Abstract* - The world's population is growing, and cities are becoming more crowded, resulting in an increase in the Number of automobiles on the road. The management of car parking is one of the primary difficulties in cities. It is inevitable for the people to update with the growing Technology in the past; studies on how to structure parking systems were done. Smart parking systems, on the other hand, are still in demand and are attracting researchers' interest as a potential upgrade to meet modern needs and Requirements. It is critical to monitor and manage vehicle access in government and private sector parking lots In order to improve the world's security system. As a result, the goal of this study is to create and construct a Smart parking system employing mobile application technology. The created system can control allowed Vehicle admission into parking areas while blocking unauthorized vehicles. Currently, smart parking or parking Guidance systems just receive available parking spot information from deployed sensor networks and then simply distribute it to drivers. Finding the parking slots and also it avoids the unnecessary Travelling through filled parking slots in a parking area. It is very difficult to find a Suitable parking place in parking slot.**

Keywords: Arduino UNO, IR sensors, Motors, Ultrasonic sensor, Node MCU, Bylnkiot app, motor drive, power supply unit.

I. INTRODUCTION

As the population increased in the metropolitan cities, the usage of vehicles got increased. It causes problem for parking which leads to traffic congestion, driver frustration, and air pollution. When we visit the various public places like Shopping malls, multiplex cinema hall and hotels during the festival time or weekends it creates more parking problem. In the recent research found that a driver takes nearly 8 minutes to park his vehicle because he spends more time in searching the parking Slot. This searching leads to 30 to 40 percent of traffic congestion.

Here we going to see how to reduce the parking problem Automatic car parking using offerings are transforming cities by improving infrastructure, creating more efficient and cost effective municipal services, enhancing public transportation, reducing traffic congestion, and keeping citizens safe and more engaged in the community. Car parking is an issue of significance both at the local and at the strategic level of planning. This project's main purpose is to produce a real life solution to the car parking problem which the whole world is facing frequently.

People usually roam around in the parking lots trying to find a suitable place to park in to solve that problem we have created the automatic car parking system, using open source hardware, programmable sensors and the use of computers to provide an interface to understand the digital output produced.

1.1 Auto car parking features

It is mainly benefit for the companies which are based on transport system. Since it can show the position of all vehicles in real time, so that they can create the expected data accordingly. This parking system accommodates maximum cars in minimum space, customized parking solution, designed and manufactured in India to provide cost effective solution, low maintenance and operation cost, safety for both car and driver, faster parking and retrieval, ecofriendly, attractive modular design.

1.2 Problem statement

People usually roam around in the parking lots trying to find a suitable place to park. As the population increased in the metropolitan cities, the usage of vehicles got increased. It causes problem for parking which leads to traffic congestion, driver frustration, and air pollution. In the recent research found that a driver takes nearly 8 minutes to park his vehicle because he spends more time in searching the parking slot.

1.3 Objectives

- The autonomous car parking system, using open source hardware, programmable sensors and the use of computers to provide an interface to understand the digital output produced.
- And also reduces the spends more time in searching the parking slot and required Manpower to maintain a parking system.

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II. LITERATURE SURVEY

2.1 Introduction

A literature review discusses about various with articles published which articulate different methodologies or algorithms along with assembling the data essential for implementation of any other techniques. Behind any effective exploration or any good implementation of a system, there will be certainly good amount of time would be spending on the literature survey. It is all about analysis of previous research papers, way of implementation and archives identified with the work which was done some time recently, it really benefits in comprehension what is being worked and done on the field or area and forthcoming work expected to be finished. After a ground work in literature survey, one will be having a clear idea of what is the next idea.

2.2 Literature Review

Various methods are prevalent for development of autonomous or intelligent parking systems. Study of these systems shows that these require a little or more human intervention for the functioning. One of the intelligent systems for car parking has been proposed by making use of Image processing. In this system, a brown rounded image on the parking slot is captured and processed to detect the free parking slot. The information about the currently available parking slots is displayed on the LCD display. Initially, the image of parking slots with brown-rounded image is taken. The image is segmented to create binary images. The noise is removed from this image and the object boundaries are traced. The image detection module determines which objects are round, by estimating each object's area and perimeter. Accordingly, the free parking space is allocated. A vision based car parking system is developed which uses two types of images (positive and negative) to detect free parking slot. In this method, the object classifier detects the required object within the input. Positive images contain the images of cars from various angles. Negative images do not contain any cars in them. The co-ordinates of parking lots International Journal of Advances in Electronics and Computer Science, ISSN: 2393-2835 Volume-3, Issue-3, Mar.-2016.

Automatic Smart Car Parking System 50 specified is used as input to detect the presence of cars in the region. Hear-like features are used for feature detection. However, limitations may occur with this system with respect to the type of camera used. Also, the co-ordinate system used selects specific parking locations and thus camera has to be at a fixed location. Limited set of positive and negative images may impose limitations on the system. Number Plate Recognition technique for developing autonomous car parking system uses image processing basis to process the number plates of the vehicles. In this system, the image of the license number plate of the vehicle is acquired. It is further segmented to obtain individual characters in the number plate. Ultrasonic sensors are used to detect free parking slots. Then the images of number plate are taken and analyzed. Simultaneously, the current timing is noted so as to calculate the parking fees. The LCD displays 'FULL' sign to indicate that a parking slot is not available. However, some limitations with the system include background colour being compulsorily black and character colour white. Also, analysis is limited to number plates with just one row. Smart Parking system designed proposed a mechanical model with an image processing facility. The car would be parked with the use of lift at multiple levels. Also, image processing is used to capture the number plate and store in database for comparison to avoid illegal car entry. Thus, we aim to propose a car parking system that represents a fully automated model with minimum human intervention and overcome the limitations of existing systems.

III. METHODOLOGY

3.1 Block Diagram

The block diagram of the automatic vehicle parking system is shown below. The block diagram shows the overall view of the system. The blocks that are connected here are arduino Microcontroller, LCD display, IR sensor, servo motor, motor drive, Power supply.

The block diagram of the automatic car is shown below. The block diagram shows the overall view of the car system. The blocks that are connected here are node MCU ESP 8266 Microcontroller, dc motor, ultrasonic sensor, motor drive, battery.

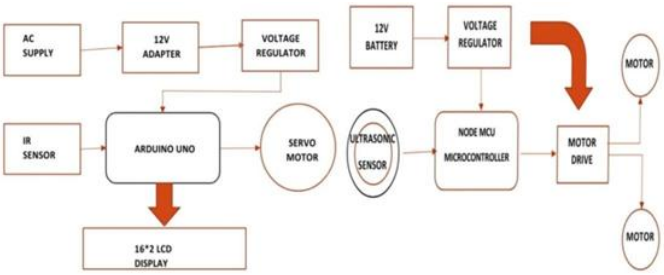

Figure 1: Block diagram of car parking system and Autonomous Car

Micro Controller Atmega328p: Micro controller is used for reading data from the sensors. It contains 32K bytes of in-system reprogrammable flash memory, 2k bit internal RAM and 20 Programmable I/O lines.

In this Project it is proposed to design an embedded system which is used for parking vehicle by using node mcu and mobile communication using Blynk app in this project

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GA328P microcontroller is used for interfacing to various hardware peripherals.

The current design is an embedded application, which will continuously monitor a moving Vehicle and report the status of the Vehicle on demand. The node mcu gives many parameters as the output, but only the NMEA data coming out is read and displayed on to the LCD. The same data is sent to the mobile at the other end from where the position of the vehicle is demanded. The hardware interfaces to microcontroller are LCD display, IR sensor Different types of sensors such as infrared sensors and ultrasonic sensor are used for detecting different types of problem encountered in the vehicle and parking area such as accident.

The block diagram of the proposed system. The system consists of Arduino microcontroller unit for the controlling process which has been interfaced with the Infrared sensor, power supply, LCD and a Servo. Infrared sensor is used to detect the parking slot and determine whether the parking slot is vacant or not. This Infrared sensor is connected to the Arduino board. This sensor is connected to a 5V supply. This information is updated on the LCD. The LCD act as an interface between the system and the end user. The purpose of LCD is to provide information about the parking space availability and the user will book the slot accordingly. Once the user books the slot then the car is parked. Then at the end the user has to pay the amount based on the parking time. Once the user will pay the amount then the owner will receive the notification about the amount paid and the number of cars still in the parking area along with the car number. By using the LCD, the owner can able to know the parking area information and the time the particular car using the particular parking slot based on that amount paid by the user. The merits of smart parking system are shorter waiting time at parking place, saves fuel, guided to nearest parking place, Carbon emission is reduced.

3.2 Parking area and Car working

The supply is drawn from battery is directly fed to voltage regulators, which regulates the voltage and fed it to the Arduino microcontroller, Motor driver, Ultrasonic and IR sensors to function properly. Arduino MC controls the peripheral which is connected to it according to program developed. The Project Consist of IR sensor, Servo Motor LCD Display with Arduino UNO micro controller. In other end the car circuit consists of Ultrasonic sensor, motor drive, Brushless Motor, and Node MCU.A Node MCU is a Wi-Fi module which are connected through Mobile App called Blynk app.

A blynk app is operated with Car in parking Area, were the parking slot is free, when the user is left the car in the parking Zone and select the parking button in mobile using Blynk App. The car will automatically search the free space in the parking area and in parking area we are installed 16*2 LCD display, The display shows the free space of parking slot and sense the car using sensors and the gate will automatically opened using servo motor and the car will automatically parked in the free space. After get back to the pickup zone and select the pickup button using Blynk App the car will automatically get back to pick up zone and pick the user.

The smart car parking system works on the simple principle of detecting obstacle and sending a visual feedback. The Proximity sensor is mounted on the ceiling of the parking lot which consists of an Infra-Red emitter and a receiver. The IR Emitter emits infra-red rays and these rays generally bounce off Objects. The IR receiver receives these rays and converts them into an electrical signal creating a potential difference. The Resulting potential difference helps complete the circuit. The LEDs are placed along the driveway and switch on based on the Input received by the sensor. Resistors are provided to ensure the safe working of IR sensors. For this project based on size a 12V Battery and adopter is used to power all the components.

Case 1: When the parking space is empty, the IR emitter emitting the rays will not bounce back an object (vehicle) is not Detected. The rays will not strike the IR receiver and hence there will be no rise in potential difference. The feedback of this Result makes the LCD display is indicating the Availability of a parking space.

Case 2: When the parking space is occupied, the IR rays Emitted by the emitter is bounced back as the vehicle height is within the threshold distance and the rays strike the receiver and these waves are converted into an electrical signal creating a Potential difference. The feedback of this result is indicates by LCD display the parking space is filled. There is continuous emission of IR waves so the feedback is Instantaneous. As soon as the vehicle exits the parking space, the rays don't return back and display the availability of parking space.

3.3 Hardware Requirements

S. NO	COMPONENTS	QUANTITY
1	Power supply	1
2	Arduino Uno	1
3	Node MCU	1
4	Ultrasonic Sensor	1
5	Motor Device	1
6	Servo Motor	1
7	IR Sensor	2
8	motors	4
9	Capacitor	4
10	LCD Display	1

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11	LED Display	3
12	Battery	1
13	Resistors	3
14	ICLM 7850	2

3.4 Components description

3.4.1 Arduino

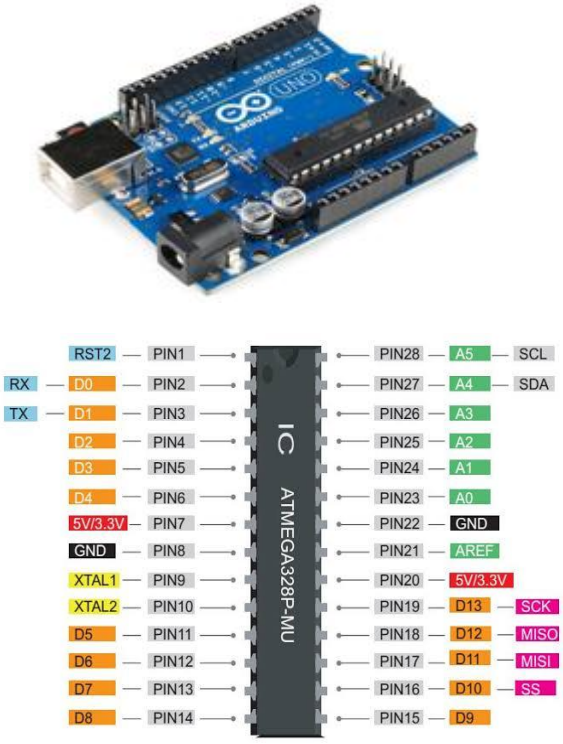

Figure 2: Arduino UNO and pin out diagram

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (Shields) and other circuits.

The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it uses theAtmega16U2 (Atmega8U2 up to versionR2) programmed as a USB-to-serial converter.

3.4.2 Node MCU

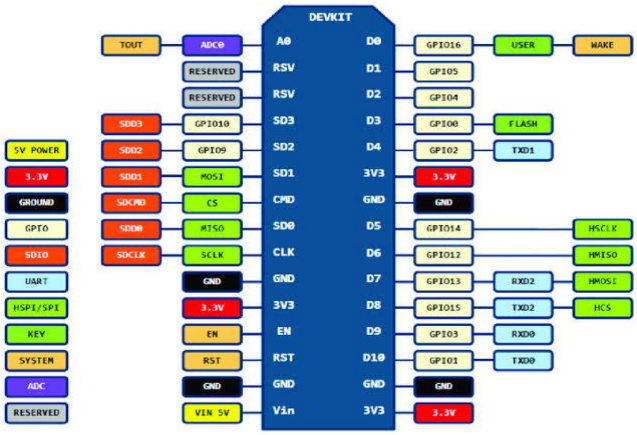

Figure 3: Node MCU and pin out diagram

3.4.3 IR Sensor

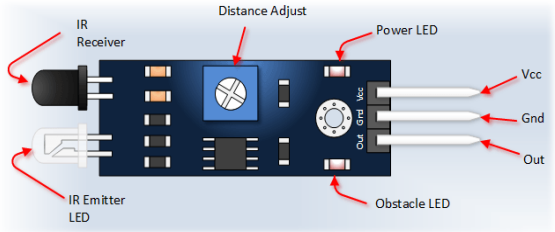

Figure 4: IR sensor pin out diagram

An infrared sensor is one of the basic and popular sensor modules in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common application in real time. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at intensity of the received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor.

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3.4.4 Ultrasonic Sensor

The Arduino Ultrasonic Range Detection Sensor is used with Arduino in order to calculate distances from objects. So if we start with the Arduino Ultrasonic Range Detection Sensor, it's an IC that works by sending an ultrasound pulse at around 40 KHz.

Figure 5: Ultrasonic sensor

It then waits and listens for the pulse to echo back, calculating the time taken in microseconds (1 microsecond = 1.0 × 10-6 seconds). You can trigger a pulse as fast as 20 times a second and it can determine objects up to 3 meters away and as near as3cm.It needs a 5Vpower supply to run. And then it waits and listens for the pulse to echo back, by calculating the time taken in microseconds.

Adding the Arduino Ultrasonic Range Detection Sensor to the Arduino is very easy, only 4 pins to worry about. Power, Ground, Trigger and Echo. Since it needs 5V and Arduino provides 5V we are obviously going to use this to power it.

3.4.5 Servo Motor

Figure 6: Servo motor

Servomotor Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.

IV. RESULTS AND DISCUSSIONS

4.1 Circuit diagram

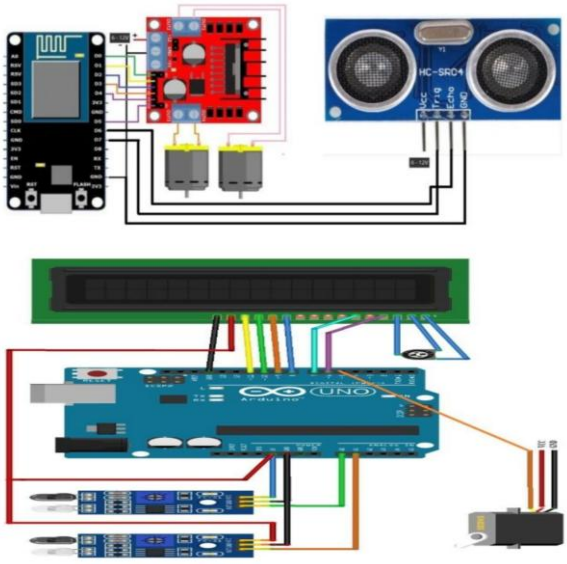

Figure 7: Circuit diagram of parking area and Autonomous car

4.2 Results of Car and Parking System

Case 1: When the parking space is empty, the IR emitter emitting the rays will not bounce back an object (vehicle) is not Detected. The rays will not strike the IR receiver and hence there will be no rise in potential difference. The feedback of this Result makes the LCD display is indicates "ALL PARKING SLOTS FREE "and also gate is opened.

Figure 8: Availability of parking space is free

Case 2: When the parking space is occupied, the IR rays Emitted by the emitter is bounced back as the vehicle height is within the threshold distance and the ray's strike the receiver and these waves are converted into an electrical signal creating a Potential difference. The feedback of this result is indicates

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by LCD display the "ALL PARKING SLOTS FULL ". There is continuous emission of IR waves so the feedback is Instantaneous. As soon as the vehicle exits the parking space, the rays don't return back and display the availability of parking space and when all slots are full gate is closed.

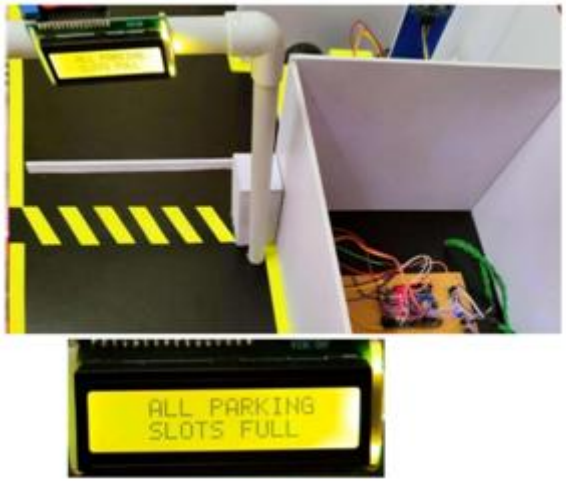

Figure 9: Availability of parking space is full

Case 3: When parking space is free click the park button on bylnkiot app. The car will start moving and finding out the available parking space and also detect the available space is sufficient or not for parking. If slot 1 is free or empty car will be parked on that slot and IR rays Emitted by the emitter is bounced back as the vehicle height is Within the threshold distance and the feedback of this result is indicates by LCD display the "SLOT 1 FULL" and click the unpark button car will be exit from parking slot 1.

Figure 10: First parking slot full and Bylnk iot app interface

When slot 1 is full it's moving and detect for next available slots. If the slot 2 is free or empty and also sufficient or not for parking (and if not sufficient for parking its moving further available slots and also detecting sufficient space.). The car will be parked on that slot and IR rays Emitted by the emitter is bounced back as the vehicle height is Within the threshold distance and the feedback of this result is indicates by LCD display the "SLOT 2 FULL" and click the unpark button car will be exit from parking slot 2 and this process of available space detection for parking is continue.

Figure 11: Second parking slot full and Bylnk iot app interface

Smart Car Parking aims to provide efficient way of parking for drivers without any hesitation. The Android app is flexible to be used by both users and administrator. The cars entering and exiting the parking slots can be tracked with minimum errors. The amount of parking payment can be redeemed by the administrator efficiently.

1) It guarantees snappy and computerized parking and simple recovery of vehicles.
2) Cars can be effectively and securely parked in the outlined model.
3) Most reasonable for parking in workplaces, shopping centers and comparable spots.
4) Low support levels are required by the framework.
5) Sensors utilized have high affectability and are anything but difficult to deal with.
6) It doesn't require observable pathway operation.
7) Cordial reorientation of cars for driving in and out.

4.3 Advantages

Smart Car Parking system is easier, efficient and less time consuming as it uses an Android app to book the nearest parking slot and also helps in tracking the number of cars entered in the parking area and the amount of payment collected which reduces human efforts. The system provides high performance in tracking the car entering and exiting from the parking area and also its presence in a parking slot.

1) It ensures quick and automated parking and easy retrieval of vehicles.

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2) Cars can be easily and safely parked in the designed model.
3) The surface space required is equivalent to the parking space of two cars only.
4) Most suitable for parking in offices, malls and similar places.
5) Low maintenance levels are required by the system.
6) Sensors used have high sensitivity and are easy to handle.
7) Low cost system, providing maximum automation.
8) It does not require line-of-sight operation.
9) Friendly reorientation of cars for driving in and out.

These are just a few advantages of the project that has been introduced in this report. We can interface more number of sensors in order to serve multiple purposes. The microcontroller that has been used in this project have inbuilt ADCs and hence the controller is capable of accepting analog inputs, which is the biggest advantage. Since all real world signals are analog in nature, by incorporating different sensors required purpose can be served.

4.4 Application

The project that has been introduced here can be used for variety of application in parking system.

- Malls
- Hotels
- IT companies
- Hospitals and VIP area

V. CONCLUSION AND SCOPE FOR FUTURE WORK

5.1 Conclusion

Our project ensures to find free parking places for public. As soon as parking place is found to be empty it is detected using IR sensors which report it further. We achieved this by programming the sensors and Arduino. Pushing the data to webpage gives us tabular output which shows availability of parking places. The project aims at fast results so that anyone can easily find place for parking and save time in doing so. As Arduino is the latest technology, using it gives uniqueness to our project.

5.2 Future Scope

In future works, this framework can be enhanced by including different applications, For Example, internet booking by utilizing GSM. The driver or client can book their parking area at home or while in transit to the shopping center. This can diminish the season of the client to seeking the empty parking area. As a further review, distinctive sensor frameworks can be added to enhance this framework to distinguish the question and guide the driver or clients speediest. We will attempt to decrease the mechanical structure and attempt to make it ecofriendly.

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