AUTOMATED CAR PARKING SYSTEM WITH EMPTY SLOTS DETECTION

[1]Ujjwal Kumar, [2]Shubham Mali, [3]Sangeeta Meena, [4]Tinkal Meena, [5] Deepak Saini
[1] Student, [2] Student, [3]Student, [4]Student, [5]Assistant Professor
[1]Department of Electrical Engineering, SKIT M & G, Jaipur, 302017
[1]Ujjwal Kumar, Begusarai, Bihar, India

Abstract: - In this project, we are designing a parking system based on wireless communication. Basically, there are two types of sensor are used. i.e. Radio Frequency module and Infrared Sensor. This System demonstrates a fully automated car parking system. For this purpose we use IR sensors along with motors, LCD display and Microcontroller for controlling the system working. Our system consists of an LCD display that is used to demonstrate as a parking gate entrance display. The display displays empty slots to new car arriving at gate of parking area. If no parking space is available the system does not open the gate and displays parking full. If slot is empty, system allows car to enter the slot and displays empty slots where user can park. To detect vehicle slot occupancy the system uses IR sensors and transmit the detecting signals to the Control room by the Radio Frequency module. Also system using the IR sensors to detect vehicle at parking gates, to open the gate automatically on Vehicle arrival by the use of Servo DC motor. The ATmega-16 Microcontroller, Motor Driver IC, Wireless sensor are used to facilitate the working of the entire system.

Index Terms **- ATmega-16 Microcontroller, DC Servo Motor, LCD display (16*2), IR Sensor, RF module etc.**

1. INTRODUCTION

Over the decades our country has been developed drastically, now we are in this state that we have a lot of well contacted roads, commercial building and increasing number of automobiles. While parking these automobiles in parking space we use the manual procedure of parking. Which most of the cases is unplanned and lack of discipline due to this, people can park their cars anywhere they want to, which creates a mess as people do not follow the particular cue most of the time. As a result of this, a huge traffic jam takes place in that place. While parking in and retrieving car due mismanagement cars can get dent by bumping with each other as there is lack of sufficient space. This leads to arguments, fights among people which sometimes make huge traffic jam. This is also an economical loss as we need to repair our damaged car and also cars consume extra fuel while parking in or out. Traffic jam is an issue here as it kills our precious time. Due to this chaos in parking our valuable time gets wasted. It harms the students, office going staffs and emergency patients to a great extent. It also causes economical loss to commercial places like shopping malls, amusement parks as people are more likely not to visit these places due to this parking hazard. As we are advancing with time, the manual car parking system in commercial spaces is creating hurdle which is causing wastage of time and some economic losses as well. Therefore we need a solution which can overcome these problems. Here we are introducing Automated Parking Systems as a solution of these problems as well as car parking system in commercial spaces is creating hurdle which is causing wastage of time and some economical losses as well. Therefore we need a solution which can overcome these problems. Here we are introducing Automated Car Parking Systems as a solution of these problems as well as a replacement to the manual car parking systems at commercial spaces. This system not only saves time and money, it can also earn money by charging for parking spaces.

2. LITERATURE REVIEW

Noor N.M et. al. stated that, the proliferation in the number of vehicles on the road, traffic problems are bound to exist. This is due to the fact that the current transportation infrastructure and car park facility developed are unable to cope with the influx of vehicles on the road. To alleviate the aforementioned problems, the smart parking system has been developed. With the implementation of the smart parking system, patrons can easily locate and secure a vacant parking space at any car park deemed convenient to them. Vehicle ingress and egress are also made more convenient with the implementation of hassle free payment mechanism [1].

Jae Kyu Suhr et. al. proposes that a vacant parking slot detection and tracking system that fuses the sensors of an Around View Monitor (AVM) system and an ultrasonic sensor-based automatic parking system. The proposed system consists of three stages: parking slot marking detection, parking slot occupancy classification, and parking slot marking tracking. The parking slot marking detection stage recognizes various types of parking slot markings using AVM image sequences. It detects parking slots in individual AVM

problem, no parking zones etc, hence comes the need of such a system which can automatically assists us to search the nearest available parking space in the surrounding area. Thus it will help us in saving time, petrol & money [3].

Pala Z. et. al. stated that most of them are manually managed and a little inefficient. All the work is done by staff of the parking slot. Drivers give the money to the staff directly. Many people are not satisfied with the current management of the parking system and the flexibility of finding empty space to park their vehicles. Parking demand is routinely high at theatres, shopping

malls and offices. The problem that always occurs at the vehicle parking is time being wasted in searching for the available parking spaces. Users will keep on circling the parking area until they found an empty parking spot. That is, people often "circle around" looking for a good parking space then a traffic jam may occur [4].Xiao long Li et. al. propose that, the vehicle management system will enhance the utilization of parking space and help user check the availability of the parking space remotely since the system is connected to the Internet. The project will be implemented in four stages. The first stage consists of embedding the code into a tag and assigning the same to a car. The second stage is sending the data from the RF module to the microcontroller [5].

3. METHODOLOGY

1. Whole system is made of IR Sensor, Radio Frequency Module, LCD Display (16*2), ATmega-16 Microcontroller, Prototype Vehicles, DC Servo Motor, and Voltage Regulator Circuits.
2. Software will be used in this project is AVR Studio 4 for coding execution in ATmega-16.
3. For Designing a Project Circuit by the using of Proteus Software.
4. All Components will be assembled in well manner and insert the program in ATmega-16 Microcontroller through the USB programmer cable.
5. Receiver module is placed on parking side, and it receives the signal from IR sensor to detect the parking slots. After few milliseconds the Receiver Module sent the signal to Transmitter Module then Transmitter Module given the instructions to Microcontroller to Display the appropriate message on LCD display.
6. Message display on LCD that parking slot is available or full, then the parking gate is open and close with the help of servo motor.

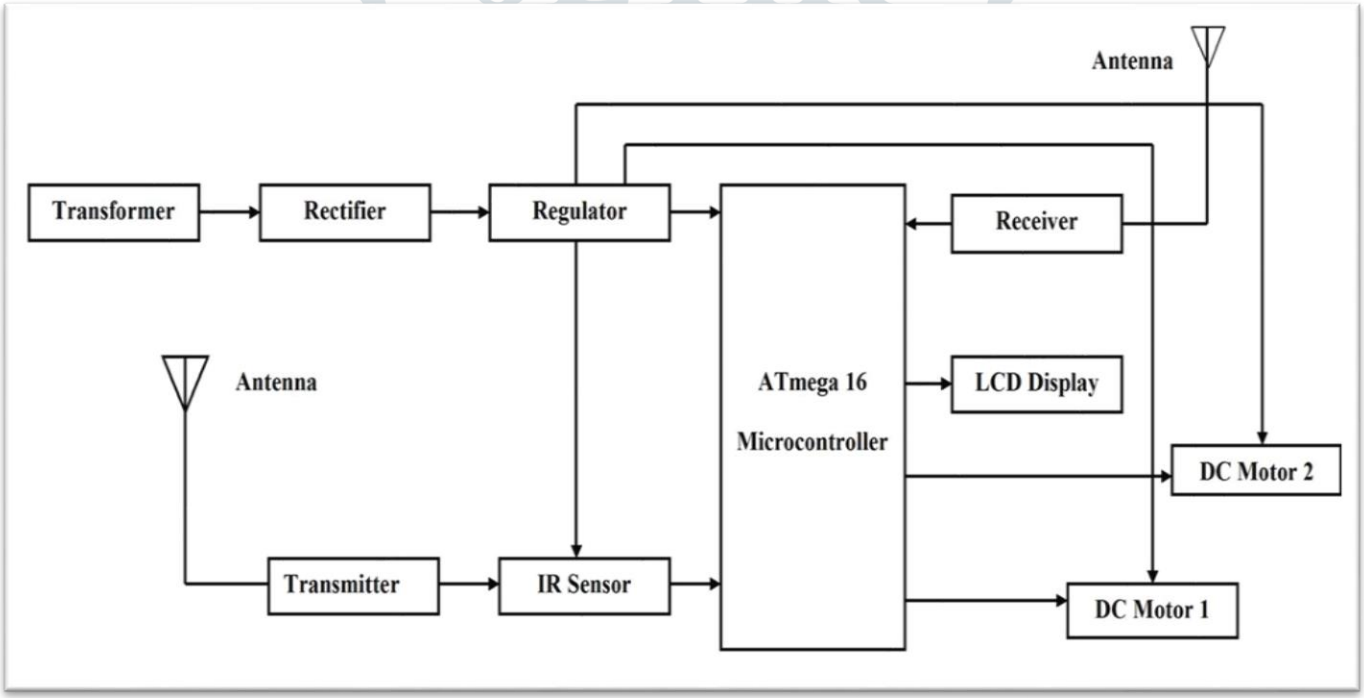

Fig. 1.1:- - Block Diagram of automated parking system with empty slot detection.

4. STRUCTURAL BASE

The LCD display will display the number of available slots. When a car will come the operator will send instruction through ATmega-16 microcontroller to open the gate. DC motor helps the gate to open up when it gets the signal from Microcontroller, Microcontroller will only get the signal to DC motor using RF module. When gate open car owner pay amount manually and take an empty slot no. and park car at empty slot. At this instant car parked the RF module send command to the display that the car is parked, slot full. When All the parking slots is getting full, the RF module send the command to Microcontroller and Microcontroller send command to the display that the slots are full, and display shows parking full. When all slots are full, the motor will not operate and gate close remain until no slot is empty. A Block diagram in Fig 1.2 shows the working of project.

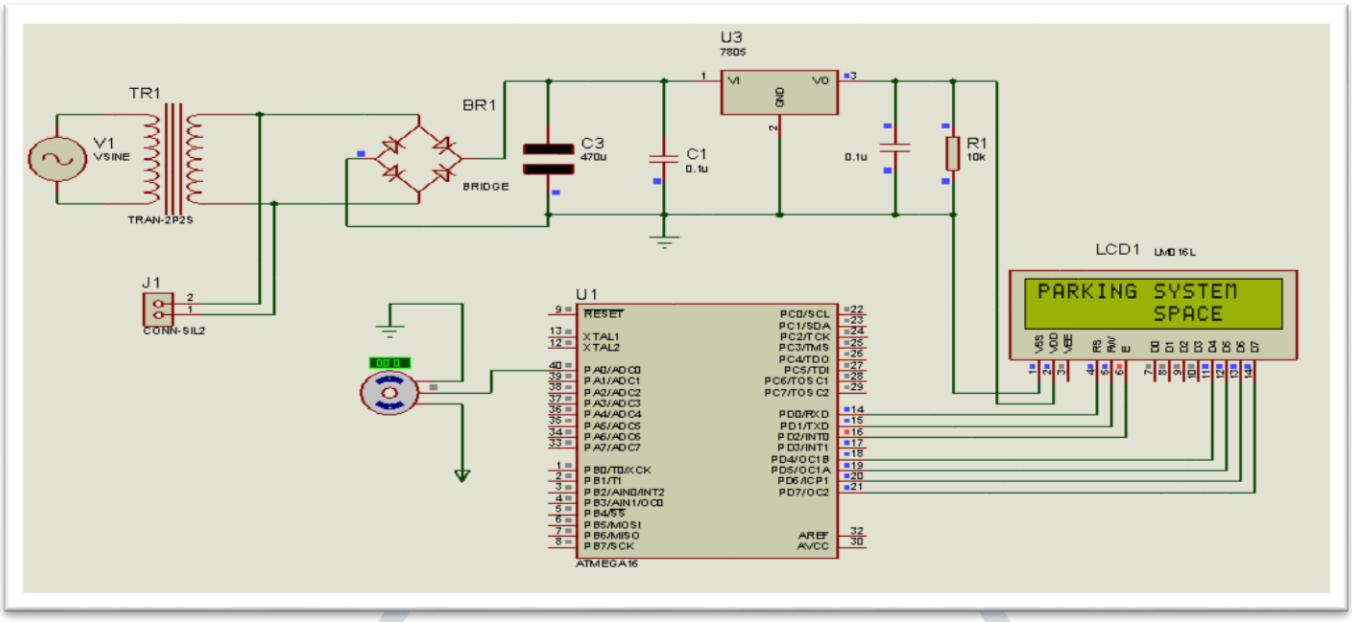

Fig. 1.2: Circuit Diagram of automated car parking system with empty slot detection.

5. APPLICATION AND FUTURE ASPECTS

1. We can recognize the cars by their number plates with the help of image processing in ACP system. By using this type of technology users can directly pay for their car parking using mobile phone's prepaid balance or car parking account balance.
2. Overall this system is executed for a long area and IOT technology is used to extend the future aspects of this project.
3. This type of system is also implemented by using X-Bee Technology and the parking gate is along 100 meters through the parking slot.

6. COMPONENTS

6.1 Atmega-16 Microcontroller

ATmega-16 is a 40-pin low power microcontroller which is developed using CMOS technology. CMOS is an advanced technology which is mainly used for developing integrated circuits. It comes with low power consumption and high noise immunity. Atmega16 is an 8-bit controller based on AVR advanced RISC (Reduced Instruction Set Computing) architecture. AVR is family of microcontrollers developed by Atmel in 1996.It is a single chip computer that comes with CPU, ROM, RAM, EEPROM, Timers, Counters, ADC and four 8-bit ports called PORTA, PORTB, PORTC, PORTD where each port consists of 8 I/O pins. Atmega16 has built-in registers that are used to make a connection between CPU and external peripherals devices. CPU has no direct connection with external devices. It can take input by reading registers and give output by writing registers. Atmega16 comes with two 8-bit timers and one 16-bit timer. All these timers can be used as counters when they are optimized to count the external signal.ATmega-16 Microcontroller pin diagram shown in figure 4.1.

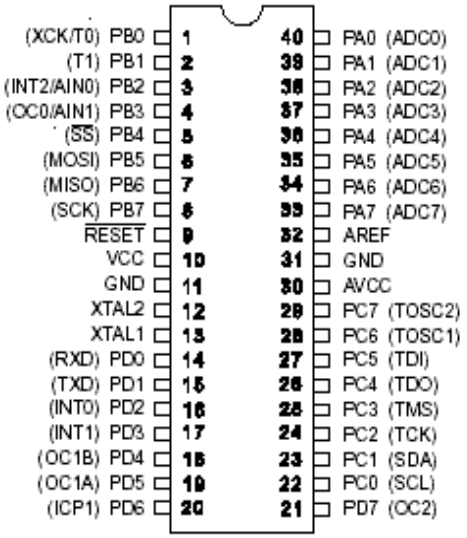

Figure 1.3:- Pin Diagram of ATmega-16

6.2 RF Module

- ✓ A radio frequency module known as RF module is usually a small electronic device used to transmit and/or receive radio signals between two electronic devices. It is often used in an embedded system to communicate with another device wirelessly.

- ✓ This wireless communication may be accomplished through radio frequency (RF) communication or through optical communication. RF as it does not require line of sight. RF communications incorporate a transmitter or receiver for many applications is the medium of choice. RF modules are widely used in electronic design as it is difficult to designing radio circuitry. Because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency, electronic radio design is notoriously complex.

- ✓ Medium and low volume products for customer applications such as garage door openers, wireless alarm system, industrial remote controls, smart sensor applications, and wireless home automation systems and sometimes used to replace older infrared communication designs as they has advantage of not requiring line-of-sight operation RF modules are most commonly used. Several carrier frequencies are commonly used in commercially available RF modules such as 433.92 MHz, 915 MHz, and 2400 MHz and short range devices may also use frequencies available for unlicensed such as 315 MHz and 868 MHz RF modules may implemented a proprietary protocol or they may comply with a defined protocol for RF communications such as Zigbee, Bluetooth low energy, or Wi-Fi. RF modules typically incorporate in a printed circuit board, transmit or receive circuit, antenna, and serial interface for communication to the host processor. RF Module shown in figure 1.4.

Most well-known types are:

• Transmitter module
• Receiver module
• Transceiver module
• System on a chip module

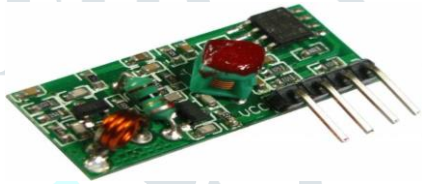

Figure 1.4:- RF Module

6.4 16*2 LCD Display

We come across LCD displays everywhere around us. Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time. An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines.

Figure 1.5: 16*2 LCD Display

Generating custom characters on LCD is not very hard. It requires the knowledge about custom generated random access memory (CG-RAM) of LCD and the LCD chip controller. Most LCDs contain Hitachi HD4478 controller. CG-RAM is the main component in making custom characters. It stores the custom characters once declared in the code. CG-RAM size is 64 byte providing the option of creating eight characters at a time. Each character is eight byte in size.

CG-RAM address starts from 0x40(Hexadecimal) or 64 in decimal. We can generate custom characters at these addresses. Once we generate our characters at these addresses, now we can print them on the LCD at any time by just sending simple commands to the LCD.

6.5 IR Sensor

An IR sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These

types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received. The figure 4.5 shows IR Sensor.

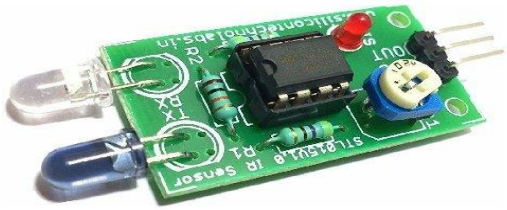

Figure 1.6: IR Sensor

✓ **IR Sensor Circuit Diagram and Working Principle: -**

An infrared sensor circuit 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 applications in real time.

✓ **This circuit comprises of the following components :-**

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo ohms.
- Variable resistors.
- LED (Light Emitting Diode)

In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit.

When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram. Read more about IR sensors.

6.6 DC SERVO MOTOR

A **servo motor** is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through **servo mechanism.** If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Doe to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc..

7. CONCLUSSIONS

Here we are trying to build a suitable computerized Automated Car Parking System with manual payment system. An assessment of the existing system would be made including the operating system being made as a prototype, the efficiency of car parking system, problem faced during operating the prototype etc. An in depth analysis of the Automated Car Parking System would then be made. Various aspects of these two systems would then be compared and the benefit of introducing the Automated Car Parking System would be found out in terms of saving in time, fuel and emission reduction.

REFERENCES

[1]. NOOR N.M, Z RAZAK AND MOHD YAMANI, "A REVIEW OF SMART PARKING SYSTEM AND ITS TECHNOLOGY", *INFORMATION TECHNOLOGY JOURNAL*, 2009.

[2]. Jae Kyu Suhr and Ho Gi Jung, "Sensor Fusion-Based Vacant Parking Slot Detection and Tracking," *IEEE transactions on intelligent transportation systems*, vol. 15, pp. 21-36, February 2014

[3]. Rushikesh Shinde, "Parking Space Searching & Reserving With Mobile Using Bluetooth Technology", *Third Biennial National Conference on Nascent Technologies*, 2012.

[4]. Pala Z., Inanc N., "Smart Parking Applications Using RFID Technology", *1st Annual Eurasia RFID Conference*, September 2007, Turkey

[5]. Xiaolong Li, Uma Kanth Ranga.," Design and Implementation of a Digital Parking Lot Management System", *the Technology Interface Journal/Fall*, 2009.