

# SMART AND SAFE PARKING SYSTEM

DIVYESH D S<sup>1</sup>, DHANUSH K G<sup>2</sup>

<sup>1,2</sup>Student, Department of EC&E, The National Institute of Engineering (NIE), Mysuru

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**Abstract** – In large cities, to find an empty parking slot is very not easy. We are also unaware of the existing parking slots in the necessary area. Therefore, this paper proposes a parking system to assist the people. This system proposes a safe and efficient parking system which will work on sensor communication. The LEDs on the empty slots in the parking facility will show the user the empty space. Accordingly, the user will select suitable parking zone. After this, the estimated shortest path to the selected parking will be calculated and showed to the driver. Using this system, we can easily find vacant space for parking and parking waiting time is reduced efficiently. In this system, we solve the problem of traffic congestion by allowing only authenticated users and eradicate the problems of accidents with the help of ultrasonic sensors. We offer a system that can easily find vacant space for parking.

**Key Words:** LEDs, Ultrasonic, Sensors, Parking, Assistance, RFID, Parking zones.

## 1. INTRODUCTION

Parking, being an essential requirement in our day to day life, we look forward to planning and acquiring a secured parking spot before heading out towards our destination in order to reduce the hassle of driving around looking for a parking spot during peak hours. The hassles of finding a parking spot in urban areas is huge and creates a ruckus in the present world:

[1]. With the fast pace development of economy and living standards, the automotive industry and population is becoming more and more demanding. [2]. Finding a vacant space in a multilevel parking lot or on road is difficult now-a-days, especially on weekends or public holidays. A study showed that finding spaces during weekends or public holidays can take more than 20 minutes for about 66% of visitors. Stadiums or shopping malls are crowded at peak periods, and difficulties in finding vacant slots at these places are a major problem for customers. [4]. Therefore, insufficient car park spaces lead to traffic congestion and driving in frustration.

To reduce this, our system with the help of RFID technology and Ultrasonic sensors make the drivers a bit stress free.

Making use of RFID, we are able to increase security and allow only the regular or people who are members of that building. This era being technologically oriented, the traffic is high as everyone owns a car and thereby reducing parking spaces. RFID, thus helps us in reducing that traffic. Now, parking slots must be free to park effectively or the

driver ends up being frustrated and this can lead to accidents. Thus, the use of IR sensors and LEDs help us in acknowledging free slots. After this, for an error or rather safe parking, we have ultrasonic sensors built in the car which detect obstacles and lets the driver know about it using tones for speakers and the driver can avoid those obstacles and park comfortably.

## 2. LITERATURE SURVEY

[1] Hans Chandra, Michael, Kenny Riszky, Handry Santoso, "Smart Parking Management System: An Integration of RFID, ALPR, WSN" : This paper presents a system in which the RFID technology is used which gave us the idea to use it for authentication and reduce congestion in traffic world.

[2] IJCAIT, "Parking System": This paper presents a system in which the parking system can be made easy. But lacks an idea of how it can be made economically feasible and our system found that using Arduino and other things, it can be made feasible for every common man.

[3] Wan-Joo Park, Byung-Sung Kim, Dong-Eun Seo, Dong-Suk Kim and Kwae-Hi Lee, "Parking Space Detection Using Ultrasonic Sensor in Parking Assistance System": This system provides a good idea in parking safely using obstacle detecting sensor ultrasonic sensor. But there the whole parking system is taken into consideration and this can be proven fatal if the traffic is huge. So, our system helps in parking it once its free and checks the whole system.

[4] Elfes, "Sonar based real-world mapping and navigation" : This method helps in navigating through the gaps and when in between obstacles by constantly checking for obstacles in front by producing sonar waves. This gave our system an idea to introduce ultrasonic sensors on all corners of the cars and keep detecting for obstacles not only during parking but all and let the driver know when the car is prone to accidents with the help of speakers adjusted with tones that can be made different as the distance keeps reducing by interfacing it with arduino microcontroller.

## 3. SYSTEM ANALYSIS

### 3.1.1 Existing System

The cars have sensors in the back and use it for obstacle detection only while reversing. RFID authentication is used in a separate system and LCDs are used to see if slots are available.

### 3.1.2 Proposed System

The system first allows only authenticated users. This is checked using RFID cards. These cards have unique codes in them which is read using a RFID reader and is kept in the beginning and end of the parking space. Then the authenticated cars are allowed inside and can view the LEDs placed on every slots as Red for non-availability and Green for the available slots. The IR sensors placed on all the slots help the LEDs change from Green to Red when a car stops in that slots and parks itself there. Thirdly, the Ultrasonic sensors available in the car, helps in bypassing the obstacles and parking it safely. If any obstacle, the ultrasonic sensor is triggered for some minimum distance and sends a signal to the driver, which in our system is the tones of speakers.

### 3.2 Tools Survey

- 1. RFID MODULE: MF RC522** is used in highly integrated 13.56MHz contactless communication card chip to read and write. The MF RC522 use of advanced modulation and demodulation concept completely integrated in the 13.56MHz all kinds of passive contactless communication methods and protocols. The digital part handles the ISO14443A frames and error detection. In addition, support Quick CRYPTO1 encryption algorithm, the term verification MIFARE series. MFRC522 support MIFARE series of high-speed non-contact communication, two-way data transfer rates up to 424kbit/s. As 13.56MHz highly integrated card reader series chip new family, the MF RC522 MF RC500 MF RC530 there are many similarities, but also have many of the characteristics and differences. Communication between it and the host SPI mode, helps to reduce the connection, reduce PCB board volume and reduce costs.
- 2. ARDUINO UNO:** The Arduino Uno is a microcontroller board based on the ATmega328. Arduino is an open-source hardware. It can be used for many purposes like interfacing with RFID modules, IR sensors and LEDs and ultrasonic sensors.
- 3. ULTRASONIC SENSOR:** This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit.
- 4. IR SENSORS:** This sensor is used as an obstacle detector. This helps in letting us know if any of the slots are empty or not. IR sensors, here, are used in an near-infrared region.
- 5. LEDs and BreadBoards:** A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p-n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is

called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm<sup>2</sup>) and integrated optical components may be used to shape the radiation pattern. A breadboard is a construction base for prototyping of electronics. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design.

- 6. SPEAKER-HxD:** The speaker used here is a passive speaker and is interfaced using an arduino to create tones with multiple frequency.
- 7. DHT-11 SENSOR:** The DHT11 detects water vapor by measuring the electrical resistance between two electrodes. The humidity sensing component is a moisture holding substrate with electrodes applied to the surface. When water vapor is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes. The change in resistance between the two electrodes is proportional to the relative humidity. Higher relative humidity decreases the resistance between the electrodes, while lower relative humidity increases the resistance between the electrodes. The DHT11 measures temperature with a surface mounted NTC temperature sensor (thermistor) built into the unit.
- 8. Servo Motor:** Servos have integrated gears and a shaft that can be precisely controlled. Standard servos allow the shaft to be positioned at various angles, usually between 0 and 180 degrees. Continuous rotation servos allow the rotation of the shaft to be set to various speeds.

### 4. METHODOLOGY

A car enters a parking space. Once it enters the area, the system has a RFID authorization centre, which checks whether the car is allowed inside the space or not. If the access is denied, then the driver is made to go to other parking space and this reduces the traffic and congestions. Once the access is provided, the car enters the actual zone and here the IR sensors interfaced with LEDs let the cars know if any slots are available. If they are available, the car can go to that spot and park without damaging itself with the use of ultrasonic sensors which can detect the obstacles and their corresponding distance.

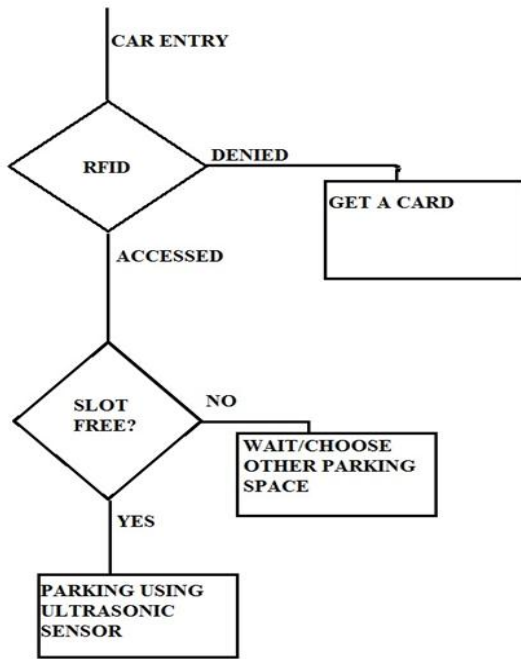


Fig.1. Block Diagram

**4.1. RFID AUTHORIZATION:**

RFID module is interfaced with Arduino Uno board. We give a certain header file called MRFC522.h to the arduino board. This gives us the ability to install all the cards that are needed to be given access to the parking slots. Only when the card is shown to the RFID, the electromagnetic field generated by it is received by the module and checks its access-id. If the access id is the same as written in the code, the access is provided and the servo motor opens up the gate. The servo motor is also interfaced to the same Arduino Board, and the code is written for a 90 degree movement.

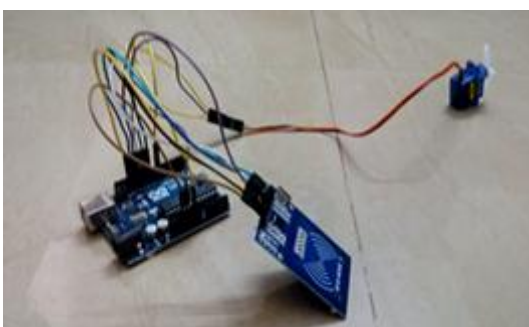


Fig.2. RFID Authorisation

**4.2. SLOT AVAILABILITY**

Once the car enters the parking space after authorization, it checks for a free slot. We have attached IR sensors along with LEDs interfaced with another Arduino board to check whether the slots are free or not. The IR sensors senses any obstacle. If there is any car present on it, then this car becomes an obstacle and is detected by the IR sensor and

the code is so written that if any obstacle is on an IR sensor, then LED would glow RED. If there isn't any car present on the IR sensor, then the LEDs will glow GREEN and this indicates that the slots are free and the cars can use this slot.

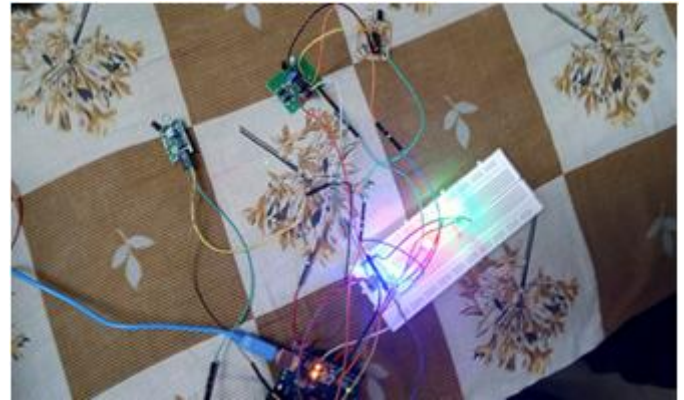


Fig. 3: Slot Availability

**4.3.PARKING ASSISTANCE**

Once the slot becomes available, the car goes to that slot. Here, while parking, the ultrasonic sensors that are built inside the cars, detect the obstacles, if any, by calculating their distance simultaneously. When the distance is very less, here < 15cm, the speaker interfaced along with this sensor to the Arduino Board, buzzes/activates itself and "informs" the driver about this and the driver can easily take suitable steps and park safely. Humidity and temperature sensor is also used to detect the obstacles pretty clearly for safe parking.

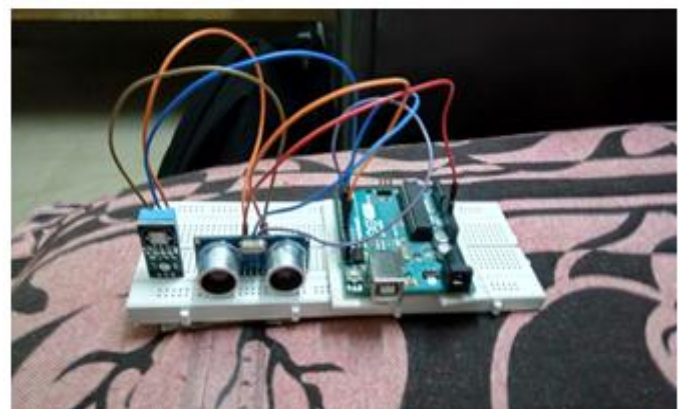


Fig.4: Parking assistance

**5. Results**

The RFID helps in the authorization process and the servo motor helps to open the gate for the cars to enter after the access is provided. The slots are informed to the driver if available using LEDs. After which the ultrasonic sensors are used to safely park the cars with the help of ultrasonic and humidity sensors.



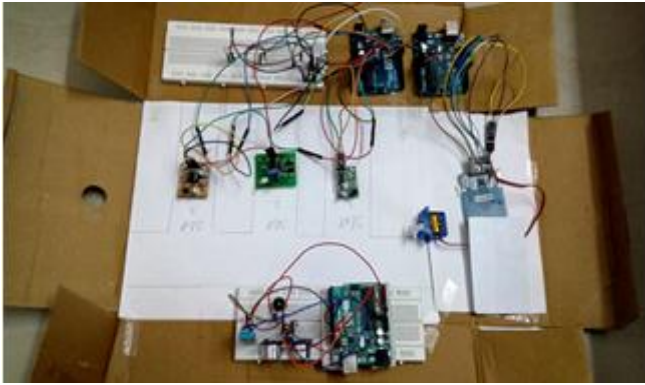


Fig.5: Parking System – Rough Idea

5. sparkfun.com, Ultrasonic sensor, 1st ed. INTERNET: WWW, 2017.
6. circuitbasics.com, DHT-11, 1st ed. INTERNET: WWW, 2017.

## 6. CONCLUSION AND FUTURE WORK

The proposed architecture of monitoring parking space availability system can effectively satisfied the basic requirement of a driver on parking system. The RFID authorisation increases security and reduces congestion. The sensor technology is done by using digital infrared sensor and it plays its role in sensing the presence of vehicles. The LEDs lets us know about the availability of slots and makes it easy to look for free slots. Furthermore, the ultrasonic sensors in the cars can monitor the parking space continuously and the obstacles if any, while parking is updated to the driver with the help of speakers and park comfortably. Therefore, this proposed system can overcome the traffic congestion in finding available parking vacancy. At the same time, it offers time savings and reliability which convince the users all time.

RFID access can be made available using payment system. Servers can be introduced to store the car plates and allow only those cars again and also increase the security. LCD/LED screens can be used to show the availability of slots. Apps can be made so as to enter the parking space easily. Voice modulations can be used to call out car plates, owners and the availability of slots.

## 7. References

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