

# Smart Car Parking System (SPS) with the applications of Intelligent Transportation System

B Suresh, N Venkat Rao, Ram Mohan Rao Papolu



**Abstract:** Intelligent Transportation Systems (ITS) is a modern approach in transportation engineering and management strategies of computer science, electronics and communication as it aims to provide advanced services in various methods of transport and traffic management systems. This helps the users to make safe, smart and efficient transport networks. Intelligent Transportation Systems (ITS) has a very wide application starting from traffic management to driver operation and vehicle control systems. Due to increase in vehicle production and world population leads to demand for more parking spaces and parking facilities. This problem is arising due to gap between demand and supply of parking spaces. The basic focus of this study is how to identify the exact location for parking the vehicle with the help of Arduino IDE software program. It will address the problems effectively associated with identification of parking slots and reaching parking places in urban areas. It informs and guide drivers to find limited number of parking spaces including their price in parking zones with in a shorter duration. Infrared sensors are also used to detect car parking slot occupancy. Smart Parking System (SPS) deals with identification of empty parking space, improper parking of vehicles and show the direction towards vacant parking slots. It also deals with digital payment facility. The ultimate focus of this is to identify the availability or non-availability of parking space.

**Keywords :** Intelligent transportation system, Smart Parking System, Arduino, parking slot.

## I. INTRODUCTION

Intelligent Transportation system (ITS) can help transport planners to reach their objectives in many different ways. It can also help traffic engineers to tackle traffic congestion, air pollution, carbon emission, vehicle collision and reduce journey time by improving safety, speed and reliability to satisfy travelers in all modes of transportation systems like navigation, air transport, water transport and rail transport. Intelligent Transportation system can improve the efficiency of transportation system by minimizing the time required for searching the empty slots for parking.

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\* Correspondence Author

**B Suresh\***, Department of Civil Engineering, Institute of Aeronautical Engineering, Hyderabad, India. Email: [sureshbuyanka@gmail.com](mailto:sureshbuyanka@gmail.com)

**N Venkat Rao**, Department of Civil Engineering, Institute of Aeronautical Engineering, Hyderabad, India. Email: [venkatnimmagadda99@gmail.com](mailto:venkatnimmagadda99@gmail.com)

**Dr. Ram Mohan Rao Papolu**, Department of Civil Engineering, Institute of Aeronautical Engineering, Hyderabad, India. Email: [ramorapa@yahoo.com](mailto:ramorapa@yahoo.com)

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The searching of parking slots burns a lot of barrel every day. The applications in ITS sector play an important role in digital toll collection, Traffic Management Systems, etc. In the application of ITS different type of works related to traffic are performed. A

Few applications are specially designed for long-distance transmission with short-distance communication. The system works on Radio modern transmission to generate computerized information through analyzed and reported data. ITS have active control on vehicle operators, passengers, and pedestrians by interacting with each other in the environment and it also improves the safety and capacity of road network system. Intelligent Transportation system has achieved advanced communication technologies in transportation infrastructure and in vehicles. It has a wide application in wireless and wire line communication with the help of information and electronic technologies for an improved traffic management system by minimize the utilization of transportation infrastructure. This directly enhances the quality of driving experience, safety and capacity of transportation and minimizes traffic congestion, pollution and collision.

(ITS) user services: About 33 user services are adopted by National ITS Program Plan. This service keep on changing by introducing new service at present there are above 33 user services which are categorized into 8 groups. This division is based up on type of organization and technical functions.

- Travel and traffic management

The real-time information of the vehicle is located by this service which improves its efficiency and productivity to detect and mitigate the environmental impacts. This Travel and traffic management service is further classified into 10 different services given as below.

- Pre-trip information
- En-route driver information
- Route guidance
- Ride matching and reservation,
- Traveler Services Information,
- Traffic Control,
- Incident Management,
- Travel Demand Management,
- Emissions Testing and Mitigation, and
- Highway Rail Intersection
- Public Transportation Management



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This service mainly involved in collection of vehicle data through advanced communications and information systems. To improve the operations of vehicles facilities and automate the planning and management functions.

- Electronic payment

This electronic payment user service allows the traveller and owners of vehicle to pay digital mode of payment for various transportation systems based upon their functions. Few electronic payment services are like Toll collection, paid parking and so on are linked through a multi-modal electronic payment and multi-use electronic payment system

- Commercial Vehicle operations

This main function of this service is to increase the efficiency and safety of travelers. It includes the services like CV electronic clearance, automated road side safety inspection, Hazardous material incident response, Freight Mobility and so on

- Advanced vehicle control and safety systems

The main purpose of this service is to improve the safety of transportation system and to maintain drivers' abilities to control the vehicle by enhancing the crash avoidance capabilities. This Advanced vehicle control and safety user service system contain the following services like longitudinal and lateral collision, intersection collision and vision enhancement for crash avoidances along with safety readiness, pre-crash restraint deployment and automated vehicle operations.

- Emergency management

This system performs two major functions. The primary function is on Emergency notification with personal security and secondary function is on Emergency vehicle management.

- Information management

This service will provide a huge quantity of data using various ITS technologies.

- Maintenance and construction management

Maintenance and construction management provides information for successful and safe road operations

## II. MATERIALS USED

### A. Arduino Boards

Arduino board is a well-known platform. It became very famous with designers and students for designing electronic products it has of a microcontroller and Integrated Development Environment (IDE) used to make electronics projects. It is used in writing and uploading computer code to the physical board. To develop any program with new code on to the board Arduino doesn't required any separate hardware it is accomplished with the help of USB cable. Arduino boards are used in most of the engineering projects. The Arduino software is a user friendly and easy to use it runs for windows, Linux and Mac the principles of physics and chemistry can be verified by students and engineers by utilizing it as low cost scientific instruments to design. Arduino can simplify the working process of microcontroller. Different types of Arduino boards

- Arduino Uno (R3)
- LilyPad Arduino
- Red Board
- Arduino Mega (R3)
- Arduino Leonardo

**Table- I: Features of Arduino boards**

Arduino Board	Processor	Memory	Digital I/O	Analogue I/O
Arduino Uno	16Mhz ATmega 328	2KB SRAM, 32KB flash	14	6 input, 0 output
Arduino Due	84MHz AT91S AM3X8E	96KB SRAM, 512KB flash	54	12 input, 2 output
Arduino Mega	16MHz ATmega 2560	8KB SRAM, 256KB flash	54	16 input, 0 output
Arduino Leonardo	16MHz ATmega32u4	2.5KB SRAM, 32KB flash	20	12 input, 0 output

### B. Sensor-Based Method

There are different types of sensors are available to detect the appropriate system to perform the task of parking. This sensor based detection method use sensors to detect vacant space available in parking slot. There are various factors involved in choosing proper sensor based on size, reliability, and adaptability to environment changes. The sensors are categorized into intrusive sensor and non-intrusive sensor.

Intrusive sensors are placed directly on the surface of the pavement by digging and tunneling of pavements where they are to be placed.

Non-intrusive sensors are directly placed or fixed on ground surface. Ultrasonic sensors are non-instructive sensors and involve simple installation process compared to intrusive sensors. Ultrasonic sensors are used in counting vehicles and occupancy status of parking slots. Ultrasonic sensors also have some disadvantages as they cannot detect during extreme air turbulence and temperature changes. IR sensor transmits sound waves between 25 kHz and 50 kHz with the help of reflected energy. Slots for parking space can be identified

### C. IR SENSOR

Infrared sensors are categorized into passive sensors and active sensors. Passive IR sensors are also called Infrared detectors they don't use any infrared source but they detect energy emitted by an obstacles in the field.

Passive sensors are again made into Quantum IR sensors and Thermal IR sensors. Thermal IR sensors are independent of wave length and they use infrared energy as the source of heat.

Quantum type infrared detectors are faster than thermal type infrared detector and they depend on wave length and they have higher detection performance. Active IR sensors consist of two elements they are IR source and IR detector.

In Infrared source the energy emitted by IR source will be reflected by an object and falls on IR detectors of LED or infrared laser diode

**D. EXPERIMENTAL PROCEDURE**

The program has been developed based on C-language the basic aim of this program is to identify vacant or occupied car parking slots when a car comes to the entry of the parking place with the help of the sensors red light or green light will glow, red light indicates no vacancy for parking and green light indicates the availability of space for parking on which the experiment was conducted below

Table- II: Program developed in C- language for Arduino

```

int LED = 11; // Use the onboard Uno LED
int ir = 7; // This is our input pin
int L=10;
void setup() {
  pinMode(LED, OUTPUT);
  pinMode(ir, INPUT);
  pinMode(L,OUTPUT);
  Serial.begin(9600);
}
void loop() {
  int hasir = digitalRead(ir); //Reads the output of the obstacle sensor
  from the 7th PIN of the Digital section of the arduino
  if (hasir== HIGH) //LOW means something is ahead, so illuminates
  the 13th Port connected LED
  {
    Serial.println("Stop something is ahead!");
    digitalWrite(LED, HIGH); //Illuminates the 13th Port LED
    digitalWrite(L,LOW);
  }
  else
  {
    Serial.println("Path is clear");
    digitalWrite(LED, LOW);
    digitalWrite(L,HIGH);
  }
}
}

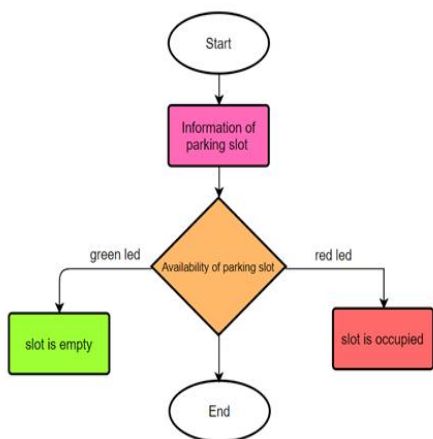
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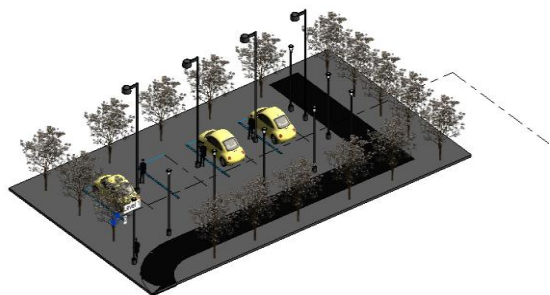
**Fig. 3. Working model representing parking slot is occupied**



**Fig. 4. Working model representing parking slot is available**



**Fig. 1. Flow diagram on parking slots available or occupied**



**Fig. 2. Car parking slots available and occupied by CAD drawing**

**III. RESULTS OF THE EXPERIMENT**

The ultimate focus of Smart Parking System (SPS) is identification of parking slots. The working model consists of one parking area with four parking slots namely 1 2 3 and 4. However the sensor is installed in slot number 4 to perform the physical investigation. It was achieved by observing the number of parking slots available and non-available.

Here the observations were divided into two events. Event A and Event B

Event A: It focuses on car not in the parking slot (parking space is available)

Event B: It focus on car in the parking slot (parking space not available)

As long as the slot is vacant the glowing of green colour led light will continues and once the slot is occupied glowing of red colour led light will continues.

Table-III Results and Observations

Events	Observation made	Indication from sensor
Event A	Car not in the parking slots	Green led (parking space available)
Event B	Car in the parking slot	Red Led (parking space not available)

**IV. CONCLUSION**

• From this research study it has been identified that a driver can easily locate the parking space in an unfamiliar city with help of intelligent transformation system.





# Smart Car Parking System (SPS) with the applications of Intelligent Transportation System

- The system can save much time by reducing waiting time of the driver.
- The test results obtained Using Arduino effectively satisfied and addressed the problems associated with car parking by minimizing the time to locate parking slot and reaching parking space.
- It has been proved the method is efficient and economical.
- A driver can easily park the car when he enters the parking area in the nearest empty slot by observing the glowing green colour led light and stops entering the parking area by observing the red colour led light which reduces the unnecessary travelling of car across the parking slots.
- As ITS has been a hot spot area of research in transportation Engineering in the present scenario this area of research will give an ample scope for new innovations and developments in future course of time

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## AUTHORS PROFILE



**B Suresh**, working as Assistant professor in Department of Civil Engineering at Institute of Aeronautical Engineering Hyderabad. He obtained his master's degree in Transportation Engineering from JNTU, Hyderabad. He published more than 10 international journals and attended two international conferences. His area of research pavement materials, Design of traffic signals and pavement design



**N Venkat Rao**, working as Associate professor in the Department of Civil Engineering at Institute of Aeronautical Engineering, Hyderabad. He obtained master's degree from JNTUH, Hyderabad and published more than 30 international and national journals and also a member of MISTE. His area of research is material, concrete and special concrete



**Dr Ram Mohan Rao Papolu**, working as Professor and Head of Civil engineering Department at Institute of Aeronautical Engineering, Hyderabad. He obtained PhD degree from Sri Venkateshwara University, Thirupathi in 1993, M.Tech from Mangalore University in 1986. He published more than 30 international and national journals and also a member of various professional bodies FIE, MISTE, ISNT, ASCE(I), MISCEE. His area of research in Fluid mechanics water resource engineering and hydraulics.