

Arduino based Automatic Parking Slot Detection

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Abstract

The automated parking slot detection system not only finds the empty slot in the parking lot but also exactly denotes the location of the slot in the parking lot. This system uses an arduino to receive the necessary information from the infrared proximity sensor which is placed at the parking slots which detects the presence of the car and if the vehicle is present at the designated slot then the LED at the parking slot will be red and if the slot is absent then the LED at the slot would be green. The arduino is to receive, process and transmit the data accordingly. The automation system we use here is a further improvement on the already existing system which only denotes the number of empty slots available in a particular parking lot where as this additional guidance system to the empty slots is a value addition to this particular system.

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1. Introduction

This automated parking slot detection system locates the empty spots in a parking lot and helps manage the traffic more effectively by reducing the time taken to find an empty parking spot. This reduces the human intervention into the parking system and thus reducing the cost of running for the parking management system. In this project we use an Arduino which is a single board microcontroller to collect the data from the available Infra-red Proximity Sensors and to process the information to find the exact location of the available empty parking slot. The empty slots can be located by the use of LEDs, RED for occupied parking slot, GREEN for empty parking slots. In order to receive the signals from the proximity sensors and to relay the light to be switched on at the parking slot which is either red or green based on the availability of the slot. This system can be used in all the parking lots to make it efficient and to be able to manage the increasing demand for parking seamlessly. It removes the involvement of human beings in directing people to available parking slots. It makes the system faster and flawless.

2. Objective

Global wastage of fossil fuels is relatively high compared to all the other time we can cut them back through the automation of a parking system where the car driver knows the occupancy of the parking slots and the exact location of the available free parking slot. Thus, cutting down the time where the driver has to go through all the slot before going to the empty slot saves much more fuel than manually finding a parking slot.

3. Literature Survey

[1]Ashraf Minhaj, "Arduino Automated Car Parking", National level hackathon for global warming, 2018.

In this specific project the arduino uses the infrared proximity sensors and displays on a board which of the particular parking slots are empty and it also uses a motor to open the gate if any of the slots are empty and shows on a board which of the following slots are empty and the number of slots that are empty.

[2]Pothana.Siva Naga Mani, Vaseem Ahmed Quersh, R.Venkatesh,, "Sensor Based Automated Parking

System for Slot Tracking”, Technology to reduce traffic problems , 2015.

The paper mentioned here finds the presence of an empty space automatically, using sensors. This IoT based project is just a prototype of the implementation methods which can be utilised with further changes and modifications in order to use it in real time scenarios. This helps in removal of human intervention into the parking system and makes the process automated thus helping reducing the operational costs and additional labour workforce on the ground. It works on a single slot with individual sensors to each.

[3]Ganesh Sharma, Nigidita Pradhan, “Design and Development of Automated Parking Slot”, Sikkim Manipal Institute of Technology, 2014.

This paper citation mentioned above works on a system which is divided into 3 separate stages where in the first stage detects the empty parking slot, The second stage identifies the kind of reservation(if any) to the parking slot. Lastly, it identifies the dimensions of the slot there by checking what class of vehicle is best suited for the slot. This system works with Ultraviolet sensors to detect the presence of a vehicle which makes the system secure and reliable.

[4]Smart Car Parking System using Arduino UNO, Suvarna Nandyal,Sabiya Sultana,Sadaf Anjum,PDA College of Engineering Gulbarga, India

This paper mentioned above, cites the development of smart cities during which the development of smart parking was widely initiated. This project makes use a sensor, controller circuit which is placed on the site. The IoT model presented here has a sensor initialised at every single parking slot, and it is used to model , screen and control the inflow of the traffic for parking based on the available parking slots. The end of the system also idealises a parking system with zero or close to zero human intervention in the complete system. The paper also tests the working of the proposed model above towards the end.

[5]Applying Arduino For Controlling Car Parking System,kusay F, Sadeer D.

In cities that large with heavy vehicular traffic, parking is an issue which never seems to be able to be solved .The availability of parking may be used by a part of the vehicles and the remaining may have to park else where. To avoid this problem a system is proposed where it specifically makes parking simpler and removes all kinds of labour and human intervention in parking. The above mentioned system can be utilised in heavy industries, shopping malls and can increase the quality of the parking slots.

[6]Arduino Smart Parking Manage System based on Ultrasonic Internet of Things (IoT) Technologies Maher Hassan Kadhim, Department of Computer Science, Karbala University.

The Internet of things plays a major role in the automation of certain things in the present day industry. The above mentioned study makes use of an arduino based sensor circuit and an application for

mobiles on the front end. The system maps the parking lot on to the device application and the user can find the nearest parking slot. This application can also help in effectively managing the incoming traffic based on the availability of the empty slots. this application which stores the location of the car also helps the driver know about the location of where his vehicle is parked. This system utilises a different signal system.

[7]Automatic Valet Parking Using Arduino Uno, Nirmalk Thomas, Nithin Johny, Sivalakshmi M, Roshan Raju, Nirmalk Thomas Int. Journal of Engineering Research and Application

Parking having gained recognition to be one of the most difficult tasks driving only makes it harder with external human intervention which may distract the driver. This system automates the entire parking process which makes the whole system easier for the driver for parking. The study makes use of a platform where [1] detection of available slots for parking [2] an automatic parking assistance system which gives the drive precise directions to park. The project in development makes use of of a circuit with sensor for detection and actuators for direction based on an Arduino uno board.

[8]Smart Parking System using IoT ElakyaR,Juhi Seth, Pola Ashritha, R Namith, International Journal of Engineering and Advanced Technology. The main problem faced in huge metropolitan cities is the road congestion caused by cars parked haphazardly .the proposed system helps in connecting wirelessly to the parking lot and keeping a track of the available open parking slots .The steady increase of the vehicle population in the metro cities makes it easier for the user to prebook the parking slot using this wireless function which can be adopted into the system. The driver usually wastes a lot of time and effort in searching for the right parking spot in a parking lot the future implementations is the ability for the system to notify the parking details via SMS. The RFID tags can also be read inorder to safeguard the vehicles from theft.

[9]Iot Based Vehicle Parking Place Detection Using Arduino, Yuvaraju. M*, Monika. M,Anna university, Chennai.

Vehicle parking being the hardest and the most time consuming part of one's day to day life is eliminated in the above study. The implementation of the system is through the presence of ultraviolet sensors which are controlled by an arduino uno board and uses a GSM module to upload the same data of the slot availability to the cloud from which the driver can retrieve the necessary data from the cloud and utilise the parking system. The arduino also keeps a track of the number of vehicles in the parking lot at all times in order to calculate the traffic inflow and outflow.

[10]Arduino Based Smart Parking System Mr. Kush Shah, Ms. Priya Chaudhari, SVIT Vasad, Gujarat, India.

“Creativity is inventing, experimenting, growing, taking risks, breaking rules, making mistakes and having fun.” Quoted by Mary Lou Cook, was the encouragement for the above citation to develop an automated parking slot detection. The open sourced controller ARDUINO is used to design and build this system thus making it easier for the driver to utilise the system and drive straight to the available parking slots without any effort or time put into the process of looking through the lot and driving which costed a lot of time, money and fuel to go waste. The above devised system marks individual empty slots with certain Infrared sensors.

4. Demonstration Methodology

Empty slot detection

The arduino board which is used for communication between the various physical components of hardware connected to the various ports of it through digital or analog means. The arduino board runs the data(signals) which processes the signals based on the algorithm mentioned below, which in turn uses the LEDs to show the occupancy. Since, digital signals are either high or low, The processing of these signals become binary during implementation. If the slot is empty the Infrared proximity sensor returns a low digital signal and if the slot is occupied the Infrared proximity sensors return a high digital signal.

Processing the data in the arduino

The arduino which processes these signals provided to it processes the signals based on the designed algorithm, where in , if the sensor provides a HIGH signal then, it implies the slot is occupied and the red LED is turned on. If the sensor provides a LOW signal, then it implies that slot is empty and the green LED is turned on.

5. Implementation Methodology

Hardware requirements

1. Arduino Uno-The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. 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 I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by the 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.[5][6] The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website.

2.Infrared proximity sensors- A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive proximity sensor or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target.

3. LED bulbs For the indication of the occupancy of the parking slot.

The hardware setup

The setup and the wiring of the infra-red proximity sensors, LEDs, and the arduino is shown below. The proximity sensors are connected to the 5V output of the arduino and the digital ports , Green LEDs to the digital ports and the red LEDs are connected to the analog ports.

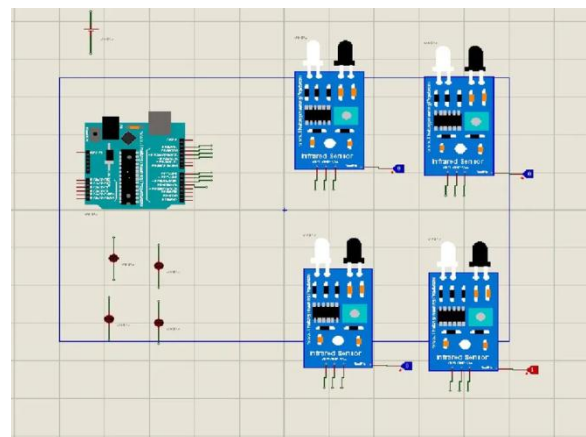


Figure 1: The complete circuit diagram of the implementation.(Please note the circuit is grounded through the ground ports on the port)

Working of the infrared proximity sensors

Proximity Sensors are used to detect objects and obstacles in front of the sensor. Sensor keeps transmitting infrared light and when any object comes near, it is detected by the sensor by monitoring the reflected light from the object. The obstacle must be present within 2 metres range from the proximity sensor.

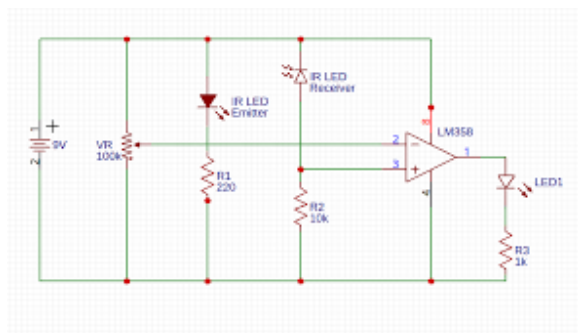


Figure 2: The working of the infrared proximity sensors.

The algorithm used

```

1.Start
2.While(true)
for(i:sensorNumber1 to sensorNumber5)
if(sensorNumber(i) == HIGH)
greenLED(Low);
Else
redLED(high);
3.Stop

```

Flowchart for the sensing of occupancy

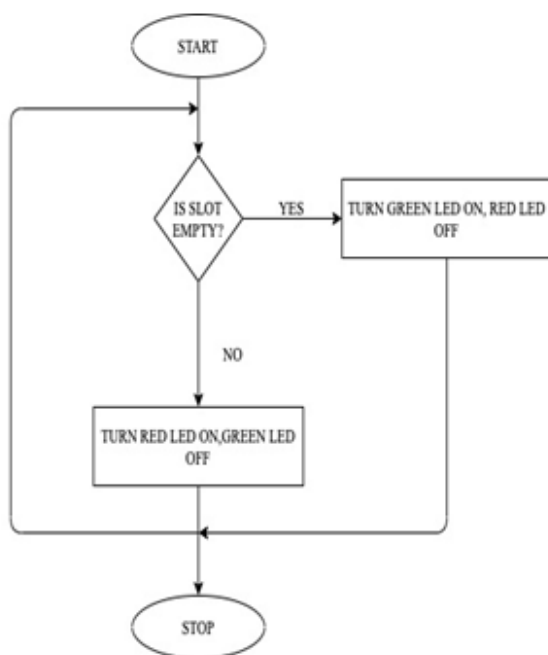


Figure 3: The flowchart showing the flow of signals through the circuit

6. Results

After connecting the circuit as shown in the figure (refer fig 1) above and providing the connected circuit with a power with 5V capacity. At first the green LEDs remain switched off (fig. 4), When an obstacle is brought close to the IR proximity sensor the respective green LED switches off and the red LED switches on for the respective sensor. The sensor output data is recorded and shown below(Fig 5).The

illustrations given below is from the test conducted on successful completion of the setup.

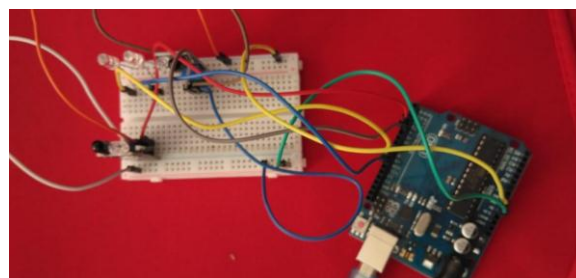


Figure 4: LEDs in the switched off state

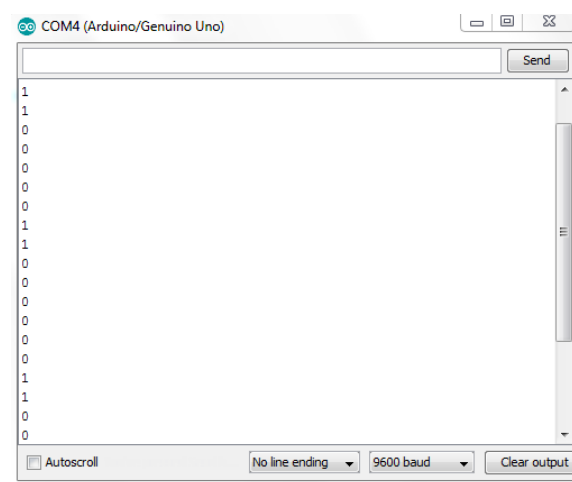


Figure 5: Showing the outputs of the IR Sensor 1

7. Conclusion

The automated parking slot detection system, as the title describes the problem, the development of this system removes the human intervention into this process and thus making it a much more efficient way to handle the inward traffic. This system also shows the exact location of the available empty slots which is currently not available in the system which was already available. The LED indication also makes it clearer for the user to understand the slot availability.

8. Future Enhancements

As previously mentioned, the main purpose of this IoT project was to reduce the wastage of the fuel in a place which could be easily avoided. Hence, the large scale implementation of this project along with an android ,iOS application for increased usability of the system can be utilised. The application can give us first hand information about the availability of the slot. It can also help determine the traffic patterns based on which the drive out counters can be kept high or low in number.

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