Smart Parking Using IoT

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Abstract

The world's population is rapidly increasing at a rate of 1.09 percent per year, resulting in a slew of issues that have a negative impact on our civilization. In the recent decade, most urban areas have seen a substantial increase in automotive ownership. These issues are not only a personal issue, but also a global issue encompassing air pollution, traffic congestion, and the waste of natural resources like petroleum and, most crucially, time. Finding a parking spot for their vehicle in congested areas might be tough. This Smart parking system proposal incorporates an onsite Internet of Things (IoT) module that offers real-time data and tracks vehicle flow into and out of the parking lot. The algorithm finds the most suitable parking location. The goal of this project, Smart parking system with IoT and disciplined parking mechanism, is to shorten the time it takes to find a parking spot for your car. This approach can be used to find out about available parking spots. The algorithm generates the best parking spot solution. This approach can be used to determine the available parking space. This project also includes a method to assist drivers in parking their vehicles in a disciplined manner. This project also includes a method to assist drivers in parking their vehicles in a disciplined manner.

Keywords – Arduino, ultrasonic sensor, cloud server, IoT.

1. INTRODUCTION

The vehicle business has seen a phenomenal increase in production in today's world's rising civilization. Finding parking spots for vehicles has become a difficult undertaking as a result of traffic congestion. The IoT-enabled Disciplined parking system with smart parking system is an automated system that allows a user to locate an available parking spot. This will allow the user to quickly locate a parking spot without having to seek for one because the user will be aware of each status of the parking spot in a large parking spot. This method is intended for mall parking lots, as well as ordinary public parking lots in metropolitan areas. This automated system uses ultrasonic sensors to determine the availability of an open place.

Device with ultrasonic sensors **Cloud Server** **Web Application**

Fig (1): Working model of Smart Parking Using IoT

As an illustration of this pattern, we'll build a smart parking system. The graphic shows a higher-level view of every component that make up this system. Arduino device is the first component that checks the state of parking spots using an ultrasonic sensor and communicates the data to a server via an HTTP request. The second component is a server with services for storing parking spot data and an interface service that displays the number of available parking spots.

We can revolutionise the way we find a parking spot for our cars by utilising Internet of Things technologies and web applications. This relieves stress on the driver while also saving time. Smart City Development can benefit from this type of parking place help solution. Before we started working on this project, we conducted a poll to get information from people who drive on a regular basis about the challenges they have when it comes to parking their cars.

The Internet of Things (IoT) is a network in which all physical items are connected to the internet and exchange data via network devices or routers. IoT systems can be set to respond to predetermined conditions. It has become a popular tool for smart city upgrades. As a result, the project employs IoT, in which sensor data is uploaded to the cloud. This information is made available to consumers via a web application, allowing them to pre-book a parking spot or locate an empty one. The back end of this web application is written in Java script, while the front end is written in HTML.

The survey's primary questions were:

1. How often did they encounter difficulty while parking?
2. Major problems that users have when trying to get a parking spot
3. Would the users use an application to help them with parking?

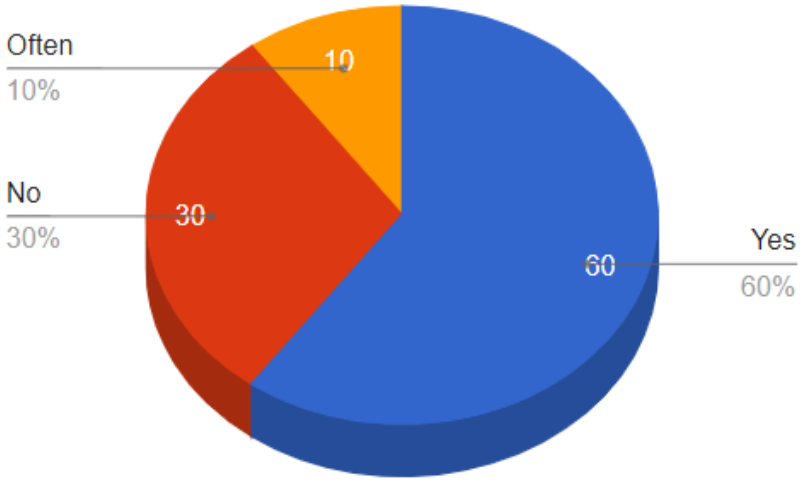

Fig (2): Pie chart shoes about the survey taken

2. LITERATURE SURVEY

Smart Parking systems gather the necessary information about the available parking space in a user's nearby area and process it in real-time to arrange vehicles in those slots. It involves the use of less expensive sensors, real-time data collection, and a web application that allows people to park and accurately estimate where the user can find the spot. [1]

Infrared Radiation (IR) sensor and Internet of Things technology are integrated into a smart car parking system (IoT). It allows the user to locate the nearest parking spot and displays the number of available spaces in the closest parking zone.[2]

Smart parking system minimises the emissions of C02 by removing the necessity for the people to look for a parking area in a crowded place. It also enables better management of parking spaces. Smart parking addresses one of the most challenging parts of city driving: finding open parking spaces and avoiding illegal parking. Three modules make up the Smart Parking System: monitoring, control, and a display unit.[3]

In addition to the aforementioned three modules, it will contain a centralised system that will maintain a parking space database as well as an SMS gateway. The ultrasonic sensors detect available parking spaces and

provide the information to the control unit. The sensor not only recognises the vehicle but also provides information such as the amount of time it has been parked.[4]

Smart City Application: The Operating systems such as iOS and android Smart Parking System makes use of a wireless sensor nodes to gather data from various locations. Sensors exchange information and receive data from their surroundings. The information gathered from the environment is sent to the network environment.[5]

The control units process the information before sending it to the central supervisory system. The controller uses UDP to communicate with the centralised supervisory system about available parking spaces. It then sends information to the user's phone, such as the allotted parking place, the amount of time spent parked, and directions [6].

Smart City Application: The Operating systems such as iOS and android Smart Parking System makes use of a wireless sensor nodes to gather data from various locations. Sensors exchange information and receive data from their surroundings. The information gathered from the environment is sent to the network environment.[7]

The project's goal is to create a cutting-edge smart parking system using IoT technologies. The gadgets can be turned on and off remotely using a mobile smartphone (Wi-Fi). In the realm of electronics, automation is the most commonly misspelt term. The desire for automation prompted numerous technological revolutions. Because of its user-friendliness, these were given greater weight than other technologies. These can be used to replace old switches in the home that cause sparks and, in some cases, fires. An innovative automated system was designed to monitor the state of parking places, taking into account the benefits of Wi-Fi. Wi-Fi (short for Wireless Fidelity) is a wireless technology that transmits data across the air using radio frequency. [8]

3. METHODOLOGY

The following stages will help you understand how the web application works in its entirety:

Step 1: It's critical to know the customer's information before offering any service, both for security and to identify the vehicle's owner. For booking purposes, the user's credentials are entered. The user's name and phone number are included in the credentials.

Step 2: This is one of the most important processes in the web application's back end. The user will get access to the parking layout as well as real-time information on available places. If an empty parking place disappears. The user will receive an automatic message directing them to the nearby parking space with an empty spot.

Step 3: If a slot for the user's vehicle is open, a screen appears for booking, it allows the user to select a nearby location. that is convenient for them and book it. When a parking spot for a car is reserved, an automatic timer begins to calculate the length of time the vehicle will be parked**.**

Step 4: When a customer decides to leave the parking lot, the amount of time they parked their car is noted, and generation of a bill takes place, which has to be paid when the customer leaves.

Step 5: When the user wants to leave after the car is parked, an online payment site is opened, allowing the user to pay for the time they spent in the space using various online payable method.

The complete working and methodology of Three steps are:

1. The Circuit connection and hardware implementation.

2. The Software part including Algorithm and code analysis.

3. The disciplined parking mechanism.

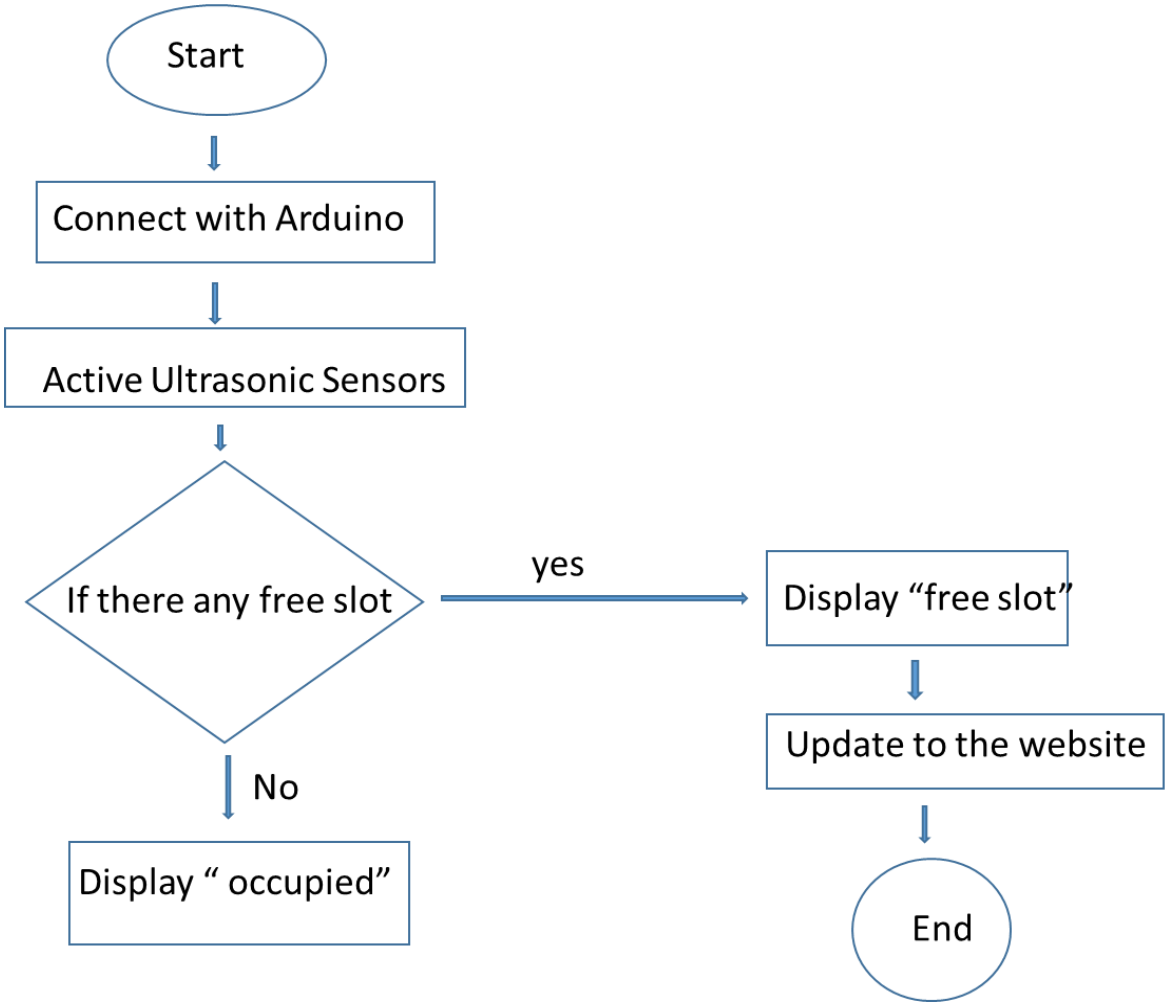

Fig (4): This flowchart shows how the smart parking system works

4. SYSTEM REQUIREMETS

Hardware Requirements:

- **Ultrasonic Range meter (HC-SR04)**: The HC-SR04 Ultrasonic Distance Sensor is made up of two ultrasonic transducers at its heart. The one serves as a transmitter, converting electrical signals into ultrasonic sound pulses at a frequency of 40 KHz. The transmitted pulses are detected by the receiver.

If it receives them, it generates an output pulse whose width can be used to calculate the pulse's travel distance.

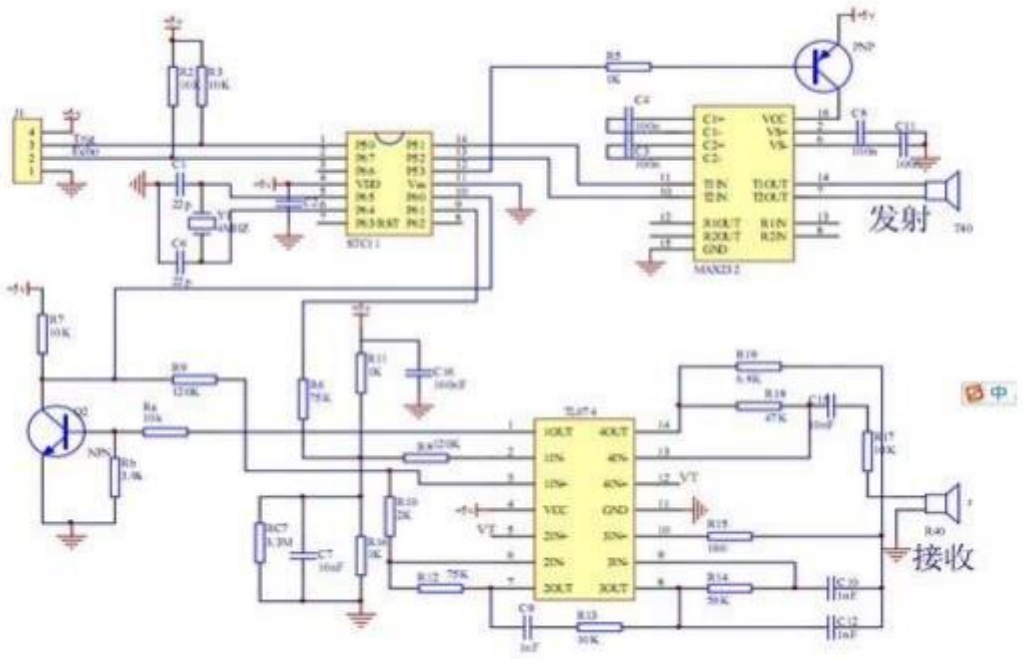

Fig (5): Internal circuit of ultrasonic sensor

The pin specifications of the HC-SR04 ultrasonic sensor:

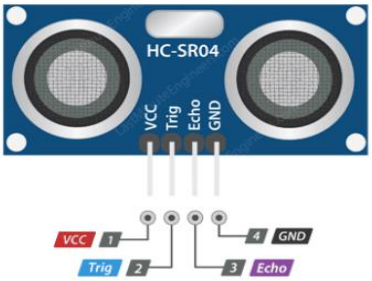

Fig (6): Pin Specification

- **Node MCU ESP 8266**: The Node Micro Controller Unit (MCU) is an open source, interactive, programmable, low-cost, smart Wi-Fi enabled gadget. The Node MCU's primary features are given below. When a pulse of at least 10 S (10 microseconds) is applied to the Trigger pin, everything begins. The sensor responds by emitting an eight-pulse sound burst at 40 KHz. This 8-pulse pattern distinguishes the device's "ultrasonic signature," allowing the receiver to distinguish the transmitted pattern from ambient ultrasonic noise.

- **LCD Display:** An LCD character display is a special form of display that can only display single ASCII characters of a specific size. We can create a text using these individual characters.

When we look at the display more closely, we can see little rectangular sections made up of a 588-pixel grid. We can construct characters within each grid since each pixel can light up individually.

The size of the LCD is determined by the number of rectangular regions. The 162 LCD is the most popular, with two rows of 16 rectangular regions or characters. There are various sizes, such as 161, 164, and 204, but they all operate on the same concept. These LCDs can also have a variety of backdrop and text colours.

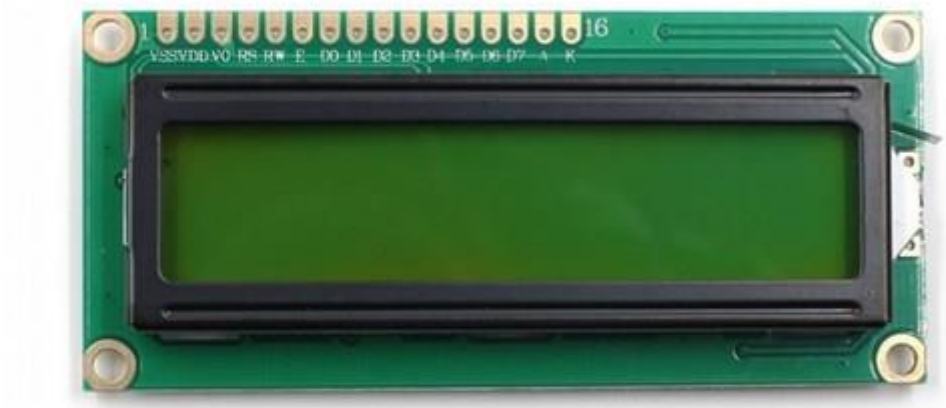

Fig (7): LCD Display

- **I2C module:** I2C is a single-ended, synchronous, multi slave, multi master packet switched serial bus. Multiple chips can be connected to the same bus, for example. Serial Data Line (SDA) and Serial Clock Line (SCL), both bidirectional open collector or open drain lines, are pulled up with resistors in I2C.
- **Puff Board:** This is a simple circuit that allows you to turn off the glowing LED with a puff. To detect your puff, a condenser mic (M1) is employed. When the push button S1 is pressed, the latching pair of transistors Q2 and Q3 are triggered, causing the LED to illuminate. The LED is still in this state. The sound pressure is turned into a voltage signal at the condenser mic's output when you puff on it. The transistor Q1 will amplify this voltage signal. Because the Q1's collector is connected to the latching

pair's emitter, the pair will stop conducting when a signal from the condenser mic is detected due to puffing, and the LED will turn off.

- **Jumper Cables:** Jumper cables, also known as booster cables or jump leads, are a pair of insulated wires with alligator clips on either end that are used to connect the malfunctioning equipment/vehicle to an auxiliary source, such as another vehicle or equipment with the same system voltage or a different battery.

Software Requirements:

- **Arduino IDE**: The Arduino Software (IDE) includes a text editor for writing code, a message box, a text console, a toolbar with buttons for basic functions, and a series of menus. It communicates with the Arduino hardware and uploads applications to it.

Sketches are projects created with the Arduino that are written in a stripped-down version of C++ (a lot of C++ features are not provided). There are a number of device-specific libraries (e.g., changing pin modes, output data on pins, reading analogue values, and timers) since programming a microcontroller differs from programming a computer. Users who believe Arduino is programmed in an "Arduino language" may be confused by this. The Arduino, on the other hand, is written in C++. It simply makes use of device-specific libraries.

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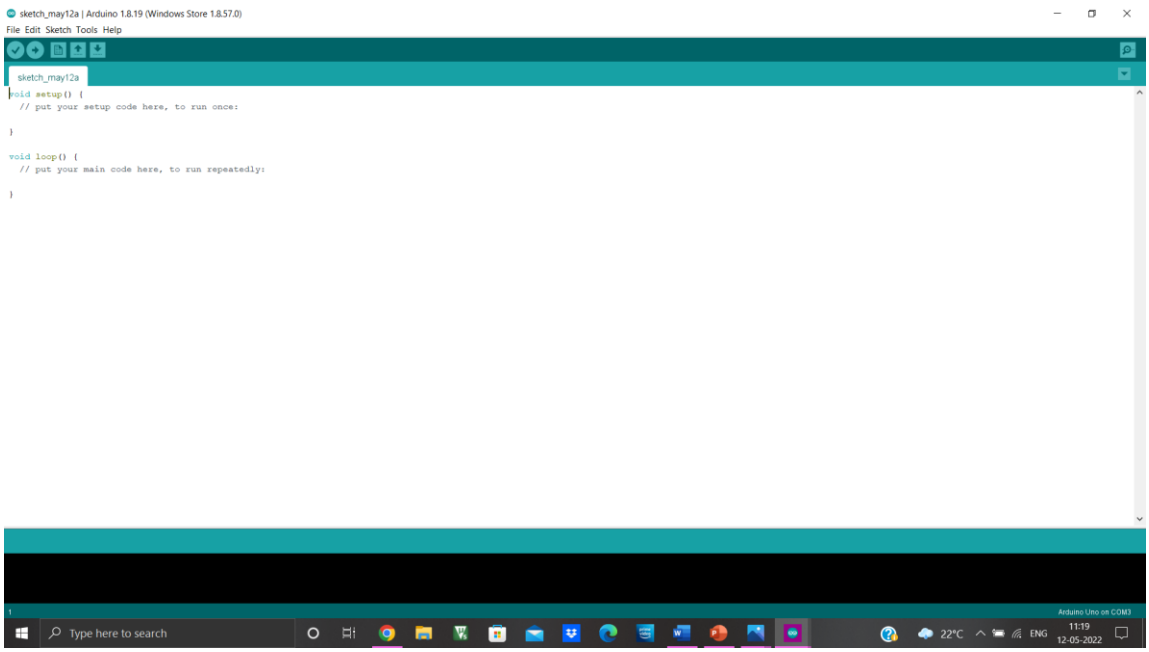


Fig (8): Arduino IDE platform

- **Thing Speak Cloud Platform:** ThingSpeakTM is a cloud-based IoT analytics tool that lets you aggregate, visualize, and analyses live data streams. ThingSpeak delivers real-time representations of data sent to the platform by your devices.

  Key Features of ThingSpeak:

  ThingSpeak is a cloud-based service that allows you to gather, visualize, and analyses live data streams. ThingSpeak has a number of significant features, including the capacity to:

- Configure popular IoT protocols to deliver data to ThingSpeak with ease.
- Real-time visualization of sensor data
- On-demand data aggregation from third-party sources.
- Make sense of your IoT data with the help of MATLAB.
- Automate your IoT analytics based on schedules or occurrences.
- Create IoT systems without having to set up servers or write web software.
- Use third-party services like Twilio® or Twitter® to automatically act on your data and communicate.

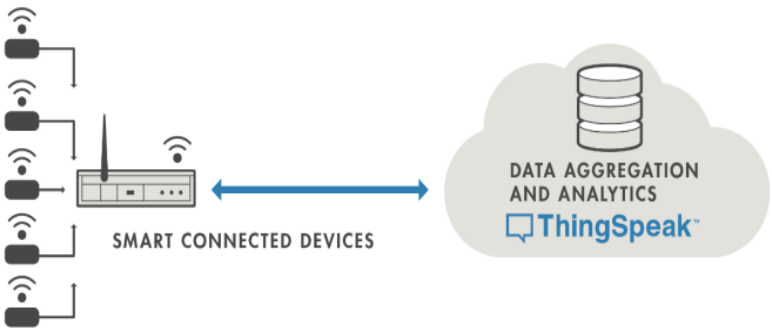


Fig (9): ThingSpeak Cloud Platform

5. SYSTEM ARCHITECTURE

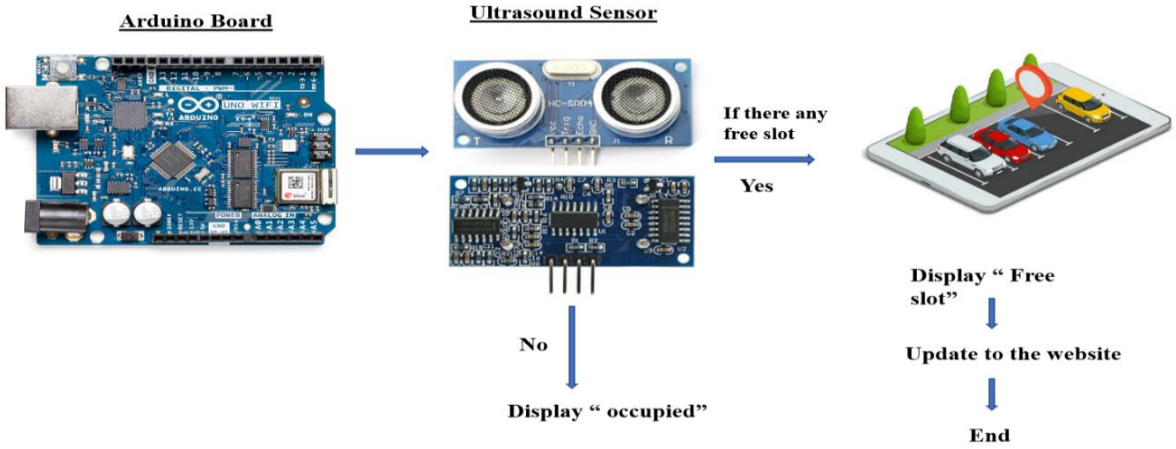


Fig (10)

6. HARDWARE IMPLEMENTATION

PINS: Vcc, Trig, Echo, and Ground are the four terminals on the HC-SR04.

Each of these terminals have a special purpose. The Vcc terminal is used to provide power for the sensor so that it can function like it is programmed to. The ground terminal provides the necessary ground connection required for the circuit. The input pin is connected to trigger ((Trig) which is used to start a measurement by emitting ultrasonic pulses for 10 seconds. Finally, the echo pin is an output pin that is set to go high for a selected amount of time, which is equal to the amount of time it takes for the wave to return to bounce back and return to the sensor.

7. RESULT AND ANALASIS

Formula to calculate the distance: Distance = Duration*0.034/2.

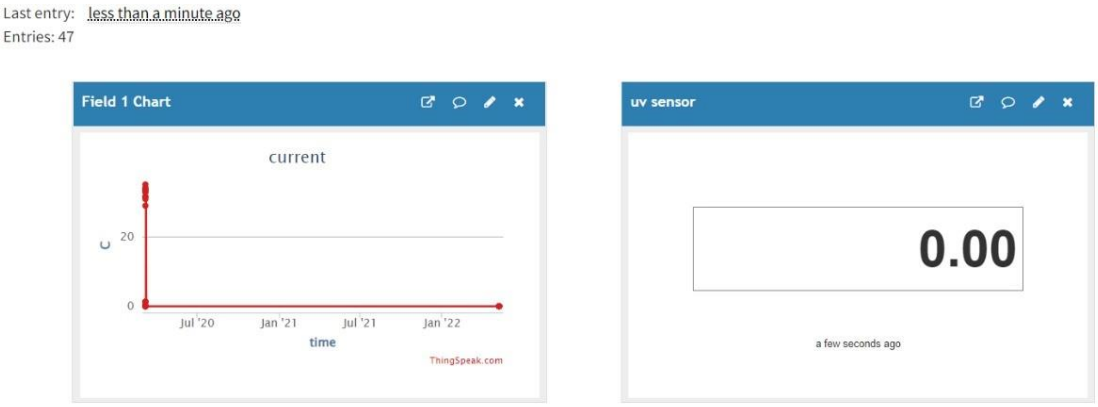


Fig (11): output shows that the object is not detected and the parking spot is empty

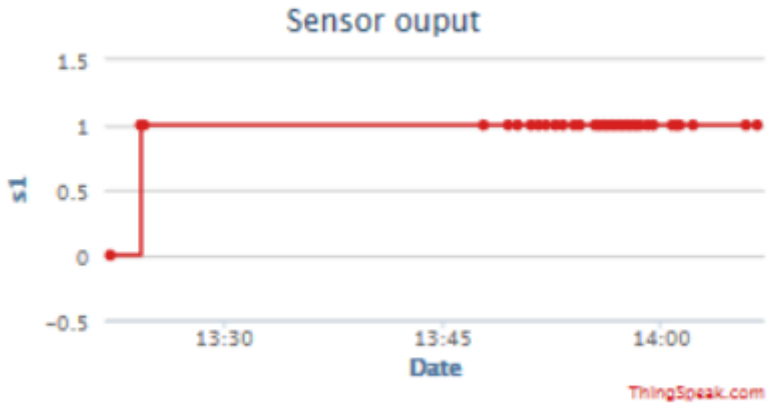
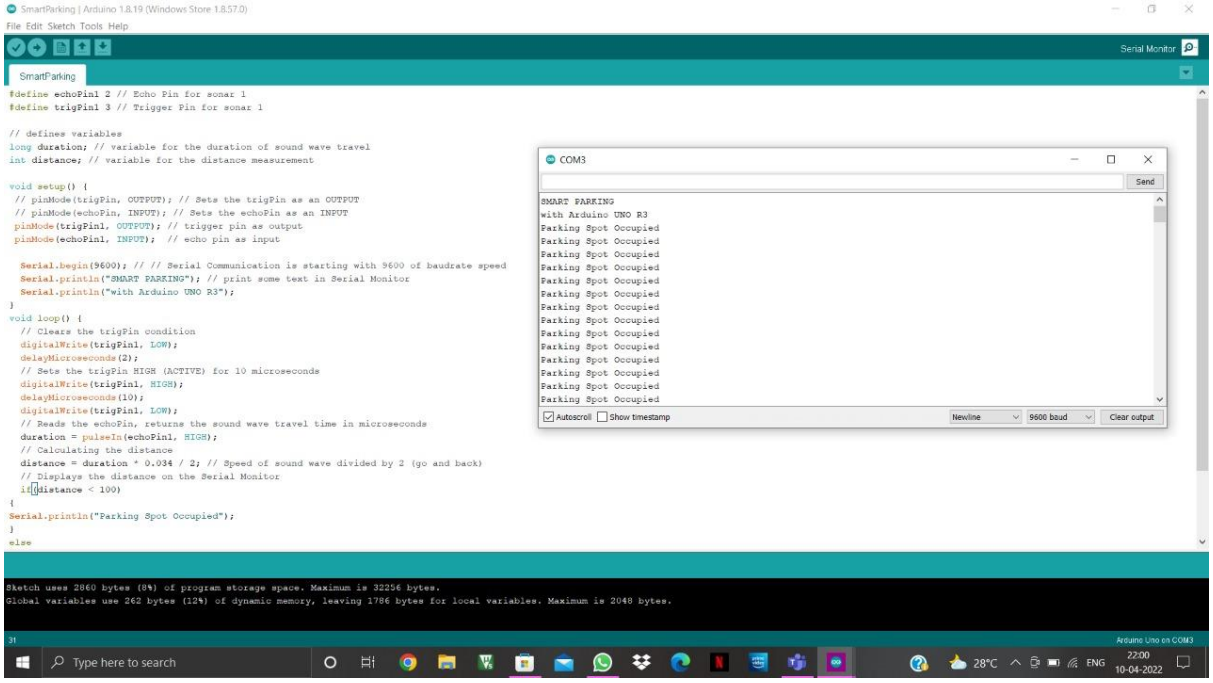


Fig (12): parking spot occupied

Code Output :



8. CONCLUSIONS

The Advanced Parking Spot Assistance System makes metropolitan living, transportation portability, and ecological manageability simpler. It is utilized in activities to further develop efficiency and administration levels. It additionally gets a good deal on running expenses while expanding pay and office esteem. Conventional help channels, for example, tollgates and stopping specialists have affected the proposed approach. It utilizes an ultrasonic sensor, a Node MCU with an ESP8266 Wi-Fi module ready, and a cloud server. The Internet of Things joins equipment, programming, and organization availability to permit things to be identified and controlled somewhat over existing organizations. Clients can screen accessible and inaccessible parking spaces, bringing about expanded effectiveness, exactness, and financial increase.

The fundamental commitment of this study is to present the main stopping problem Finding an unfilled space — and propose an answer. Ultrasonic sensor can be utilized both for
parking spot location and inappropriate stopping discovery. The proposed engineering for stopping recognition framework and the web application would diminish scanning time for empty spaces and decrease occasions of single vehicles inappropriately left across two spaces. The web application permits the client to get to accessible parking spots and book them, in this way diminishing the time taken. Future examination could look at the reconciliation of various stopping scenes into a solitary application.

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