Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 5, May : 2023

Smart Car Parking System

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***Abstract*—Internet-of-things-based technologies have advanced so much and helped public necessities. The use of IoT at a parking lot will help vehicle users to know the availability of a parking location through smartphones. This IoT-based parking system is created by using controllers, sensors, servers and cloud. Controllers and sensors will be placed on the ceiling of each parking slots to detect the presence of a car. Server collect the results of the sensors and store them in Cloud. System test is conducted by installing three sensor cultrasoniccuits and server in a parking lot. The tests consist of measuring time that requultrasoniced for data transmission and the rate of success of data transmission from the parking lot to the Cloud. Based on above tests, it is observed that the sensor cultrasoniccuit and Radio Frequency Identification are able to transmit the parking lot data without error. This system requultrasonice maximum 1 min to update parking lot data. The process of obtaining data until the data being stored in Cloud takes 12 s and the process of acquultrasonicing parking condition data from Cloud to smartphone takes 30 s. The accuracy level of parking lot data transfer is 100 %.**

Key words: Internet of things, Thingspeak, IoT cloud, parking lots, smart parking system.

I. INTRODUCTION

The parking system is controlled by the cloud system. In the recent times car parking in congested cities. So we go for an easy method using the IoT parking system. In this project we use ultrasonic sensor to detect the slot is occupied or available and the data is send through the arduino. The arduino will send the data to the cloud server (web page). This displays the users to verify the available parking slots online from anywhere and available free parking.

Thus this proposed system rectifies the parking issues for metropolitan cities and gets the users an efficient IoT based parking management system. Previously in the parking area there is no automatic system to park the car in the parking slot. They will be collecting an amount from the owner of the vehicle at the free space and then allow the vehicle to park in the parking slot. To resolve this regular problem with IoT (Internet of Things). IoT revolution helping in many ways to solve the issue. The present situation proposes taking effective help from Cloud based systems model called smart-parking system (SPS).Here with the parking data additionally added GPS(Global Position System) data to Cloud Data. The data of Parking information will update frequently in every 15 seconds in the cloud, then SPS system will display how many parking's are available to park at respective building lobby or anywhere according to building. Each parking having its own identity like typical parking.

II. RELATEDWORKS

More research is going on in this subject. We mainly focus on a management system that assists drivers to find parking spaces in a specific parking district, and satisfies the needs of both parking providers and drivers. In addition, an important goal of the system is to reduce the traffic searching for parking, hence reduce energy consumption and air pollution. In this paper, we review background on smart parking systems, including the performance metrics, existing solutions and challenges. We also briefly discuss the related work.

An IoT based parking system is a vehicle parking management system to ease the search for a vacant parking spot in a parking lot through a smartphone. The system utilizes various sensors and microcontrollers with internet capability for detecting parked vehicles and to update the data in real-time on internet designations.

As mentioned above, the proposed smart parking lot circuit will be equipped with several sensors, inexpensive microcontrollers and Wi-Fi module using which a car / any vehicle owner can check if there is a vacant space in a parking lot using his / her phone or tablet or even on computer.

The number of vacant spaces in the smart parking lot can be viewed from anywhere in the world using a URL link or the user can scan a QR code. The scanned / shared URL can be browsed on any web browser to know how many empty parking spot exist in real time.

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III. METHODOLOGY

The proposed smart parking system is very useful in electric vehicle charging stations and this technology is going to a boon for those who are passing beside the charging stations equipped with this system. Now the motorists can see number of vacant chargers on their smartphone and plan their journey accordingly.

In conclusion, the main purpose of a smart vehicle parking system is to save time and reduce hassle for motorists to find a parking lot with a vacant parking spot; otherwise a driver may need to spend their time to find if there are any vacant parking spot left or should they move on to an another parking lot and this situation may put many motorists to mental stress especially those who are in an urgent circumstance.

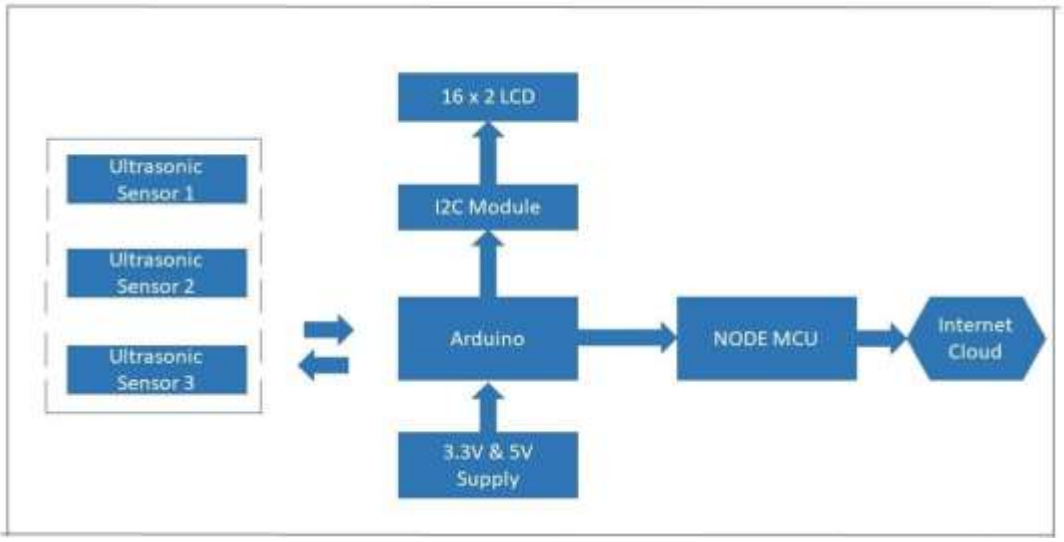

Fig.1.Architecture of thesystem

The circuit we are going to build will be based on the above architecture. An inexpensive Arduino board is going to be the brain of the project.

A 16 x 2 LCD is utilized for displaying the number of vacant spots locally (without internet). An I2C module is utilized for driving the LCD with just four wires so that GPIO pins can be saved for interfacing the sensors and other modules.

There are three ultrasonic sensors for detecting 3 cars / vehicles on the parking spot, we are using ultrasonic sensors instead of IR based sensors because if the parking lot is situated outdoors, infrared light from sunlight may interfere with IR sensors and may give incorrect detection of the vehicle, whereas ultrasonic sensor acts like a mini radar and environmental factors affecting its functionality is minimal.Please note that we are constructing a scale down version of the real project; hence we are just using three sensors.

An ESP8266 Wi-Fi module is used for internet connectivity which sends the parking lot's data to a cloud server where general public can view the data in real time. A power supply module is utilized which provides 5V and 3.3V for Arduino, ultrasonic sensors and ESP8266 Wi-Fi Module.

The internet cloud service we are going to use is called "Thingspeak" where the parking lot's data to be sent, stored and displayed in real time. This concludes the block diagram.

IV. SYSTEM DESIGN

The system design totally based on Microcontroller Node MCU Here the Node MCU acts as a main controlling unit. As we continuously monitor the data will received by Node MCU from sensors and GPS it first decodes, fetches and will execute its operation finally. Here the simulation circuit of system design is shown below. we can Node MCU as main controlling unit in this connected with Infrared radiation sensors(IR sensors),Web Page(Things Speak).

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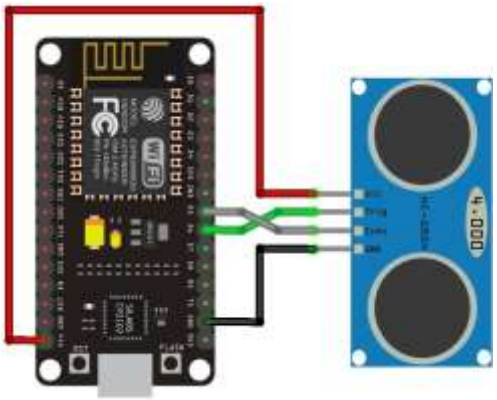

Fig.2. Simulated circuit diagram

A. Node MCU: Espressif Systems Smart Connectivity Platform (ESCP) of high performance wireless SOCs, for mobile platform designers, provides unsurpassed ability to embed Wi-Fi capabilities within other systems, at the lowest cost with the greatest functionality. Node MCU is a free source for IoT projects. It have a firmware which can run on the ESP8266 Wi-Fi Espressif systems.

Fig .3. Node MCU

B. Ultrasonic Sensor:The sensor we are going to use for detecting a parked vehicle on its parking spot is called HC – SR04 which is an ultrasonic sensor module.The ultrasonic sensor module generates ultrasonic sound at around 40 KHz, these sound waves are inaudible to human beings and propagate through air and if the ultrasonic sound wave hits an obstacle, it reflects back to sensor just like radars.If a car or any vehicle is parked, the ultrasonic sound waves hit the parked vehicle and the sensor module detects the reflection and thus existence of a vehicle on a parking spot is detected.

Fig. 4. Ultrasonic Sensor

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C. Power Supply:A power supply module takes 9V to 12V DC from a wall adapter and converts in to 5V and 3.3V outputs, the 5V output from power supply module is directly connected to 5V pin of Arduino and GND of power supply is connected to GND

of Arduino.Similarly 3.3V from the power supply unit is connected to 3.3V Vcc of ESP8266 (it operates strictly on 3.3V and 5V will kill the module), the ground of power supply is connected to ground of ESP8266.Make sure you that have inserted the voltage select jumpers correctly.

Fig. 5. Power Supply

D. LCD Display: In this project we are using a 16 x 2 LCD display for displaying parking lot's data locally without the need for internet. The LCD is driven by an I2C adapter module to reduce the number of wires to four; otherwise you need to connect up to 16 wires to Arduino just to drive the display. If the LCD occupies most of the I/O pins, then there won't be any pins left for the sensors.The I2C module has 16 pins at the output and just four at the input: Vcc, GND, SDA and SCL. The SDA and SCL are I2C bus pins which are connected to A4 and A5 pins of Arduino respectively and it operates on 5V.You can control the contrast of the display by adjusting the trim pot on the I2C adapter module. This concludes about the circuit diagram.

Fig. 6. LCD Display

E. Arduino Uno: Arduino uses its own programming language, which is similar to C++. However, it's possible to use Arduino with Python or another high-level programming language. In fact, platforms like Arduino work well with Python, especially for applications that require integration with sensors and other physical devices.AC socket. Some Arduino boards like UNO, MEGA and DUE, come with an AC socket that can be used to power the boards and to supply additional voltage if needed. A

power supply adapter that provides from 7 to 12V (Volts) of DC (Direct Current) is required.

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Fig. 7. Arduino Uno

V. HARDWARE CIRCUIT

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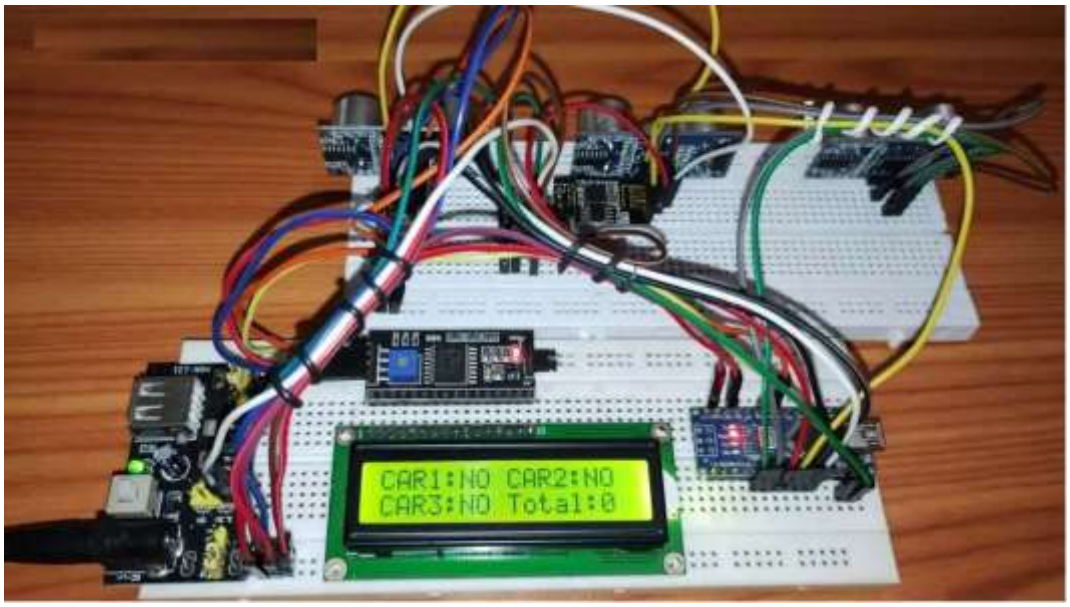

Fig. 8. Implemented Hardware circuit

VI. RESULTS & CONCLUSION

The project "IOT based Smart Parking system" was designed such that the status of parking slots can be known from anywhere in the users webpage. This is achieved using Wi-Fi communication. In this system, the user has to be connected to the Wi-Fi network of that particular parking area through which he is given access to the webpage and can know about the status of the parking slot. The Microcontroller processes this data and transmits over Wi-Fi, which will be received from MOBILE. In achieving the task the controller is loaded with a program written using Embedded „C" language. The user who wants to park the vehicle is connected to the Wi-Fi network of that particular parking lot through the password. The IR sensors send the status to the

microcontroller where the data processing is done. The microcontroller sends information to the webpage about the status of the slot to the user using IOT. This way the user can easily find a parking slot without any congestion and in less time.

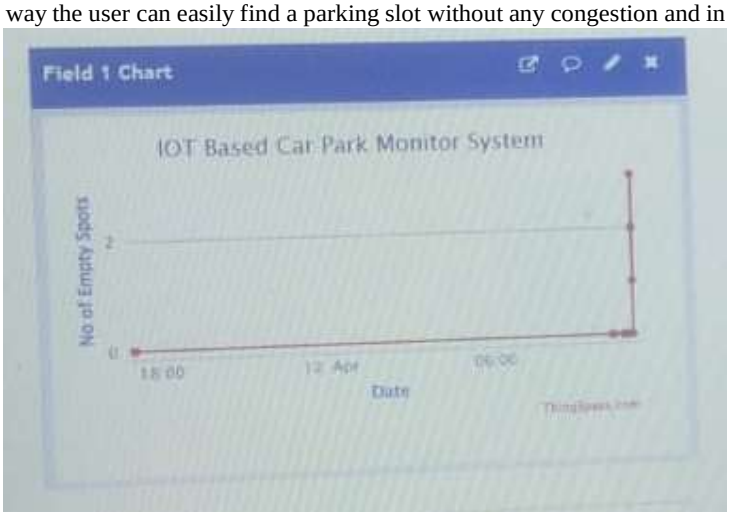

Fig.9.1.Result of ThingSpeak Field 1 Chart

Fig.9.2 Result of ThingSpeak Field 1 Chart

VII. ACKNOWLEDGMENT

We would like to thank our guides for all the guidance and knowledge provided during this project. Apart from that,we would also thank our guides for the extended support during our research paper writing.

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