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Smart Parking Solution for Smart Cities Using Arduino

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Abstract: ***Today's world peoples are focusing more on internet. People are becoming dependent on internet as it makes our life easier and faster. In order to maximize the performance and accuracy of the urban area economic-development constant efforts are made in the field of IoT. With the help of IoT platforms we can connect the sensors with the internet. Therefore by using IoT we can implement many applications. The smart parking system is one of this IoT application. There are many problems regarding unplanned parking not only in India but also in many other countries of the world. Hence, we have Introduced IoT based parking system to reduce the issue of unplanned parking and also to reduced the traffic congestion. This project allow the user to find the vacant parking space in a given area. We have developed mobile application using which the user can easily check the availability of parking slot.***

Keywords: Arduino UNO, IoT, Ultrasonic Sensors, Wifi, Android Application

I. INTRODUCTION

IoT that is "Internet of Things" is becoming continuously developing topic of conversion as it makes our task and work easy to handle. By using sensors, Arduino and other components we can construct a setup that will reduced the human effort. The Internet of Things is a concept which illustrates upcoming era where day-to-day physical objects will be connected to the internet.

As we all know almost every country is moving towards smart world by introducing various frameworks like smart-education, smart e-healthcare, smart waste management, etc. Many cities are also becoming metropolitan city and in metropolitan city it is very difficult to find the parking space. Due to the lack of the parking spaces the drivers are facing many problems. They need to move around in search of parking space. To resolve the mentioned issues, we have created this project.

In our project we have created an IoT setup along with an android application. The user has to register only once in the app, after that they can login directly. For IoT setup we have used Arduino UNO board, ultrasonic sensors, wifi module and led lights. We have created two parking slots to demonstrate our project. For two parking slots we have used two ultrasonic sensors.

Ultrasonic sensors are used to measure the distance of the object. Ultrasonic sensors are connected to the Arduino board through wires. We have used two led lights, one is white colour led light which shows the space is available for parking the car and another is red colour led light which indicates that parking zone is full.

II. LITERATURE REVIEW

Rishi Gupta, Sharvil Pradhan, Abhijit Haridas & D.C. Karia[1] has proposed "Cloud Based Smart Parking System" a solution for smart parking by using Internet of Things. This system prototype is based on Raspberry Pi and Cloud MQTT. They focus on providing information related to available parking area and also provide the booking facility through android application only.

With the IoT, Alsafery et al. [2] proposed a smart parking system solution for smart cities. Aside from providing information about the number of parking spaces and nearest parking spaces, their system included with roads traffic congestion status. They applied the machine learning algorithm based on data analysis and data processing from the specific data collected by their own. They use cloud web service to collect data from fog microcontroller distributed devices around the users, analyze and process the data, before passing the information about nearest parking space to the user. To collect the data, the system requires lots of efforts which are expensive and costly, while the machine learning algorithm shouldn't be too complex to analyze lots of data in a real time. The above implementation require most cost in terms of hardware and software.

Meanwhile, Fikri & Hwang [3] dedicated their application for disabled people. They propose to secure the disabled parking space by using Near-field communication (NFC) tag reader and alarm system.

Differently, [4] Chandran et al. recommended a parking reservation system using Android application. User can also book the parking space in advance. They installed infrared sensor to detect the availability of free space.

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III.COMPONENTS USED

A. Arduino UNO

Arduino UNO is a microcontroller board which is used to read the inputs from sensors or from led lights. It is an open-source electronics platform which is based on easy to use software and hardware. Arduino software is a flexible and easy to use for new users as well as for advanced users. By using Arduino we can make low cost projects. We have used C++ language for coding purpose.

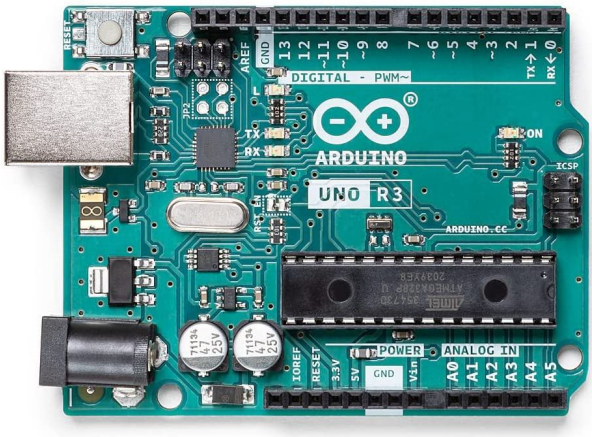


Fig (a) : Arduino UNO

B. Ultrasonic Sensors

An ultrasonic sensor is an electronic device that is used to measure the distance of the objects by using sound waves. It is also used in robotic system for detecting the obstacles. It has four pins named as Vcc, Trigger, Echo, and Ground. For input and output purpose we use Trigger and Echo pin. Trigger pin is an input pin that is used for measurement purpose by transmitting ultrasonic waves. Echo pin is an output pin, it produces a pulse when it received the reflected signal back.



Fig (b) : Ultrasonic Sensors

C. Wifi Module

A wifi module ESP8266 is an self contained system of chip (SoC) which is developed by Espressif system. It is integrated with TCP/IP protocol stack that helps the microcontroller for accessing the wifi network. It is used for the development of IoT applications. It is used for connecting the Arduino UNO board with the internet.

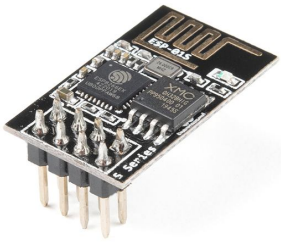


Fig (c) : Wifi Module

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D. LED Lights

LED "Light Emitting Diodes" is a semiconductor device that is used for emitting light when an electric current passes through it. In our project it is used to indicate the available parking space and non-available parking space. If there is any space available for parking then it blinks the white colour light and if there is no space available for parking than it blinks the red light.



Fig (d) : LED Lights

E. Jumper Cables

Jumper cables in our project is for connecting the items like ultrasonic sensors, wifi module, led lights with the Arduino microcontroller board. It is a wires that have connectors pins from both the end.



Fig (e) : Jumper Cables

IV. WORKING

For our project we have used technologies like IoT, sensors, microcontroller board for making the smart parking system that will inform the user about the vacant or available parking slots of the parking area through their mobile phones only. We have created one mobile application in addition with an IoT setup. For IoT setup we have used electronic components such as Arduino UNO, Ultrasonic sensors, Wifi Module and LED light. We have combined all these components altogether by using jumper cables for creating one hardware module. In mobile application the user will be able to view the available parking spaces.

Firstly the ultrasonic sensors measures the distance of the object for detecting the object by using sound waves. After that it transfers that information to the Arduino UNO which is used for connecting hardware with the software. After that the Arduino UNO transfers or stores that data to the internet or cloud. Then by using wifi module that information is reflected in mobile application and user can easily view that information. For using mobile application the user needs to register themselves in that application. After that they can easily login to that app.

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The working of our project consists of three different module:

1) The first module is known as “Data Collection Module” in this for collecting data we have used ultrasonic sensors like ultrasonic sensor for measuring the distance of the object for detecting, is there any vehicle is parked or not. After detecting the information gets uploaded on the cloud.

2) The second module is known as “Data Processing Module” in this the cloud gets the information from the node and processes that information for displaying availability and non-availability of parking in the mobile application.

3) The third module is known as “Data Display Module” this is the last module of our system. It is the most important module as the user can view the application by the help of this module. It is a user interface module. User can view the vacant spaces easily.

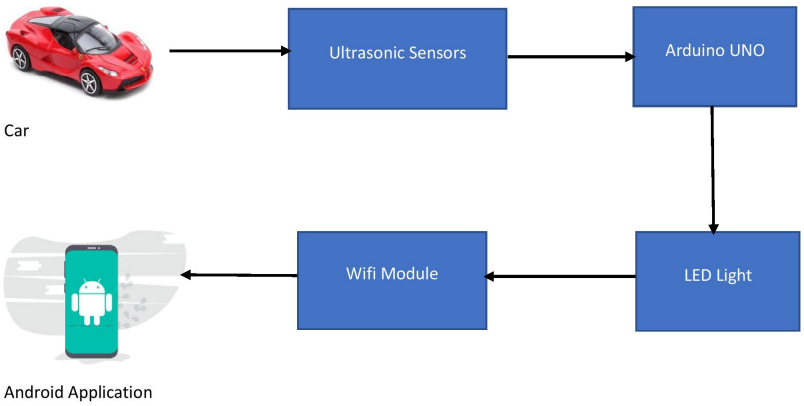


Fig (f) : Block Diagram

V. RESULT

Our project consist of IoT setup and also one android application. In mobile application the user needs to register themselves for the first time only, after that they can directly do the login. Through mobile application the user can easily see the available parking slot.



Fig (g) : Login Page

Fig (g) shows the login page of our mobile application. If the user is a new user they need to first register themselves in the app by simply clicking on the new user button. The registration page is shown in fig (h).

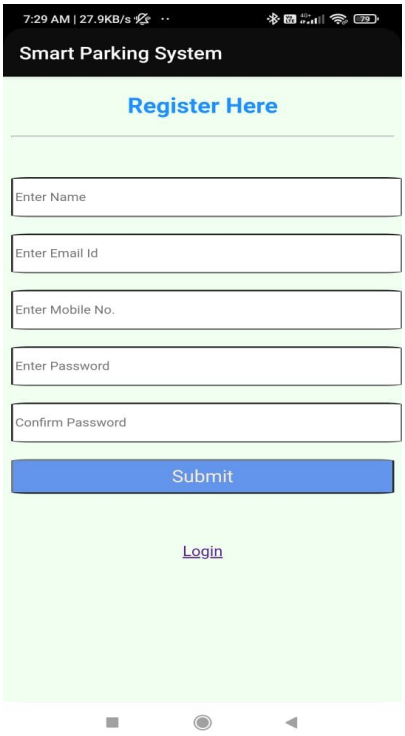


Fig (h) : Registration Page

After registration, the user can login by clicking on the login button. Once the user logged in to the app Status page will open from which the user can view the status of the parking lot. If there is parking available then it will shoe available infront of the parking number and if there is no parking available then it will show not available infront of the parking number.

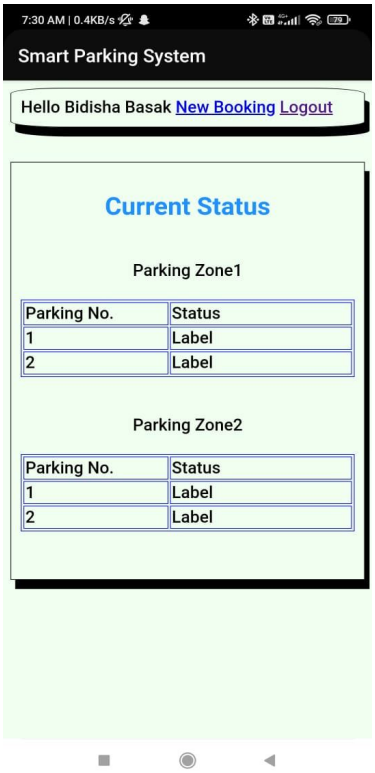


Fig (i) : Status Page

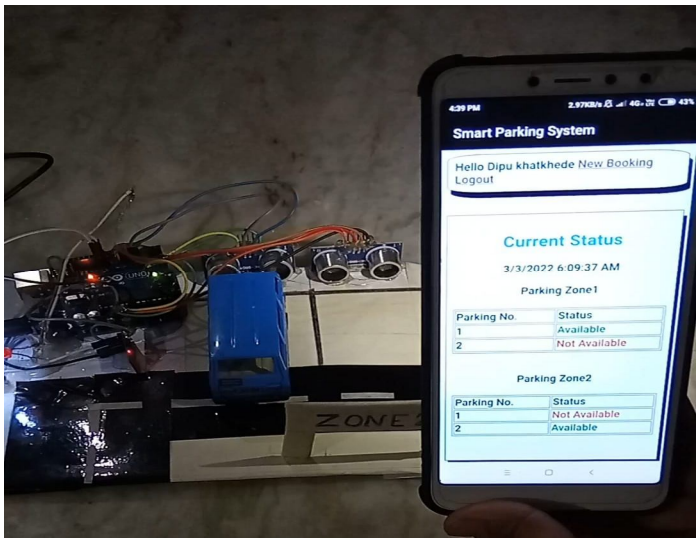


Fig (d) : Parking Status 1

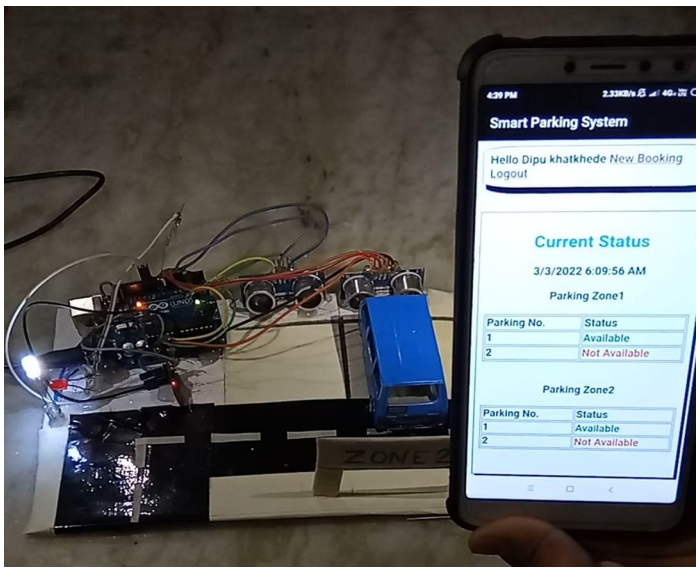


Fig (j) : Parking Status 2



Fig (k): Parking Status 3

VI. CONCLUSION AND FUTURE SCOPE

This project detects the empty parking slots and help the drivers to find empty space to park their vehicle in an unfamiliar area or city. It help the users to effectively reduce the time it takes to find their vehicle an empty parking space. The purpose of making this project is to connect the parking area with the internet world so that it can make the city a smart city and it reduces the time and also it reduces the fuel usage. It also focuses on reducing the traffic congestion especially on weekends and holidays. I also shows that how mobile application is connected with internet through IoT and can help the society to develop as smart society and it leaves a good impact in the society. It considers as a modernization of the city.

In future we can also enhanced this parking system by adding different modules like online booking of the parking space using GSM. It can be used for safety purpose by applying number plate recognizing technique or face recognition technique by using camera through which the face of the drivers can be identified. In future the user can also check the prices of different parking areas.

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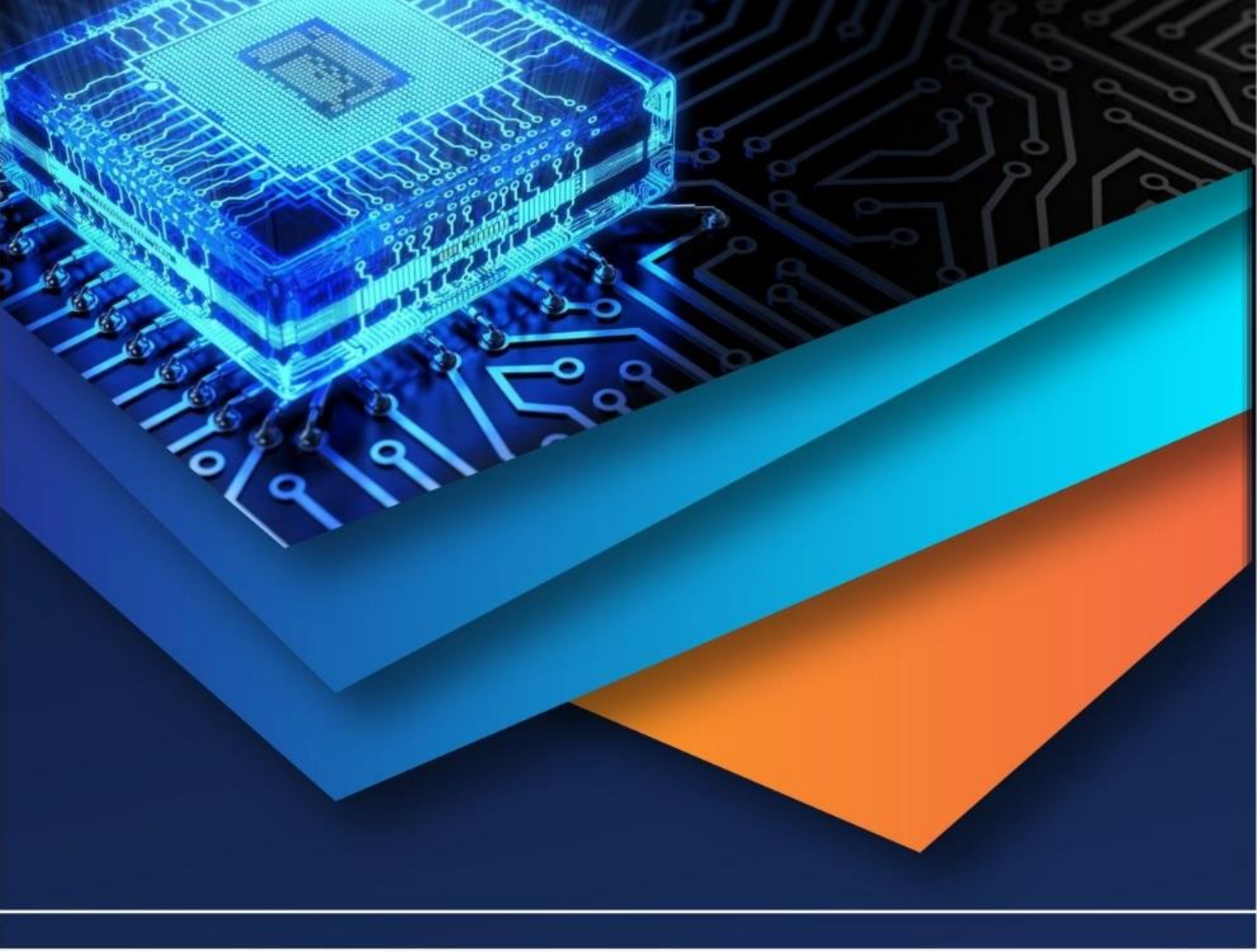
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