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Cost effective Portable Wireless Car Parking Sensor System by Using NodeMCU

Bobby Dumir
Department of Computer Science and Engineering
, Lovely Professional University, JalandharCity, India
dumir.360@gmail.com

ABSTRACT : The objective of the proposed system is to design a Car Parking Sensor system and display its result on a portable device like Mobile or Tab. It is created by using NodeMCU as aMCU (microcontroller unit) used for processing. The proposed system is coded to display distance in numeric form as well as in graphical form so that there is no need to look behind during parking. A buzzer system is also introduced in which buzzing sound increases as thecar (Sensor behind the car) moves towards the wall. The proposed system removed the placement of costly LCD/LED screen in car for this purpose as well as no internet is required for this purpose which makes proposed system Cost Efficient.

KEYWORDS :MCU (Microcontroller unit), NodeMCU, ESP8266, Ultrasonic Sensor, Micro-Buzzer, AP (Access Point), parking sensor, IOT (internet of things), SSID (Service Set Identifier), HTML (Hyper Text Mark-up Language).

I. INTRODUCTION

In a transport or logistic industries, IOT devices are placed in vehicles to get its live location. Now a day, it has also been introduced in mobile robots to fetch information out of them[2].Various Car Parking Sensor systems have been designed over the years but they are wired as well as introduction of graphical panel makesit costly. This calls for a need to develop Car Parking Sensor system that are based on intelligent data acquisition, wireless communication, and processing. Our proposed work focuses on using IOT technology to configure and deploy Car Parking Sensor system that provide remote, continuous, and real-time information [3] related to distance from obstacle/wall on a mobile phone itself which removes the requirement of graphical screen for display and decreases the overall cost of the system.

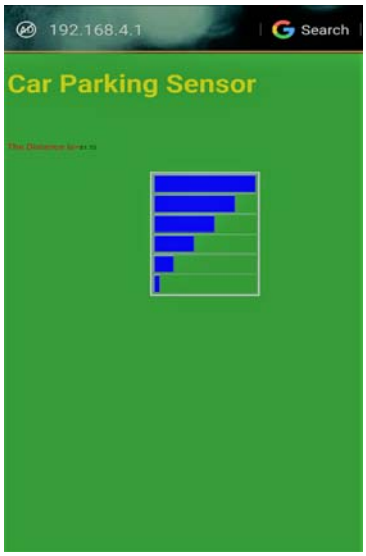
Devices that connect to Wi-Fi network are called stations. Connection to Wi-Fi is provided by an access point (AP) that acts as a hub for one or more stations. The access point on the other end is connected to a wired network. AP is usually integrated with a router to provide access from Wi-Fi network to the internet. Each access point is recognized by a SSID (Service Set Identifier) that essentially is the name of network you select when connecting a device (station) to the Wi-Fi. [1]

NodeMCU is a development board of ESP8266 Wi-Fi module. ESP8266 module can operate as a station, so it can connect it to the Wi-Fi network. It can also operate as a soft access point (soft-AP), to establish its own Wi-Fi network. Therefore, it can connect other stations to such ESP module. ESP8266 is also able to operate both in station and soft access point mode. This provides possibility of building mesh networks [5].

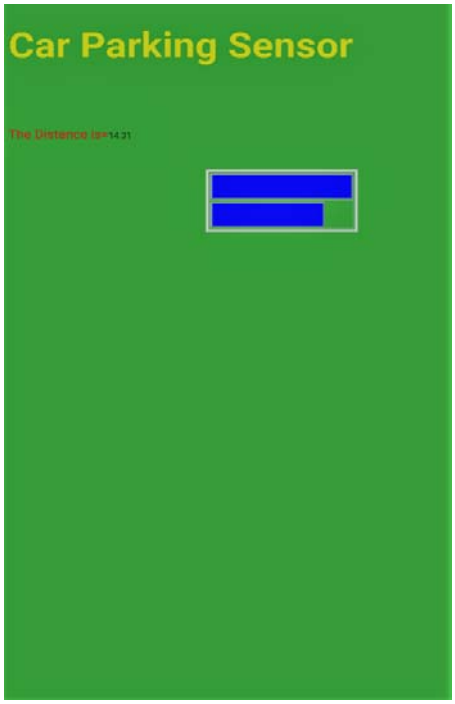
In our proposed work, NodeMCU is configured as an access point so that the system can work without using internet. Any mobile phone can be connected to NodeMCU by using its SSID & password to get the graphical display directly on smartphone. This makes the system portable, wireless as well as cost effective.

II. SOFTWARE DESCRIPTION

Arduino Software IDE is used for coding NodeMCU. C++ is used in Arduino IDE for coding. NodeMCU is coded here as an Access Point.Access Point method is one of the best features of NodeMCU, her it works as a router and one can access it usinga Mobile/Tab. In this configuration, no internet connection is required therefore it can be used anywhere and anytime.



(a)



(b)

Fig. 1: (a) & (b) Graphical panel created using HTML codes

In our proposed work, HTML (Hyper Text Mark-up Language) is used with CSS to create graphical panel as shown in Fig. 1 above. After writing HTML code, it has been introduced with C++ programming of NodeMCU in Arduino IDE.

III. HARDWARE DESCRIPTION

Ultrasonic sensor is used for distance measurement in our work. HC-SR04 is a ultrasonic sensor modulewhich is based on the principle of measuring the properties of sound waves with frequency above the human audible range [7].The Ultrasonic transmitter transmits an ultrasonic wave when triggered by MCU at its TRIG pin, then this wave travels in air and as it gets objected by any material then it is reflected back toward the sensor.This reflected wave is observed by the Ultrasonic receiver module and processed[6]. The processed output is a pulse of duration equals to time taken between triggering and receiving of wave. The whole process is shown in Fig. 2 below. Then the equation below is used to calculate the distance by using the above duration and speed of sound as a speed,

Distance = Speed × Time (1)

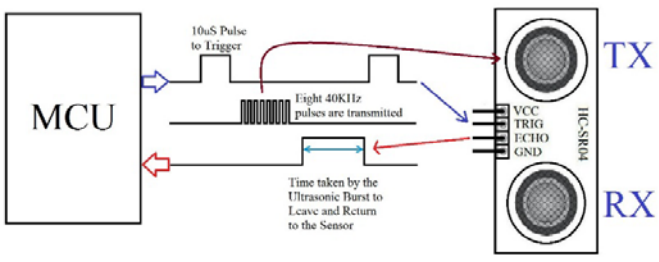


Fig. 2: Functioning of ultrasonic sensor module

NodeMCU as shown in Fig. 3 is an open source software and hardware development environment that is built around a very inexpensive System called the ESP8266. It contains all crucial elements of the modern computer: CPU, RAM, networking (Wi-Fi), and even a modern Operating System.

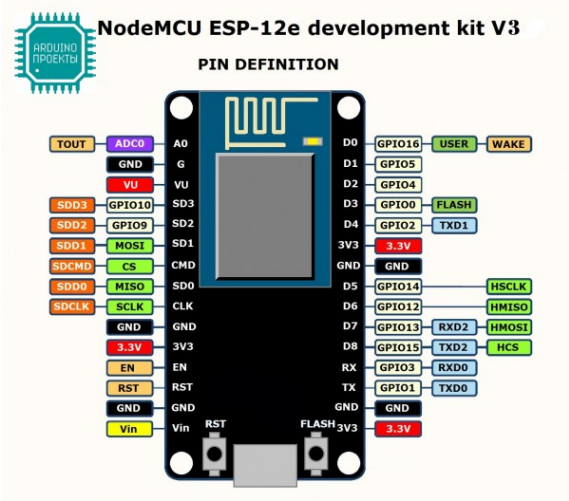


Fig. 3: Pin configuration is given in the diagram

The IP given by NodeMCU is Static IP so it isnot required to change IP every time [8].

Micro-buzzer creates a flicker and thus gives random intensity sound therefore a 400 ohms resistance and 104M capacitor is connected which absorbs all the flicking signals and provide full clean signal to the Buzzer [7].

Sensor nodes are used extensively in order to gather real-time information. it becomes important how to reduce the power consumption of huge sensor nodes. In this work, normally-off architecture of microcontroller for future low-power sensor node is proposed. To realize true low-power effects with normally-off computing technology, a co-design of hardware and software technology is much important. In this work, the power consumption of sensor nodes is possible to reduce of around 70% by using normally-off MCU architecture in sensor node [10].

IV. WORKING

Node MCU is configured as a Wi-Fi access point in our work and therefore one need to connect hisMobile/Tab by using SSID & PASSWORDof NodeMCU to access its data. Aftersuccessful connection,one need to open the browser in the Mobile phone and enter the IP address provided by NodeMCU to open the graphical panel created in HTML.The website (Graphical panel) will remain closed until any object will not come in its range.Once any wall/object comes in range, it starts showing distance and vertical progress bar indicating distance between wall and car as shown in the Fig.1. Now as every time distance changes, that will be reflected in graphical panel on the mobile phone in real time as shown in flowchart in Fig. 5. Buzzer is also introduced in this work. Buzzer sound increases as the distance between car and wall decreases.

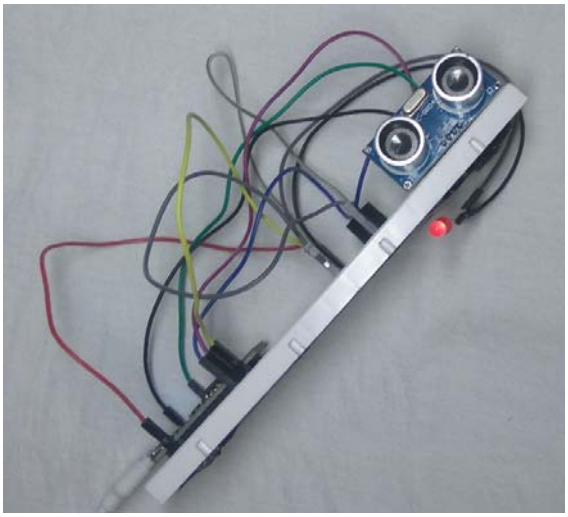


Fig. 4:hardware of the project.

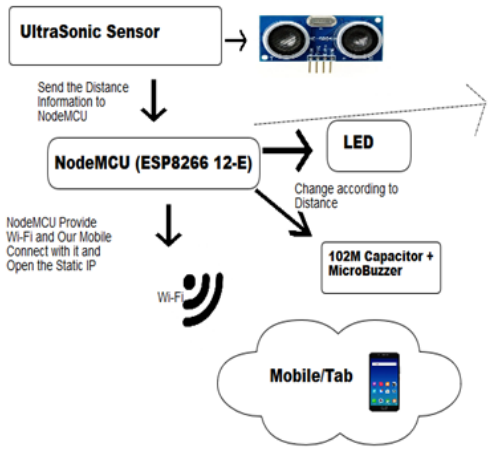


Fig. 5: Flowchart of working.

The hardware of the project is shown above in Fig. 4. It consists of ultrasonic sensor, buzzer, NodeMCU and wires for connections.

In order to reduce fluctuations,six values of sensor have been taken first and then average of those six values is taken as final output. If the average of the above values is not taken then the display value will change very quickly and the graph &distance on the website flicker[9].

The ultrasonic sensor takes values in m/s so for our convenience, it is converted cm/s by dividing m/s /29.And it is also required to divide it by 2 because the distance travels twice by the wave, firstly when it is sent and then when it will be strike back and received by “echo” [1], [4].

V. CONCLUSION

It is hard to park the car by looking at back mirrors therefore car parking sensor systems has been introduced which make use of buzzer sound to indicate distance. Next level car parking system makes use of LCD panels to display distance in graphical form but due to costly LCD panels, the system is not cost effective. Our proposed system makes use of NodeMCU device, which is capable of sending data directly on the smartphones and thus make our system portable. Since the display is shifted on to the smartphone therefore extra LCD panel is not required in car and thus it decreases overall cost of the system. Our proposed system works on Wi-Fi technology, therefore it is also wireless unlike present systems.

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