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Smart car parking system model for urban areas

Rahman Atiqur
Information and Communication Engineering, Chongqing University of Posts and Telecommunications, Chongqing Key Lab of Mobile Communications Technology, China
University of Chittagong, Faculty of Engineering, Computer Science and Engineering Department, Bangladesh

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ABSTRACT

This article is on the smart car parking system. In which we going to utilize the ultrasonic sensor to distinguish the vehicle and it will assist the proprietor with finding an advantageous parking spot. Parking spots are significant in city urban areas. In view of the expansion in a huge number of vehicles, the requirement for parking spots is a need, and henceforth an earnest need to build up a system that can deal with these parking spots. To determine these necessities, we build up a system to show the empty path in the parking spots. This includes a system that incorporates an ultrasonic sensor, Raspberry pi 4, Wi-Fi module, and a light emitting diode (LED) show outside the vehicle parking entryway. Parking spots are observed by the staff of the concerned power. The paper incorporates the subtleties of parts that are utilized and about the working of this system. The paper likewise shows that our system's looking through an ideal opportunity to locate a free spot is more productive than some other existing system.

Corresponding Author:

Rahman Atiqur
School of Information and Communication Engineering
Chongqing University of Posts and Telecommunications
Key Lab of Mobile Communications Technology, Chongqing, 400065, China
Email: bulbul.cse.cu@gmail.com

1. INTRODUCTION

Because of the quick increment in the cars, there exists an issue for parking of cars. It prompts traffic blockage and furthermore contamination [1]. Along these lines, we have to keep up the vehicle park management to lessen the wastage of time. In the event that we see in the bigger urban areas when we visit the shopping centers or traveler places or some other business zones there emerges an issue for parking of our vehicle [2]. We essentially center on planning another smart parking system that helps drivers to discover empty parking spots in a particular parking zone. Consequently, to lessen human exertion and air contamination [3]. The primary thought process is to improve each parking space with the goal that it arrives at the condition of-craftsmanship innovation. For this reason, each parking slot has been given a sensor for example Ultrasonic sensor that will distinguish the nearness of the vehicle left in the particular slot. At the point when it will recognize the vehicle it will naturally show on light emitting diode (LED) that the parking space is full. A similar message or yield is given to the mindful staff. So, the staff part will manage the individual to the empty parking space [4]. This framework has numerous adaptable capacities, it can be used for a little parking space just as the enormous shopping center's staggered parking. Portions of this system incorporate Ultrasonic sensor, Wi-Fi module, LED Display, and Raspberry Pi4 gadget [5]. Based on our review from many parking spaces in Dhaka (see Figure 1), the time consuming in the parking method are caused by time consumed at doors where the driver has to get a parking card at the entry gate and has to pay parking fee at the exit gate (1 and 5) and time to find the vacant slot (2). Furthermore, in this method, there is another suffering case that might happen

when the driver forgets to remember his/her parking slot and he/she has to walk around the area many floors to find his/her car, which is also time consuming [6].

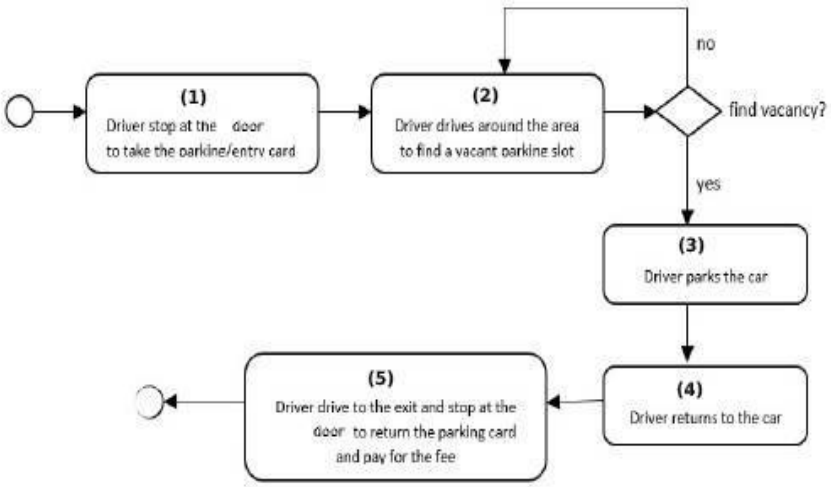

Figure 1. Existing parking system

Therefore, in this paper, we propose a solution to these problems by introducing a smart car parking system (SCPS) that is design based on internet of things (IoT), image processing and an iOS mobile application to give smart services such as locating available parking slots in real time, detecting car plate number, and recording position of the parked car, calculating parking fee and allowing mobile payment for the bill. In our proposed system, the doors at the entry and exit points can be removed so the bottleneck at the gates can be reduced. How the proposed system is better than the existing system graphically shows in section 4.

In Section 2 we present our proposed smart car parking system model and circuit diagram also describes how its component works. Section 3 gives the result based on our proposed model and describes how these systems are more efficient compared than another existing system and Section 4 concludes the paper.

2. PROPOSED SYSTEM

The following Figure 2 shows the block diagram of our proposed system. The entire system is controlled by the Raspberry Pi 4 device. In these proposed systems mainly Raspberry Pi4, Ultrasonic Sensors, Wi-Fi-Module and LED Display. Each component is explained below in a detailed manner.

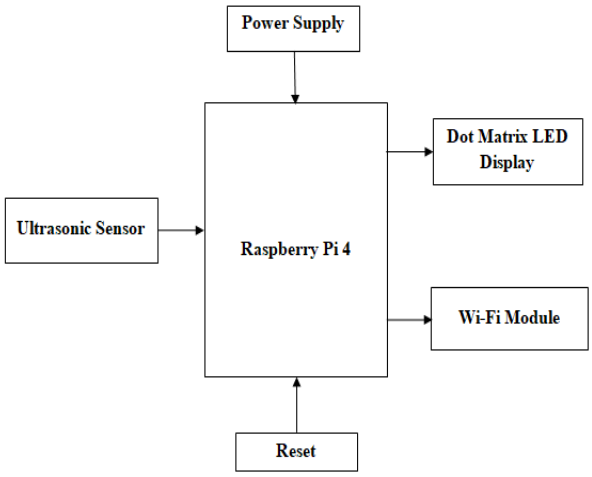

Figure 2. Block diagram of smart car parking system (SCPS) using Raspberry Pi4

2.1. Raspberry Pi 4

Raspberry Pi4 is a debit card-sized single-board computer with an OS Raspbian installed [7]. Raspberry Pi4's specifications are specified in Table 1. The raspberry collects the number of parking slots from each NodeMCU V3 and processes the data and updates the database server with a total number of vacant slots. Figure 3 shows the available interfaces in Raspberry Pi4 [7].

Table 1. Raspberry Pi 4 specifications [7]

Specifications	Values
CPU	Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
RAM	1GB, 2GB or 4GB LPDDR4-2400 SDRAM (depending on model)
USB Ports	2 USB 3.0 ports; 2 USB 2.0 ports
GPIO Pins	Raspberry Pi standard 40 pin
Other Features	1. HDMI – 2 × micro-HDMI ports (up to 4kp60 supported) 2. Display port – 2-lane MIPI DSI 3. Camera port – 2-lane MIPI CSI 4. Audio – 4-pole stereo audio and composite video port 5. Storage – Micro-SD card slot for loading operating system and data storage 6. Misc. – H.265 (4kp60 decode), H264 (1080p60 decode, 1080p30 encode), OpenGL ES 3.0 graphics 7. OS–Debian Linux 10 based

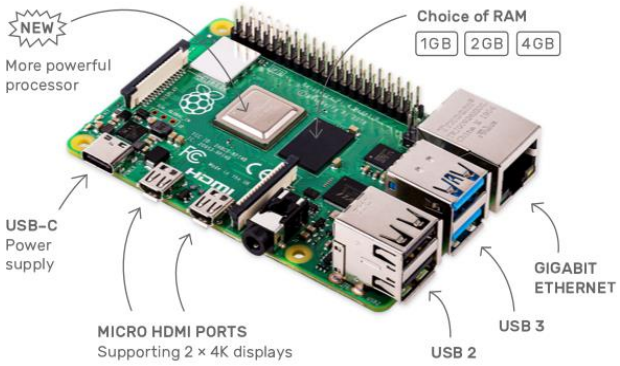

Figure 3. Raspberry Pi4 boards

2.2. Ultrasonic sensor

Figure 4 shows the graphics of an ultrasonic sensor. The theory behind the ultrasonic parking sensor is based on echo-location. The frequency of the sound is so high that men cannot perceive it, which is useful because it provides correctness and remains ordinary. As sound hits a solid object, after creating an echo it is reflected back. Since the speed of sound is well-known and steady for similar conditions, it is possible to decide the distance of the object you hear an echo from by multiplying the speed of sound by half the time it takes to hear the echo (because the echo time is actually the time it takes the sound to go there and back) [8]. Technical specifications of ultrasonic sensors are specified in Table 2 [9].

Figure 4. An ultrasonic parking sensor

Table 2. Technical Specification of sensors [10]

Parameters	Ultrasonic Parking Sensor
Range	0.3~2m
Beam-width	H>60, V>60 degree
Beam Pattern	Conical
Frequency	315 MHz/433 MHz
Unit Cost	30 INR.

2.3. LED display

A LED show is a level board show that utilizes a variety of light-producing diodes as pixels for a video show [11]. Their brilliance permits them to be utilized outside where they are noticeable in the sun for store signs and bulletins. As of late, they have additionally gotten ordinarily utilized in goal signs on open transport vehicles, just as factor message signs on parkways. Driven presentations are fit for giving general enlightenment notwithstanding visual showcases, as when utilized for stage lighting or other beautifying (instead of instructive) purposes [12]. LED showcases can offer higher complexity proportions than a projector and are in this way an option in contrast to conventional projection screens, and they can be utilized for huge, continuous (without a noticeable lattice emerging from the bezels of individual presentations) video dividers. Miniaturized scale LED shows are LED shows with littler LEDs, which presents huge improvement challenges [13], [14].

LED Display (light-emitting diode show) is a screen show innovation that utilizes a board of LEDs as the light source. Right now, an enormous number of electronic gadgets, both little and huge, use LED show as a screen and as an association medium between the client and the framework. Present-day electronic gadgets, for example, cell phones, TVs, tablets, PC screens, workstations screens, and so on, utilize a LED show to show their yield.

LED Display is one of the principal screens shows that are as a rule economically utilized. The greatest favorable position of the LED show is its productive and low-vitality utilization, which is particularly required for handhelds and chargeable gadgets, for example, cell phones and tablets. A LED show comprises various LED boards that, thus, comprise of a few LEDs. LEDs have various favorable circumstances over other light-transmitting sources that can be utilized then again. Besides being power effective, LEDs produce more splendor and more noteworthy light force. LED-Display is not the same as the vacuum fluorescent showcase utilized in some purchaser hardware, for example, vehicle sound systems, videocassette recorders, and so forth., and, consequently, these two ought not to be mistaken for one another [15], [16]. Figure 5 shows the pin diagram of a 7 segment display board.

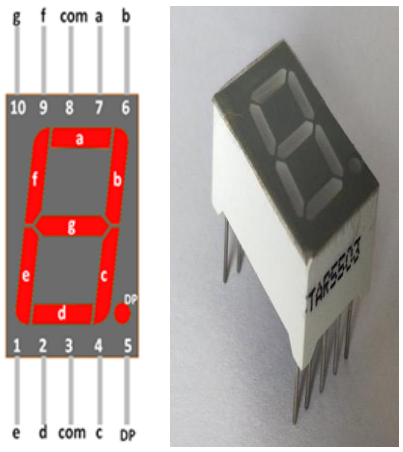

Figure 5. 7 Segment display pin diagram

2.4. Wi-Fi-module

The ESP8266 Wi-Fi Module shown in Figure 6 is an independent system on a chip (SOC) with an incorporated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is able to do either facilitating an application or offloading all Wi-Fi networking capacities from another application processor [17]. Each ESP8266 module comes pre-modified with an AT order set firmware,

which means you can essentially attach this to your Raspberry Pi4 gadget and get about as much Wi-Fi-capacity as a Wi-Fi Shield offers. The ESP8266 associates with the outside world utilizing the serial port. The Pi controls it and moves information utilizing an arrangement of AT orders. These were normally used to control modems and other correspondence gear despite everything being utilized in cell phone modems. Generally, the ESP8266 resembles a modem that interfaces with Wi-Fi. The ESP8266 module is a very savvy board with an enormous, and ever-developing, network.

Figure 6. Wi-Fi-module

2.5. Circuit diagram of our proposed system

In this circuit, ultrasonic sensors are utilized for each parking slot. These ultrasonic sensors are associated with the Raspberry Pi4 pins. The LEDs are associated with the Digital I/O pins which give shading RED and GREEN. The reading will be shown on the LED which will educate the guests about the free space accessible inside the parking. At the point when the slot will be empty then the ultrasonic sensor collector won't get any sign. Thus a GREEN light will sparkle. In the event that any sign is gotten by the ultrasonic sensor beneficiary, at that point it will be contrasted with the edge esteem, and in the event that it is more than the limit esteem, at that point the RED light will shine [18]. This procedure will be like every other space, and at whatever point a vehicle enters or leaves the parking region, the information is ceaselessly refreshed. At the point when a vehicle enters or leaves the parking slots, the separate LED will gleam right away. On the off chance that any of the parking slots are involved, at that point, an instant message will be shown on LED and your versatility about the amount more space is empty [18]-[20]. All of the things are graphically shown in Figure 7.

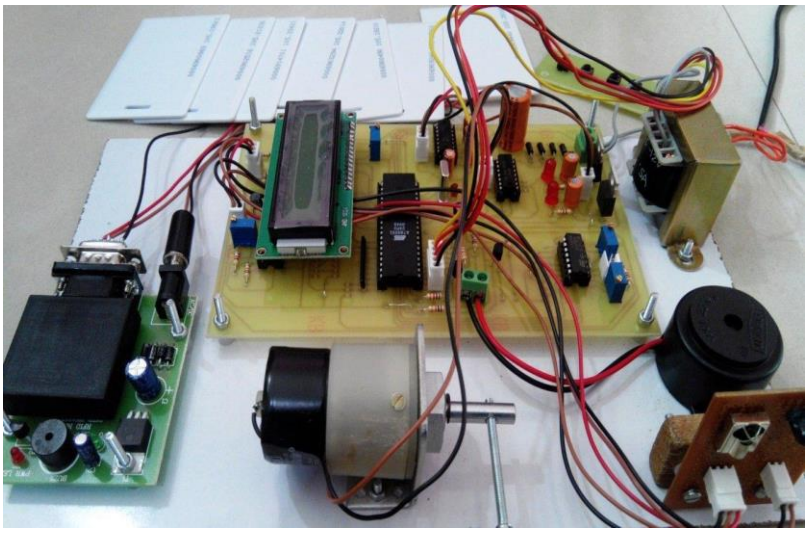

Figure 7. The circuit diagram of the proposed system

3. RESULTS AND DISCUSSION

3.1. Database

Here, in this thesis we are using a live dataset of cars and it is in store in MySQL.

3.2. Experimental setup

3.2.1.Hardware requirement

a. Raspberry Pi 4
b. Ultrasonic Sensor
c. Wi-Fi Module
d. Web Camera

3.2.2.Software requirements

a. The system is built using the Java framework on Windows platform
b. The Net beans IDE are used as a development tool
c. For Database using MySQL
d. MATLAB Simulation Software

3.3. Expected result

In this subsection discussed the experimental result of the proposed system. Table 3 and Figure 8 represent the comparative analysis of time required for smart parking in existing and proposed systems. From the figures it is clear that the proposed system is faster than the existing system to park the car.

Table 3. Required time and distance comparison

Distance Travelled (in meters) for Existing System	Time Required (in minute) for Existing System	Existing System	Distance Travelled (in meters) for SCPS System	Time Required (in minute) for SCPS	SCPS
0	10	Success	0	10	Success
160	20	Success	50	20	Success
220	30	Success	40	30	Success
290	40	Success	30	40	Success
395	50	Success	35	50	Success

Now from the tabular value the following assessed chart Figure 8 it plainly shows that our system will be progressively more effective than the other existing system where the existing system was manual based or some other online systems which are used by older devices compared to our proposed system. From Figure 7, it is clear our proposed smart car parking system requires less than an ideal opportunity to scan for a free spot when contrasted with that of ordinary pursuit. In a typical inquiry client sets aside part of the effort to discover the accessible space. Be that as it may, in our proposed strategy we have a choice of pre booking, which spares time [21]-[25].

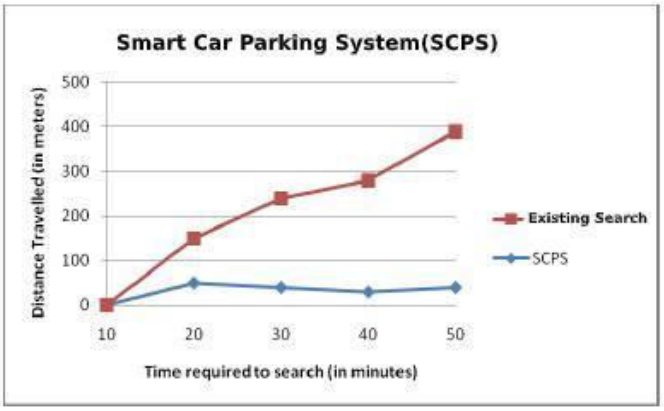

Figure 8. Performance comparison with existing system

4. CONCLUSION

In this article, we brought out how the parking issue in jam-packed spots can be handled in an all-around concocted way. It is a very time-productive technique, it causes the guests to discover the accessibility of a parking slot. It likewise empowers urban communities to build up a completely progressed and smart transportation system for simple access to parking. This system will dodge wastage of fuel, thus less contamination and traffic blockage can be decreased. It assists drivers with finding empty parking spaces near them. Looking through the time of our proposed smart car parking system requires less contrast with some other existing system. It very well may be generally utilized in shopping centers and business structures or swarmed regions where countless individuals can share a parking area. This smart car parking system will diminish time-wastage, long lines, pressure, and increment the effectiveness of the parking system. Notwithstanding this, it expands wellbeing and gives a without hustle condition. It diminishes time utilization. So by actualizing our smart car parking system utilizing ultrasonic sensors we can deal with our time and vehicles can be left without any problem.

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BIOGRAPHIES OF AUTHORS

Mr. Rahman Atiqur received his Bachelor of Science (B.Sc) and Master of Engineering (M.Engg.) degree from the Department of Computer Science and Engineering at University of Chittagong, Chittagong, Bangladesh. In profession, he worked in the Department of Computer Science and Engineering, University of Chittagong, Bangladesh as an Assistant Professor since April 2016.Formar he was a lecturer in the Department of Computer Science and Engineering, University of Chittagong, Bangladesh. He is now conducting his Ph.D. research works under the Chinese Government Scholarships (CGS) Program at Chongqing University of Posts and Telecommunications, Chongqing, China. His current research interest lies in the field of edge computing based IoT systems.