

Automated smart car parking system using raspberry Pi 4 and iOS application

Rahman Atiqur¹, Yun Li²

^{1,2}Information and Communication Engineering, Chongqing University of Posts and Telecommunications, P.R. China

¹Computer Science and Engineering Department, University of Chittagong, Faculty of Engineering, Bangladesh

Article Info

Article history:

Received Jul 11, 2020

Revised Aug 8, 2020

Accepted Sep 14, 2020

Keywords:

IoT

LED

Power supply

RFID

Ultrasonic sensor

WIFI module

ABSTRACT

In interconnection and computerization of different physical gadgets, vehicles, home machines and different things, the internet of things (IoT) innovation plays a critical role. These objects associate and trade information with the assistance of s/w, different sensors, and actuators. A human's standard of life and method of living is improved with this computerization of gadgets, which is a forthcoming need. In this paper we talked about a comparable requirement for instance, a smart car parking features which empowers a client of discover a parking area and a free slot in that parking spot inside a city like Dhaka city in Bangladesh. This paper centers around lessening time squandered on discovering parking spot close by and continuous through the filled parking slots. This in whirl diminishes the fuel utilization and way of life. With the exponential increment in the quantity of vehicles and total populace step by step, vehicle accessibility and use out and about as of late, finding a space for parking the vehicle is turning out to be increasingly more troublesome with bringing about the quantity of contentions, for example, automobile overloads. This is tied in with making a dependable framework that assumes control over the undertaking of recognizing free slots in a parking zone and keeping the record of vehicles left extremely methodical way. The foreseen framework decreases human exertion at the parking region generally, for example, in the event of looking of free slots by the driver and figuring the installment for every vehicle utilizing parking area. The different advances engaged with this procedure are vehicle distinguishing proof utilizing RFID labels; free space discovering utilizing Ultrasonic sensors and installment count is done based on time of parking.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Rahman Atiqur,

School of Information and Communication Engineering,

Chongqing University of Posts and Telecommunications,

2 Chongwen Rd, Huangjueya, Nan'an District, Chongqing, 400065, P. R. China.

Email: bulbul.cse.cu@gmail.com

1. INTRODUCTION

Array of events turn up when we visit diverse open spots like multiplex film lobbies, 5-star and 7-star lodgings, shopping centers, and so on. The intricacy we meet at these spots is finding the accessibility of parking spot. Most extreme occasions we have to cross through various parking openings to locate a free space for parking. The situation gets drearier and tedious if the parking is multi-put away. This condition requires the requirement for a robotized parking framework that not just holds the manual inclusion to a least yet in addition directs parking in a given spot. Our foreseen framework tells an Autonomous vehicle leaving

that controls the quantity of vehicles that can be left in a given space at some random time dependent on the parking spot availability. At the passageway point, a vehicle will be halted at the primary door and the driver de-sheets the vehicle. Utilizing the iOS application on his iOS apparatus, the client can check the status of accessible parking spaces. The client arranges the vehicle to get left to the named opening, if the availability of parking spot is set. The vehicle follows its path to the section of the parking space. Here, it sits tight and the subtleties obligatory for leaving of vehicle at the correct opening are conveyed to the Car Control Unit. In the wake of getting the data, the vehicle will additionally follow its way to free parking space. On effective parking, the information on the LED will be refreshed by plan. For salvage reason, the client orders "Un-park", through the iOS Application. Subsequent to accepting of this SMS, the vehicle starts to follow back the path to the passage, where the vehicle driver is pausing. In this way, this framework ends up being convenient with the end goal of the vehicle leaving computerization and along these lines diminishes the vehicle driver's time, as the looking of the free parking spot is taken care of by the Parking Control Unit. There is a ton of fuel and time squandered by endless suburbanites to discover for a spot for parking. This turned into our key inspiration to build up a framework were suburbanites can get parking data on fingertips, since time spared is time earned. Radio frequency identification (RFID) is an extremely convenient innovation in computerization of vehicle leaving framework in a shopping center or building. It will by configuration deduct the sum from the RFID tag of vehicle holder and open the entryway for leaving and augmentation the counter of leaving. There is no sitting tight for manual preparing of the receipts they can pay either on the web or disconnected dependent on the client proportions.

Road Map: In Section 2 We talk about the implementation and methodology of existing and proposed system. Section 3 presents the research method of smart car parking systems. Section 4 gives our results and discussion of the proposed systems and Section 5 concludes the paper and also say the future scope of this works.

2. IMPLEMENTATION AND METHODOLOGY

Methodology demonstrates orderly approach to accomplish work. It is run of the mill strategy for portraying process, how it is done in least complex way. Configuration comprises of use of logical hypothesis, methodological data, and considerations for advancement of novel framework to do correct occupation in parking [1].

2.1. Existing system

In Bangladesh individuals are confronting an issue in leaving their vehicles like vehicles, bikes, and so on in a couple of days ago. There are numerous frameworks existing for leaving however they have a few merits just as demerits. One of the strategy for shrewd leaving framework depends on picture handling method which is significant expense and the client needs to scan every single opening for the free space [2-6]. A few techniques utilize the camera which will get harm in the stormy seasons. While scanning for the free openings in the stopping region part of time will be squandered. In this way, the framework is tedious. The clients need to remain in a line for taking care of the tabs which results are burning through heaps of time.

2.2. Proposed system

In the proposed framework, shown in Figure 1 we are utilizing the RFID reader tags and different parts which makes the proposed framework basic and useful. The clients are told with the free openings accessible in the stopping territory with the assistance of this framework. So, they can legitimately go to the free openings without burning through their time looking with the expectation of complimentary spaces [7-9].

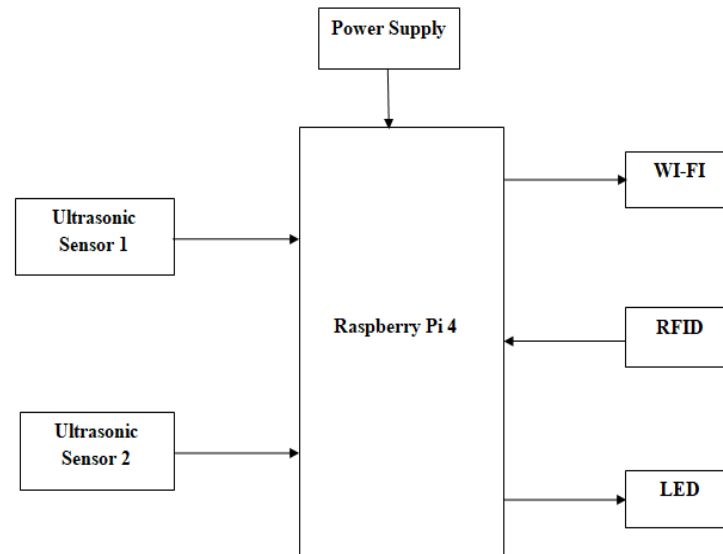


Figure 1. Block diagram of smart parking system (SPS) using raspberry Pi 4

In light of this the framework isn't tedious if the framework is utilized in 5-star lodgings the clients can invest more energy in the inns than in the stopping region [10]. Here we are not utilizing the cameras rather than cameras we are utilizing the sensors to know the accessibility of free spaces. In this framework there is no any harm by the climate conditions or others. The passage and leave time is noted through on the web and the bill is sent to the client. Client can take care of tab through on the web or by hand dependent on their convenience. The square graph shows the parts that are utilized in our proposed framework. The Raspberry Pi 4 [11] is the primary part which is utilized to associate the every single other segment, for example, Ultrasonic sensors, RFID, LED, WIFI module, Power flexibly. An ultrasonic sensor is essentially an electronic gadget which is utilized to distinguish the nearness of objects. Ultrasonic sensors are utilized for the free space discovery that are accessible in the stopping region which is sufficiently quick. RFID reader module is a gadget which sweeps and assembles the data from the RFID Card [12]. This card can be utilized to follow objects. As the vehicle enters the leaving territory, the client checks the RFID card and all the data put away in card is moved to the administrator through this module [13]. Driven is utilized for the showcase of the free openings. The clients can ready to see the LED is they can continue with the online data through WIFI module [14]. WIFI module is utilized for the correspondence between the proprietor of the stopping territory and the client. Force gracefully turns on the Raspberry Pi 4 gadget in these frameworks [15, 16]. Below are the steps that a driver needs to follow in order to park its car using our iOS Application:

- Step 1: Mount the savvy stopping application on your iOS gadget.
- Step 2: With the assistance of this application chase for a stopping territory close by your end.
- Step 3: Pick a specific parking space.
- Step 4: Surf through the different stopping openings available in that parking space.
- Step 5: Pick a specific stopping opening.
- Step 6: Pick the measure of time (in hours) for which you might want to leave your vehicle for.
- Step 7: Pay the stopping accuses both of your e-wallet or your Mastercard and by hand.
- Step 8: Once you have viably left your vehicle in the chose leaving opening, affirm your inhabitation utilizing the iOS application.

The previously mentioned strategy for booking a space and leaving a vehicle in that very opening is clarified with the assistance of the accompanying screen captures [17].

The Figure 2 delineates the nearness of empty and involved stopping openings with the assistance of red and green shading. For this situation stopping openings named A1 and A3 are empty while space A2 is possesses. The driver picks the A1 stopping space and the Figure 3 delineates the situation when a driver needs to determine the measure of time for which it needs the chose stopping opening. For this situation the driver chooses the 1 hour choice and Once the driver has left its vehicle in the chose opening it needs to affirm its inhabitation. Figure 4 delineates this very situation wherein the driver needs to determine its essence. This component is included with the goal that solitary an authentic driver can leave its vehicle in a

specific leaving opening. On the off chance that a driver neglects to affirm his inhabitation in the following 60 seconds of leaving its vehicle, an alert would begin ringing making the specialists realize that a vehicle has been left in an inappropriate spot. On the off chance that by any possibility a certifiable driver comes up short do so he can stop the alert whenever by affirming his inhabitation.

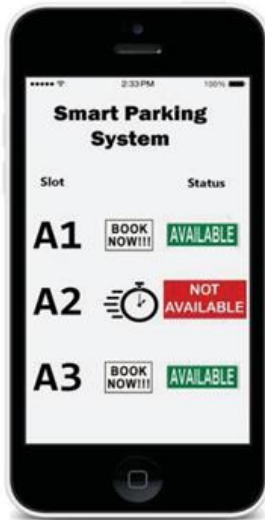


Figure 2. Booking a parking slot



Figure 3. Selecting the amount of time



Figure 4. Occupancy check

In the event that the driver over shoots its stopping time, a warning expressing this situation would be sent to the driver just as to the stopping orderly. The driver would then have a choice of broadening its stopping time and pay in like manner for the additional time. In the event that the driver neglects to do as such, the stopping chaperon would make a note of this and charge cash for the additional time in type of a fine. This fine would be gathered from the driver when the vehicle would leave from the leaving region.

3. RESEARCH METHOD

At present there has been a fabulous increment in the populace. Where there is a swell in individuals consequently there is growing in the vehicle taking care of. In such cases there is an interest for vehicle parking and it's an emergency in numerous spaces. There are many parking regions to be had in which the clients need to chase for the free opening to park their vehicles. For the most part, these are time overpowering practice and the client may get annoyance while testing for the spaces. This paper presents a simple and valuable plan for parking the vehicles, for example, cars, bikes and so on. In this paper, we are utilizing Ultrasonic sensors to recognize the free spaces accessible in the parking area. This data is direct spoken with the client through the WI-FI module or they can see the data in the LED which is situated in the parking garage.

4. RESULTS AND DISCUSSION

The free spaces recognition is done through the ultrasonic sensors and this data is send to the proprietor. The proprietor of the stopping territory speaks with the client through WI-FI module about the accessibility of spaces in the stopping zone. Through this data the client can leave their vehicle straightforwardly in the free spaces without burning through their time. The sum as indicated by the use of the stopping region is send to the client through the WIFI module.

5. CONCLUSION AND FUTURE SCOPE

In the proposed framework, the execution of an automated car parking framework told by iOS Application is effectively talked about. The parts utilized for the usage of the framework give proficient yield at different phases of execution. The interfaces set up between different segments give a compelling correspondence over the general working of the framework. Accordingly, the framework working is effective

and is suggested for business usage. In future, certain progressions can be fused according to the prerequisites of the associations executing the framework. They are: - Search of free stopping spaces can be improved utilizing binary or hash search. Framework can be stretched out to staggered and numerous stopping territories by rolling out possible improvements in the equipment arrangement. SMS sent through iOS Application can be made secure by applying encryption calculations. Additionally, for security reason, Login office can be given to the clients.

REFERENCES

- [1] Prasanth, M., K. S. Roshini, T. Pujitha, C. Sai Thanusha, C. Sai Mahesh, M. Purushotham Rao, and P. Rajesh, "Design and Implementation of Smart Parking System Based on Raspberry Pi Advanced Microcontroller System," *Journal of Interdisciplinary Cycle Research*, vol. XII, no. VI, pp. 960-965, 2020.
- [2] R. Yusnita Fariza Norbaya Norazwinawati Bashruddin, "Intelligent parking space detection system based on image processing," *International Journal of Innovation, Management and Technology*, vol. 3, no. 3, pp. 232-235, 2012.
- [3] Hamada R.H. Al-Absi Patrick Sebastian Justin Dinesh Daniel Devaraj Yap Vooi Voon, "Vision-based automated parking system," *10th International Conference on Information Science, Signal Processing and their Applications (ISSPA 2010)*, pp. 757-760, 2010.
- [4] M.M. Rashid A. Musa M. Ataur Rehman Farhana A. Farhana, "Automatic parking management system and parking fee collection based on number plate recognition," *International Journal of Machine Learning and Computing*, vol. 2, no. 2, pp. 93-98, 2012.
- [5] M.O. Reze M.F. Ismail A.A. Rokoni M.A.R. Sarkar, "Smart parking system with image processing facility," *International Journal of Intelligent Systems and Applications*, vol. 4, no. 3, pp. 41-47, 2012.
- [6] Amba James Garba Adamu Murtala Zungeru, Adamu Murtala Zungeru, "Design and implementation of a short message service based remote controller," *Computer Engineering and Intelligent Systems*, vol. 3, no. 4, pp. 106-119, 2012.
- [7] Thanh Nam Pham, Ming-Fong Tsai, Duc Bing Nguyen, Chyi-Ren Dow and Der-Jiunn Deng, "A cloud-based smart-parking system based on internet of things technologies," *IEEE Access*, vol. 3, pp. 1581 1591, 2015.
- [8] Renuka R. and S.Dhanalakshmi, "Android based smart parking system using slot allocation reservations," *ARPN Journal of Engineering and Applied Sciences*, vol. 10, no. 7, pp. 3116-3120, 2015.
- [9] Sushil Palande, Surekha Gangurde, AkshayPote, "Automatic Pay And Park System," *International Journal of Scientific and Research Publications*, vol. 5, no. 5, pp. 1-4, 2015.
- [10] Ggyu Gunasekara, Adai Gunasekara and Rps "A Smart Vehicle Parking Management Solution," *Proceedings of 8th International ResearchConference, KDU, 2015*.
- [11] Baratam MKumar Gandhi and M.Kameswara Rao, "A prototype for IoT based car parking management system for smart cities," *Indian Journal of Scienceand Technology*, vol. 9, no. 17, pp. 1-6, 2016.
- [12] Pooja Sanjay Pagar, Tabassum Jalal Khan, P. R. Ghodekar, M. R. Bhadange, V. Salve, "Smart car management system using raspberry Pi," *International Journal of Advanced Research in Engineering Management (IJAREM)*, vol. 1, no. 9, pp. 225-230, 2015.
- [13] Zeyd in Pala , Nihat Inanc, "Utilizing RFID for smart parking applications," *Facta Universitatis Series: Mechanic al engineering*, vol. 7, no. 1, pp. 101-118, 2009.
- [14] RakhiKalantri, Anand Parekar, Akshay Mohite, Rohan Kankapurkar, "RFID based toll collection system," *International Journal of Computer Science and Information Technologies*, vol. 5, no. 2, 2582-2585, 2014.
- [15] Vishwanath Y., Aishwarya D. Kuchalli, Debarupa Rakshit, "Survey paperon Smart Parking System based on Internet of Things," *International Journal of Recent Trends in Engineering and Research (IJRTER)*, vol. 2, no. 03, 2016.
- [16] Ahmed Yaseen Mjhoool, Ali Abbas Al- Sabbagh, Ruaa A. Saeed Alsabah, "Smart Parking techniques based on internet of things," *Journal of Networks and Telecommunication Systems*, vol. 1, no. 1, pp. 1-10, 2015.
- [17] Khanna, Abhirup, and Rishi Anand, "IoT based smart parking system," In *2016 International Conference on Internet of Things and Applications (IOTA)*, pp. 266-270, 2016.

BIOGRAPHIES OF AUTHORS

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. Former 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.



Yun Li is a professor of Electrical Engineering in College of Communications, Chongqing University of Posts and Telecommunication, China. His research interests include mobile cloud computing, cooperative/relay communications, green wireless communications, wireless ad hoc networks, sensor networks, and virtual wireless networks. He (co-)authored more than 150 journal/conference articles. He is the Executive Associate Editor of Elsevier/CQUPT Digital Communications and Networks (DCN). He is on the editorial board for IEEE Access and Wiley Security and Communication Networks. He served as co-chair for ChinaCom 2010 WCN symposium, IEEE RWS2011 DSPAW symposium. He has also served as a TPC member for numerous conferences including IEEE GLOBECOM, IEEE WCNC, WiCON, CNC2012, WOCC, IWCMC, and WiCOM. He received his Ph.D in communication engineering from University of Electronic Science and Technology of China.