

IOT Based Smart Parking System Using Node MCU with FCFS Priority Scheduling

Garvit Gupta, Prateek K. Singhal, Aditya Pareek, Dhruv Bansal, Kartiki Kapoor, Devik Rathore

Electrical Engineering Department, Swami Keshvanand Institute of Technology,
Management and Gramothan Jaipur, Rajasthan 302017 (India)

Email: garvit.gupta@skit.ac.in, prateek.singhal@skit.ac.in, adityapr001@gmail.com,
bansaldhruv20032003@gmail.com, kapoor27k@gmail.com, devikrathore123@gmail.com

Received 30.01.2026 received in revised form 06.04.2026, accepted 10.04.2026

DOI: 10.47904/IJSKIT.16.1.2026.63-66

Abstract- In this research paper, we are applying an efficient method for solving the vehicle parking problem of a large crowded city contingent upon demand for number of available parking slots because we know that the transport systems in urban areas are significantly affected by inadequate parking just as it results in fuel wastage, traffic jams, noise pollution and raising air pollution. To overcome these situational challenges, this paper proposes an internet of things (IoT) related smart parking system using First-Come-First-Serve (FCFS) priority scheduling mechanism to keep efficient allocation of the parking space. The current status of parking slots is obtained through the use of sensor-based detection and cross-correlation to a central control system. The use of IR sensor-based detection units for obtaining real-time parking slot status helps to ensure that all vehicle parking slots are assigned in the order in which vehicles arrive and to reduce potential conflicts and ensure balance use of available resources. The proposed approach eradicates the threat of constraints and has the ability to reduce the amount of computational processing time required for real-time calculation. This model demonstrates the utility of smart city applications by providing an easily scalable, transparent and cost effective parking management solution which is consistent with the objectives of a smart city.

Keywords- Internet of things, Smart parking, Real-time Slot allocation, FCFS75655 Algorithm, Automated Parking Management smart cities, FCFS.

1. INTRODUCTION

The ever-increasing numbers of vehicles, especially in urban areas have made managing these parking a serious problem for the growing cities. Traditional parking systems rely on human surveillance or even fixed signage, which do not necessarily offer real-time accurate information to drivers. Hence, the vehicle wastes much time looking for an empty bay and causes a problem of traffic jam, fuel economy degradation, as well as inconvenience in driving. These constraints require the automation and intelligence of parking systems.

In recent years, the internet of things (IoT) has made it possible for real-time monitoring of sensors in parking spaces. During recent years, research [1- 3] existing sensors; wireless communication module and cloud-based have been studied to be used in detecting presence of vehicles to present the parking availability. Other techniques include mobile applications that allow users to reserve a parking space in advance through a wireless connection to reform user experience.

Parking models based on reservation could lead to poor use of space when the reserved slots remain empty. Meanwhile, other complex processing programs and systems that depend on time and implementation costs also exist. To mitigate the problems, this paper presents the IoT-based smart parking system with FCFS policy unlike existing centralized mesh or simulation-oriented methods, that use logical control to dynamical determine parking allocation, the system proposed is a purely reliable and always based on FCFS assignment of parking spaces. A number of advantages are provided by the proposed system such as fair slot distribution, less system latency, lower implementation complexity as well as increased parking throughput. As it discourages the hoarding of slots as well as idle space condition which in turn improve overall parking efficiency.

To provide enough power to the components we are using two lithium ion cells of 3.7 volt and 2000mAh. This way 7.4 volt in total is provided. Since the components are rated at 5 volt, so to step-down the voltage to 5 volt we are using regulator (LM7805) to give power to single sided PCB for Microcontroller and LCD and Buck Converter (LM2596) to provide power to IR sensors.

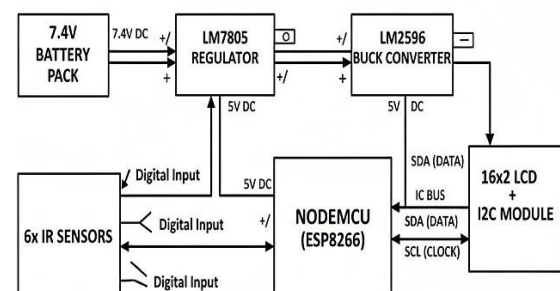


Figure 1: Block Diagram

Regulator LM7805 and Buck Converter LM2596 are linear monolithic integrated circuits that are used to step-down voltage from 7.4 volt to 5 volt. They are capable of excellent line and load regulation driving 3A load.

Three capacitors are used to provide protection to the regulator LM7805. These capacitors are rated at 1000 μ f, 470 μ f and 0.1 μ f respectively. They are connected in parallel with the regulator LM7805. A 2.7k ohm resistor is also used to provide stability to the system.

Two single pole single throw (SPST) switches are used. One is used as sensor switch for IR sensors and other one is used as main switch for main single sided PCB giving power to microcontroller and LCD module. Two switches are used to reduce the load on the cells.

2. CIRCUIT STRUCTURE

Two standard Lithium-ion cells (3.7 volt each) are used to give power supply of 7.4V DC. This 7.4V is used to power the circuit. Main switch and Sensor switch are used to reduce the load on cells on the same time. Regulator LM7805 and Buck converter LM2596 are used to stabilize the supply to rated 5V DC. Three capacitors are used as protection for regulator LM7805 in case of any instability in supply.

Regulator LM7805 is connected on single-sided PCB to provide regulated supply to Node MCU microcontroller and LCD module. Pin D1 and D2 of microcontroller are used as SDA (series data) and SCL (serial clock) pins respectively.

Each sensor is connected in parallel to the Microcontroller chip where each sensor's VCC and Ground pins are connected to a common power rail. Buck converter is used to provide regulated stable power supply of 5V to the IR sensors. VCC and Ground pins of sensors are connected to the buck converter.

Sensor's data pins are routed to Node MCU via separate output pin from sensors to GPIO pins (D0, D3-D7) of Node MCU microcontroller.

To minimize the pin usage, we are interfacing the LCD using an I2C module, where controller's SDA and SCL lines are utilized. The jumper button is connected to the I2C module

The Arduino integrated development environment is used to develop the firmware for the Node MCU. A coding is done into the microcontroller to ensure and continuously check the status of the IR sensors.

3. METHODOLOGY

This kind of IoT-based model shows a Smart Parking Model that uses Node MCU and gives preference according to FCFS.

There are four steps:

- Hardware Integration,
- Software implementation,
- System design
- Preference based slot allocation.

A Vehicle presence can be found by using IR and ultrasonic sensors. And each sensor is connected to the node MCU. This is why it works as a central controller and communication unit. An interface is subjected to shows the status of parking slots (available or not) and to allow vehicles according to FCFS.

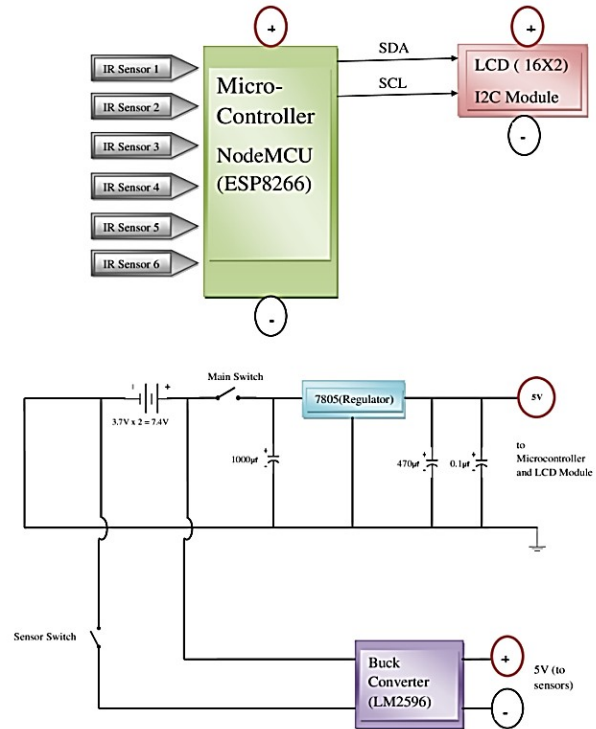


Figure 2: Circuit Diagram

Hardware Integration:

1. Data can be fed using microcontroller (in built Wi-Fi).
2. IR / Ultrasonic Sensors: Vehicle occupancy can be found by using these sensors.
3. LED Indicators: It consists of two indicators green-available and red-occupied.
4. Power Supply: It helps to provide the voltage to the system components.
5. The LM2596 buck converter steps down the input voltage from 7.7V to the desired 5V output.

Software Implementation: In this Sensor data is monitored continuously, so it could be sent to the cloud and has this is the first come first serve system so that the scheduling logic is working has the controller or server to properly assign the parking slots to everyone.

Slot Allocation on Priority-based: In this, the algorithm itself gives parking slots in other vehicles, which is arrived at the entrance of the parking after this, every following vehicle has its own timestamps, whenever it's request entry by this vehicle automatically allocated the nearest available slot.

4. WORKING

How the IoT-based smart parking system works, step by step:

1. Vehicle Detection: The install sensor at different places can tell if a vehicle is there or not when it arrives at the parking area.
2. Data Acquisition: The node MCU gets the sensor data and shows that the information has been processed in real time.
3. FCFS-Based Slot Allocation: It also note the time of the vehicle arriving and tells that the nearest parking space available or not because it is based on FCFS.
4. Slot Occupancy Update: The system updates the status of the slot after the vehicle is parked and the sensors ensure that it is occupied or not.
5. Handling Vehicle Exit: When the Vehicle leaves the slot, it hits the sensor to let it know that there is a vacancy available.

Key Advantages:

- It helps to reduce the burden in the parking area.
- It ensures fair & reliable operation for everyone.
- Our model gives latest updates about vacant & occupied spaces in the parking area.

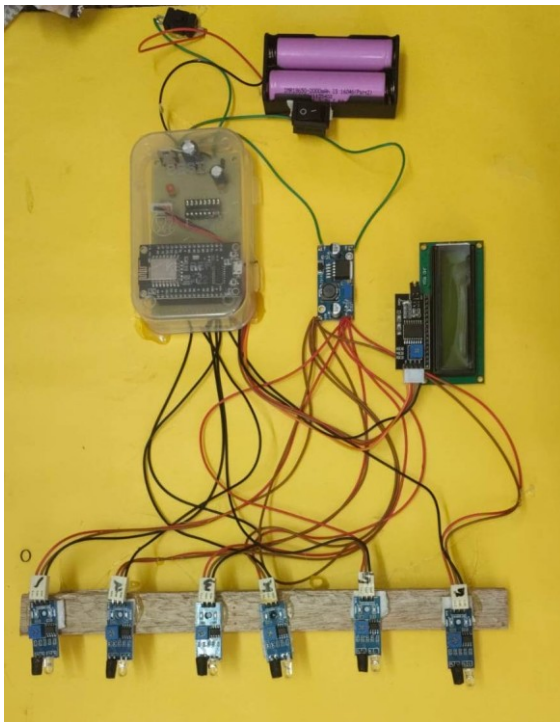


Figure 4: Physical view of Project

5. RESULTS AND DISCUSSION

The smart parking model is successfully designed & demonstrated. The Vehicle Occupancy is detected in particular parking places by using Infrared sensors, after that resultant data is sent to Node MCU for further decision.

The user interface shows automated updates of vacant and full parking spaces, so people can check if there is a space available or not before they entering the parking area.

Overall, the results show that the proposed IoT smart parking solution is efficient and scalable and is capable of enhancing parking management through automation and real time monitoring.

This smart parking model encourages and motivates people to effectively use modern technology, helping them save time by eliminating the need to queue.

It also promotes tourism at tourist destinations by improving parking facilities.

6. CONCLUSION

In this study a FCFS technique is used to develop and implement an IoT followed smart parking system in Node MCU. The device addresses parking problems such as space scarcity, jam-packed and time waste by serving information dynamically and automatically assigning slots.

Combining the IR sensors with Node MCU microcontroller provided precise measurement of vehicle detection and data processing.

Wireless experimental results shows that the model is reliable, economic efficient, and well for small and medium space parking. It is designed in a way that easy upgrade can be done for adding more slots or features like mobile application, payment systems etc.

In conclusion, the developed IoT followed smart parking system offers a feasible and effective solution for contemporary parking system that can promote to a development of smart city infrastructure by improving space utilization as well as user convenience.

An IoT-based smart parking model greatly improves the tourism experience by reducing the time spent searching for parking and minimizing traffic congestion at popular destinations. It enhances visitor satisfaction through real-time availability updates and efficient space management. Overall, it supports sustainable tourism by lowering fuel consumption and reducing environmental impact.

7. REFERENCES

- [1]. W. Li, "Design of smart campus management system based on Internet of Things technology," *Journal of Intelligent and Fuzzy Systems*, vol. 40, no. 2, pp. 3159–3168, 2021.
- [2]. H. Zhang and X. Lu, "Vehicle communication network in intelligent transportation system based on Internet of Things", *Computer Communications*, vol. 10, pp. 799–806, 2020.
- [3]. A. Hanna and R. Anand, "IoT based smart parking system," in *Proceedings of the International Conference on Internet of Things*, Pune, India, 2016.
- [4]. F. Bock, S. Di Martino, and A. Origlia, "Smart parking: Using a crowd of taxis to sense on-street parking space availability," *IEEE Transactions on Intelligent Transportation Systems*, vol. 21, pp. 496–508, 2020.
- [5]. G. Ali, T. Ali, and M. Irfan, "IoT-based smart parking system using deep long short-term memory network," *Electronics*, vol. 9, no. 10, p. 1696, 2020.
- [6]. S. N. Ghorpade, M. Zennaro, and B. S. Chaudhari, "GWO model for optimal localization of IoT-enabled sensor nodes in smart

- parking systems,” IEEE Transactions on Intelligent Transportation Systems, 2020.
- [7]. Y. Allbadi, J. N. Shehab, and M. M. Jasim, “Smart parking system using ultrasonic sensors,” IOP Conference Series: Materials Science and Engineering, vol. 1076, 2021.
- [8]. P. Scully, 11% of Global Public Parking Spaces Are Now ‘smart’ – New Report Finds, IoT Analytics, 19-Dec-2018 [Online]. Available: <https://iot-analytics.com/smart-parking-market-report-2019-2023/>. (Accessed 10 October 2022).
- [9]. Mohamed A. Ahmed, R. Mohamed, El-Sharkawy, Young-Chon Kim Remote monitoring of electric vehicle charging stations in smart campus parking lot Journal Of Modern Power Systems And Clean Energy, 8 (1) (January 2020), 10.35833/MPCE.2018.000502 A. Khanna, R. Anand.
- [10]. IoT based smart parking system 2016 International Conference on Internet on Things, Maharashtra Institute of Technology, Pune, India (2016).
- [11]. T.V. Roja, N. Sandhya, Ashwini, Harshitha Bedre Smart parking system using IoT International Journal of Advance Research, Ideas and Innovations in Technology (2018).
- [12]. F. Bock, S. Di Martino, A. Origlia Smart parking: using a crowd of taxis to sense on-street parking space availability IEEE Trans. Intell. Transport. Syst., 21 (2020), pp. 496-508.
- [13]. Denis Ashok, Akshat Tiwari, and Vipul Girje, “Smart Parking System using IoT Technology”, IEEE, 27 April 2020.
- [14]. Tharun Bhupathi, Abhilash Chittala, Durga Prasad Alakunta, “INTELLI Parking System using Internet of Things”, Reliability Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO) 2021 9th International Conference on, pp. 1-6, 2021.
- [15]. Adil H., Abderrahim M. And Larbi H., “Designing And Managing A Smart Parking System Using Wireless Sensor Networks”, Journal Of Sensor And Actuator Networks, 2020.