International Journal of Research In Vocational Studies (IJRVOCAS)
Vol. 5, No. 1, April 2025, pp. 25~30
Print ISSN 2777-0168| Online ISSN 2777-0141| DOI prefix: 10.53893
https://journal.gpp.or.id/index.php/ijrvocas/index

Rotary Parking Design Using DC Motors with RFID and IoT-Based Monitoring (Internet of Things) Via Telegram

Nurhaida* & Indah Susanti

Department of Electrical Engineering, Sriwijaya State Polytechnic, Srijaya Negara Street, Palembang, Indonesia.

Email address:

t.nurhaida6@gmail.com
*Corresponding author

To cite this article:

Susanti, I., & Nurhaida. (2025). Rotary Parking Design Using DC Motors with RFID and IoT-Based Monitoring (Internet of Things) via Telegram. *International Journal of Research in Vocational Studies (IJRVOCAS)*, 5(1), 25–30. https://doi.org/10.53893/ijrvocas.v5i1.399

Received: 02 17, 2025; **Revised**: 03 20, 2025; **Accepted**: 04 12, 2025; **Published**: 04 25, 2025

Abstract: Parking in dense urban areas is a big challenge because the increase in the number of vehicles causes a shortage of parking spaces, congestion and air pollution. As the number of vehicles increases, parking space is needed to accommodate many vehicles. Limited land often results in illegal parking which has a negative impact resulting in traffic jams. Rotary parking is one solution to maximize the use of limited parking space more efficiently. To move rotary parking, a DC motor is needed. In this rotary parking design, which has a capacity of 20 kg, a DC shunt wiper motor with a power capacity of 10-50 watts, 12VDC, and a current of 1-4 Ampere was chosen. This system is equipped with RFID technology to ensure safe vehicle access. The test was carried out eight times with gradual loads ranging from 16.5 kg to 20 kg. The results show that the tool can work well at each stage, with output power ranging from 14.46 watts at a load of 16.5 kg to 12.76 watts at a load of 20 kg. In conclusion, this rotary parking system can work as expected, efficiently handling the carload and a total load of 20 kg, as well as providing additional security using RFID and easy monitoring via IoT.

Keywords: Rotating parking, Design, DC motor

Introduction

Parking is a condition where a vehicle stops and is abandoned. Along with the development of technology, the number of car drivers is increasing, which in turn requires the construction of parking lots to accommodate many vehicles. The limited parking space is what often results in illegal parking on the sidewalk and even on the shoulder of the road which has a negative impact on traffic and road user safety, especially congestion. This limited land must maximize the existing land, namely by building a parking lot with a rotary parking system.

Rotary parking, also known as rotary parking, is considered a solution to the challenge of limited parking space in dense urban areas. By utilizing technology, rotary parking allows cars to be parked in a rotary fashion on specially designed structures. The main advantage of rotary parking is its more efficient use of land. Compared to traditional horizontal parking, which requires a larger and more spacious lot. Moreover, the rotary parking system is equipped with the use of RFID and IoT monitoring.

Rotary parking using RFID and IoT monitoring systems can solve the increasingly complex parking problems in crowded cities. In this case, RFID technology enables fast and

accurate vehicle identification. In addition, the IoT monitoring system provides additional benefits. With sensors connected to the IoT network, real-time information about parking availability can be monitored and managed more efficiently. The data collected from the IoT system can also be analyzed to improve future parking management strategies. In the design of this rotary parking device, component selection is very important. One of the main components is the DC motor used to drive the parking mechanism. The selection of DC motors is based on several factors such as power, torque, speed, and efficiency. The DC motor was chosen for its ease of speed and direction control, as well as its ability to provide enough torture to lift and rotate the vehicle.

1. Methodology

The data collection technique used is documentation and recording in the table that has been made, this technique is carried out by measuring and calculating the data obtained from the tools that have been made. The machine that has been made can be seen in the picture below.

Figure 2.1 Rotary Parking

1.1. Rotary Parking Working Principle

Rotary parking is an automatic parking system that works by rotating the parking lot so that vehicles can be placed or taken more efficiently. This system uses several main components such as a 12VDC wiper motor to move the parking lot up and down, an RFID reader to read RFID cards or tags as access to and identification of parking slots, a limit switch to detect the position of the parking lot and count the number of slots passed, and a servo motor to open or close the parking gate. The way it works starts with the user attaching the RFID card to the RFID reader. The RFID reader will read the identity of the card and match it with the available parking slot data. The wiper motor then rotates the parking lot until it finds the appropriate slot. The limit switch detects the number of slots passed to ensure the identity match. If the RFID card matches, the parking space stops at the designated position, and the door bar opens to allow the vehicle to be parked. After the user exits, the door bar closes again. When the user wants to retrieve the car, the same RFID card is used to rotate the parking space to the vehicle position, open the bar, and allow the car to be retrieved.

The DC motor used in this system works by converting electrical energy into mechanical energy through the interaction of magnetic fields to produce motion. In the process, the wiper motor is connected to a gearbox and chain that drives the gears, allowing the parking lot to rotate smoothly. The system offers various advantages, such as time and labor efficiency as the parking and vehicle retrieval processes are automated, as well as enhanced security with RFID technology that only allows registered users access. Ease of use is also a plus, where users can simply use an RFID card and can monitor real-time parking information through the Telegram app. In addition, the system features IoT-based surveillance to monitor parking activities in real time and enable quick response to emergency situations or technical issues. With integrated technology, rotary parking is a modern solution that is safe, fast, and convenient for parking needs in the digital era.

1.2. Block Diagram

Rotary Parking System design using RFID equipped with IOT-based monitoring (internet of Things). Power supply is used for power input to the load circuit. The power supply used with the switching type has an output value of 12VDC and 15A. Power Supply will be connected to the window wiper motor and connected to the power supply then to reduce the 12VDC voltage to 5VDC which will supply voltage to the RFID sensor, LCD, 16x2, Limit switch, and servo motor. Block diagram of the RFID sensor as input data to the Arduino Uno R3 in a way that when the ID Card is brought closer to the RFID module, the RFID will read the serial ID on the card, then processed by Arduino Uno R3, if the serial ID has been registered then Arduino Uno R3 will send a signal to move the window wiper motor to rotate the empty parking elevator or will take the car then the 16x2 LCD will display the number of empty parking elevators or will take the car. Block diagram of LCD 16x2 to display data on the number of parking lifts that are empty. The servo motor block diagram is used to move the opening and closing of the parking bar. Block diagram of the limit switch sensor to calculate data and the number of car entries and car exits. Block diagram of ESP8266-01 as a data sender for the amount of parking to the telegram carried out by car users by using communication via arduino uno R3.

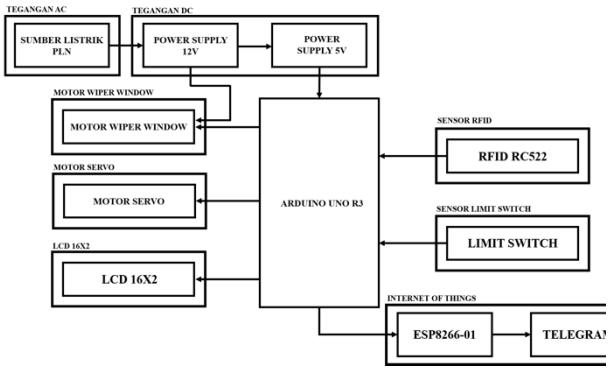

Figure 2.2 Circuit Block Diagram

1.3. Tools and Materials

In designing a rotary drive system with a load weighing 20 kg, a large gear with a diameter of 7 cm is required, the average chain rotational speed is between 20 rpm, so the motor specifications used can be seen in the table below.

Table 1. Specifications of Motor DC

Name	*Description*
Factory Serial Number	85110 – BZ010
Model Number	TG159200 - 7440
Voltage	12 V
Power	10 – 50 W
Place of Origin	China (mainland)
Current	1 – 4 A
Brand Name	DENSO
Model	Mitsubishi L300
Motor	Brush
Type	Motor DC Shunt
Certificate	ISO9001

The following are some of the components used in designing system devices.

Table 2. System Device Components

Name	*Quantity*
Arduino Uno R3	1 piece
Esp8266 Module	1 piece
DC Wiper Motor	1 piece
Servo Motor	1 piece
Relay Module	1 piece
Stepdown Module	1 piece
DC Light	2 pieces
RFID	1 piece
Power Supply	1 piece
Limit Switch	1 piece
On/Off Button	2 pieces
PCB Board	1 set

2. Discussion

This functional testing is done by running the entire system. The program is run to command the motor in an on or on condition as shown in the table below:

Table 3. Measurement Results

No.	Load Total	Current (Ampere)	Voltage (V)	Rpm (N)
1	No car 16 Kg	1.31	12.20	25.7
2	1 Cars 0.5 Kg (without 16 Kg car load)	1.37	11.84	24.4
3	2 Cars 1 Kg (without 16 Kg car load)	1.43	11.73	23.8
4	3 Cars 1.5 Kg (without 16 Kg car load)	1.47	11.55	22.2
5	4 Cars 2 Kg (without 16 Kg car load)	1.53	11.44	21
6	5 Cars 2.5 Kg (without 16 Kg car load)	1.56	11.72	20.2
7	6 Cars 3 Kg (without 16 Kg car load)	1.58	11.59	19
8	7 Cars 3.5 Kg (without 16 Kg car load)	1.65	11.41	18.4
9	8 Cars 4 Kg (without 16 Kg car load)	1.69	11.43	17.2

To achieve output power, the torque current value and the angular velocity/omega value are required. by multiplying the torque value by omega, the output power of each load test is obtained.

Table 4. Output power based on calculation

No.	Load Total	P_{in} (Watt)	Torsi (Nm)	P_{out} (Watt)
1	No car 16 Kg	15.98	5.5	14.48
2	1 Cars 0.5 Kg (without 16 Kg car load)	16.22	5.65	14.46
3	2 Cars 1 Kg (without 16 Kg car load)	16.52	5.83	14.41
4	3 Cars 1.5 Kg (without 16 Kg car load)	17.01	6.00	13.95
5	4 Cars 2 Kg (without 16 Kg car load)	16.95	6.17	13.58
6	5 Cars 2.5 Kg (without 16 Kg car load)	18.28	6.34	13.42
7	6 Cars 3 Kg (without 16 Kg car load)	18.31	6.51	13.97
8	7 Cars 3.5 Kg (without 16 Kg car load)	18.83	6.68	12.89
9	8 Cars 4 Kg (without 16 Kg car load)	19.32	6.86	12,76

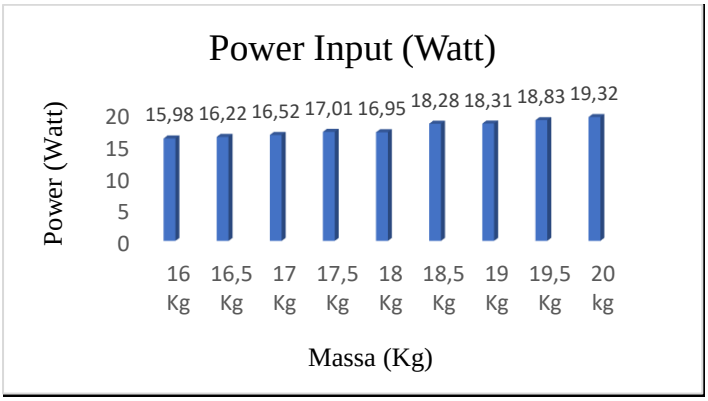

Figure 3. 1 Power Input (Watt)

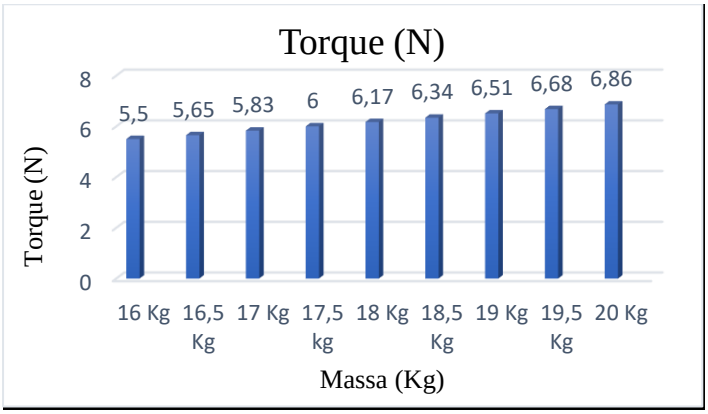

Figure 3. 2 Torque (N)

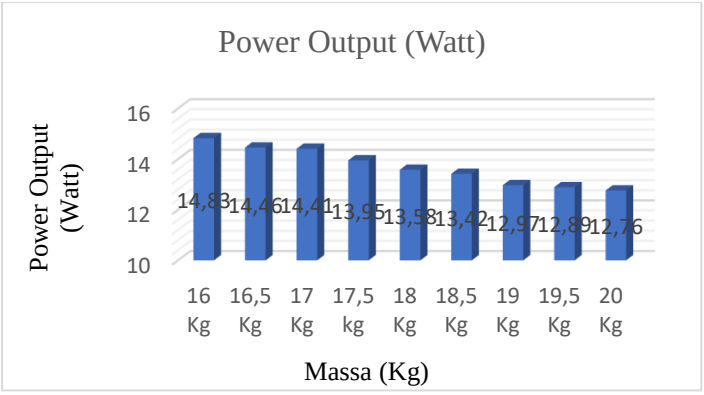

Figure 3. 3 Power Output (Watt)

When the load without a 16 Kg car, the input power data is 15.98 watts, the torque is 5.5 Nm and the output power at a load of 14.83 watts. When the load is 16.5 Kg, the input power data is 16.22 watts, the torque is 5.65 Nm and the output power at the load is 14.46 watts. At the time of load 17 Kg obtained 16.52 watts, torque of 5.83 Nm and output power at a load of 14.41 watts. At the time of load 17.5 Kg obtained 17.01 watts, torque of 6.00 Nm and output power at a load of 13.95 watts. When the load is 18 Kg, the input power data is obtained at 16.95 watts, the torque is 6.34 Nm and the output power at a

load of 13.42 watts. When the load is 18.5 Kg, the input power data is 18.28 watts, the torque is 6.34 Nm and the output power at the load is 13.34 watts.

When the load is 19 kg, the input power data is 18.83 watts, the torque is 6.68 Nm and the output power at load is 12.89 watts. When the load is 20 kg, the input power data is 19.32 watts, the torque is 6.86 Nm and the output power at load is 12.76 watts.

It can be analyzed from the graph that for motor power from a load of 16 kg with 15.98 watts to 20 kg there is a significant increase, up to 19.32 watts. From the torque produced by the motor when the load of 16 kg is 5.5 Nm, there is an increase when the motor load is added up to 20 kg of 6.86 Nm, at a load of 20 kg this motor has produced maximum torque because the maximum torque on this motor. From the power generated by the mechanic or mechanic at a load of 16 kg is 14.83 watts, there is a decrease during testing up to a load of 20 kg of 12.76 watts.

3. CONCLUSION

Based on the results of the research that has been carried out, it can be concluded as follows:

1. The rotary parking device was successfully designed by integrating RFID technology to ensure safe and fast vehicle identification. The use of IoT-based monitoring through telegram applications can monitor and control remotely in real time.
2. Based on load calculations, this motor can transport loads efficiently. The calculation results show that to operate the rotary parking tool requires a power of 20 Watt, a torque of 6.86 Nm, and the motor can lift loads between 16 Kg to 20 kg.
3. Rotary parking tool is able to work with a maximum overall load of 20 kg. The value of torque increases with the greater the load given to the rotary parking tool, where at a load of 16 kg the torture is 5.5 Nm and at a load of 20 kg the torque is 6.86 Nm. The initial mechanical power generated is large but as the load increases the mechanical power decreases, the decrease in mechanical power from 14.83 watts to 12.76 watts is about 14.02% from 16 kg to 20 kg load, with data on 16 kg load mechanical power of 14.83 watts and at 20 kg load mechanical power of 12.76 Watt.

Acknowledgements

The researcher sincerely thanks everyone who supported the data collection and research process. Appreciation is also given to those whose work served as references. Hopefully, this study benefits a wide audience.

References

[1] M. Rusdi, F. N. Hulu, M. S. H. Daulay, R. R. Wirasari, R. R. W. Safety, and M. System, "Worker Safety Monitoring System in the Telecommunications Industry Based on the Internet of Things Email address : To cite this article :," vol. 4, no. 4, pp. 67–72, 2025.

[2] Ismael, A. A. Siregar, and D. C. Sari, "Design Smart Classroom Based IoT at SMP Ali Bin Abi Tholib," *Int. J. Res. Vocat. Stud.*, vol. 3, no. 4, pp. 89–94, 2024, doi: 10.53893/ijrvocas.v3i4.35.

[3] Nofiansah, Y. Marniati, Rumiasih, S. Yahya, H. Yani, and P. A. Bofynna, "Monitoring Tool for Electricity Usage in Residential Homes Based on the Internet of Things (IoT) Using BLYNK Application," *Int. J. Res. Vocat. Stud.*, vol. 3, no. 3, pp. 32–40, 2023, doi: 10.53893/ijrvocas.v3i3.226.

[4] R. Arundaa and W. W. Kalengkongan, "Smart Canary Based on Iot With Rfid and Telegram," *J. Teknol. dan Sist. Tertanam*, vol. 3, no. 1, 2022, doi: 10.33365/jtst.v3i1.2819.

[5] D. Rika Widianita, "PROTOTIPE SISTEM ROTARY PARKING MENGGUNAKAN RFID (RADIO FREQUENCY IDENTIFICATION) DILENGKAPI MONITORING THINGSPEAK BERBASIS IOT (INTERNET OF THINGS)," *AT-TAWASSUTH J. Ekon. Islam*, vol. VIII, no. I, pp. 1–19, 2023.

[6] H. Huang *et al.*, "Design of An IoT based Smart Parking Lock," *J. Phys. Conf. Ser.*, vol. 1952, no. 4, 2021, doi: 10.1088/1742-6596/1952/4/042025.

[7] H. Isyanto, H. Muchtar, R. Rasma, and A. R. Dinata, "Design of Security System Device for Motorized Vehicles through the Telegram Messenger Application and Updating GPS Locations on Smartphones in Real Time with IoT-based Smart Vehicles," *J. Electr. Technol. UMY*, vol. 6, no. 2, pp. 67–76, 2022, doi: 10.18196/jet.v6i2.16182.

[8] G Vaishnavi Haritha Koya, K Likhitha, K Srilatha, G Saida Babu, "IoT Based Smart Vehicle Parking System Using RFID," *Int. J. Mod. Trends Sci. Technol.*, vol. 10, no. 02, pp. 53–60, 2024, doi: 10.46501/ijmtst1002008.

[9] S. H. Nova *et al.*, "IoT Based Parking System: Prospects, Challenges, and Beyond," *2022 Int. Conf. Innov. Intell. Informatics, Comput. Technol. 3ICT 2022*, no. November, pp. 393–400, 2022, doi: 10.1109/3ICT56508.2022.9990838.

[10] A. Akhmadi, Amin Nur., Wulandari, Ratih., & Mustofa, "Pengaruh Variasi Putaran Mesin Terhadap Waktu Pengeboran Dengan Material Aluminium Al 6063 Pada Mesin Bor Duduk," *J. Mech. Eng.*, vol. 10, no. 1, pp. 11–15, 2021.

[11] U. Hasnita, "Motor Speed Control Sensor Using Hall Effect Sensor Based on IoT," vol. 4, no. 4, pp. 86–90, 2025.

[12] Basri, "Komponen Elektronika," *Sukabina Press*, pp. 64–65, 2018.

[13] T. Christianto, *Driver Motor Berbasis H-Bridge*. Yogyakarta, 2014.

[14] M. George H, *Kinematika dan Dinamika Teknik*, 2nd ed. Jakarta: Erlangga, 1995.

[15] I. N. Bagia, *Motor Motor Listrik*. Bandung: Rasibook, 2018.