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Parking Quota Monitoring System Internet of Things Based

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Revised: February 01, 2025; Accepted: May, 04,2025

Abstract

The development of science and technology has now progressed rapidly. Humans try to overcome parking problems by adopting automatic equipment systems, replacing manual systems. One approach applied is to design an information model regarding the number of automatic parking areas around the parking lot entrance. This information system will display information regarding the number of parking slots available in the parking area. This research produces systems and tools that can monitor parking quotas using IR sensors. System users can park their vehicles as long as the parking lot is not full and the user's ID card has been registered with the system. By using RFID, the system allows users to park easily without swiping the card first. The system will automatically increase the parking quota if it detects a vehicle leaving the parking area. Based on the results of tests carried out to enter parking automatically where the parking quota has not been met and the ID card that has been registered can run well with a percentage of 98%. Meanwhile, the automatic parking exit system also runs well with a percentage of 98%. This presentation is influenced by the speed of the sensor in reading the presence of the vehicle.

Keywords *: RFID , Infraread Sensor , Parking System .*

1. Introduction

According to PP No. 43 of 1993 parking defined as a vehicle that stop at certain places whether indicated by signs or not, and not solely for the purpose of picking up or dropping off people or goods. So this parking space must be there at the end or destination of the trip has been achieved [1]. According to the Great Dictionary of the Indonesian Language, parking is defined as the act of stopping or placing (a motor vehicle) temporarily in a location that has been provided. This definition includes the same concept as that offered by parking service providers, which provide a place for motor vehicles to stop temporarily [2].

convenience in the current electronic era is applied in the parking system to make it easier for users to find parking locations. This system also allows for further development, such as parking location reservations and parking payments using electronic money [3]. This smart parking system not only includes security management, but also management of the layout or address of vehicles in available parking spaces [4], [5]. This smart parking system not only includes security management, but also management of the layout or address of vehicles in available parking spaces [6][7].

The development of science and technology has now experienced rapid progress [8], [9]. Humans are trying to overcome parking problems by adopting an automatic equipment system, replacing the manual system [10], [11]. One approach applied is to design an information model regarding the number of automatic parking areas located around the parking lot entrance [12]. This information system will display information about the parking slots available in the parking area. The creation of this parking monitoring system involves the use of infrared sensors to detect the arrival and departure of vehicles, while the nodeMCU is responsible for controlling all hardware automatically.

2. Research methods

As for the road research conducted in make parking quota monitoring system design is as following :

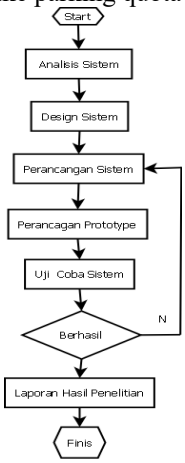

Figure 1. Research Path

2.1. Analysis System

The system analysis stage is a stage to do or plan the components and applications needed to build the system. This stage can include hardware requirements and software requirements as well as learning how the system will work later .

2.2. Design Stage

The following is a flowchart of the parking quota monitoring system that explains the work flow in this system. The system flowchart can be seen in Picture

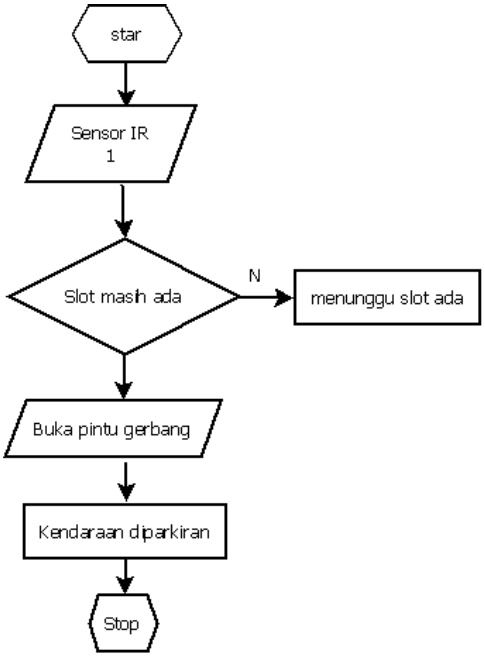

Figure 3.2 System Flowchart

Following This is explanation from every steps in the system flowchart .

1. Start
   Start is point the beginning of the process of channel work on the system .
2. IR Sensor
   Stage This is stage Where system can detect arrivals and departures vehicle .
3. Slots still There is
   Stage This is stage For check the remaining s lot There is parked .

4. Waiting for slot to be available
   Stage This is stage Where parking slot Already penung and must waiting for an empty slot so you can enter .
5. open the door gate
   Stage This is stage Where system to inform that the slot is still there is and door gate or signpost open and car Can enter .
6. Vehicle parked , meaning vehicle Already is at in the parking and get place parking .
7. Stop
   Stop is point end from channel Work system .

2.3. Prototype Design

Stage Prototype design is steps in which product prototype created as representation physical resemblance final product, but with more form simple . At the stage this , simulation done For verify are the sensors or the device used operate in accordance with desired specifications , testing its functionality and performance .

In step this , the system will also experience testing For ensure that device has operate as should be , including sending and receiving data from sensors. This process aiming For identify and reduce potential errors , and ensure that product the resulting end result in accordance with needs and preferences user . As for example , if the IR sensor detects arrivals and departures vehicle as has been set , system will in a way automatic give know the slot is still there There is What Already full . In addition , activation will monitored through telegram application that has prepared previously .

2.4. System Testing

At this stage is the stage where you try all the components and systems used.

1. The sensor will tested whether can detect come and gone vehicle .
2. Testing done whether tool the walk in accordance with the program that has been entered into the microcontroller or No .
3. The system will be tested to determine whether it has to rule component in accordance with that desired and also operate all existing *logic* in the program.
4. Component will tested whether Already walk in accordance desired command Good in a way automatic and also manually .
5. Me raft all series systems and components used For monitoring arrival and departure vehicle .

If the results of the trial do not match the wishes of the developer or user, system improvements or prototype improvements will be carried out again until the system can run as desired.

3. Results and Discussion

This research produces a system and tool that can monitor parking quotas using IR sensors. System users can park their vehicles as long as the parking lot is not full and the user's ID card has been registered in the system. By using RFID, the system allows users to park easily without swiping the card first. The system makes it easy for parking owners to monitor parking availability and automatically notify users if the parking lot is full. .

3.1. Wiring Diagram

This Wiring Diagram is something important for developer systems and tools for developers can understand and plan development fast and accurate . Wiring Diagram is also common used For breakdown problem If happen interference with the components used .

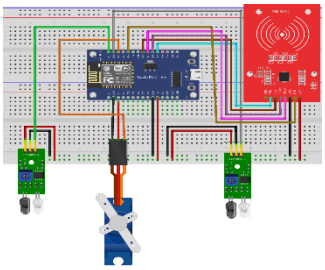

Figure 1. Waring diagram

3.2. Telegram Bot View

This bot looks like this is telegram bot view that will used see notification if the user or user succeed enter parking lot or If parking lot full . User must Clicking or type /start first formerly For start the Parking Quota Monitoring bot .

Figure 2. Bot display successful enter parking lot

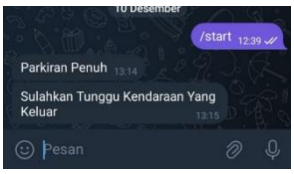

Figure 3 Bot view if the birthplace full

Figure 4. Bot view if Not yet registered

3.2.1. System Prototype View Parking Quota

The following is a display and prototype and components of the parking quota monitoring system. The parking quota monitoring prototype can be seen in the picture .

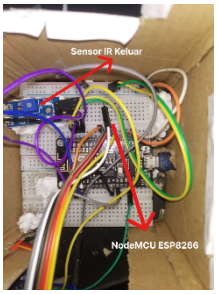

Figure 5 . Prototype

3.3. Testing

The testing phase is the phase carried out to test the components and systems to see whether they are running as desired to monitor parking quotas.

3.3.1. IR Sensor Testing

. The IR sensor is a sensor used to detect the presence of a vehicle in front of the parking gate or not.

Table 1. Parking Entry IR Sensor Testing

NO	Distance	Detection Time (seconds)	Detection Status
1	1 cm	0.1	Success
2	2 cm	0.1	Success
3	3 cm	0.1	Success
4	4 cm	0.1	Success
5	5 cm	0.1	Success
6	5.5 cm	0.1	Success
7	5.6 cm	0.1	Success
8	5.7 cm	0.1	Success
9	5.8 cm	0.1	Success
10	5.9 cm	0.1	Success
11	6 cm	0.1	Success
12	6.1 cm	0.1	Success
13	6.2 cm	0.1	Success
14	6.3 cm	0.1	Success
15	6.4 cm	0.1	Success
16	6.5 cm	0.1	Success
17	6.6 cm	0.1	Success
18	6.7 cm	0.1	Success
19	6.8 cm	-	Not Successful
20	6.9 cm	-	Not Successful
21	7 cm	-	Not Successful
22	7.1 cm	-	Not Successful
23	7.2 cm	-	Not Successful
24	7.3 cm	-	Not Successful
25	7.4 cm	-	Not Successful

Table 2 . IR Out Sensor Testing Parking

NO	Distance	Detection Time (seconds)	Detection Status
1	1 cm	0.1	Success
2	2 cm	0.1	Success
3	3 cm	0.1	Success
4	4 cm	0.1	Success
5	5 cm	0.1	Success
6	5.5 cm	0.1	Success
7	5.6 cm	0.1	Success
8	5.7 cm	0.1	Success
9	5.8 cm	0.1	Success
10	5.9 cm	0.1	Success
11	6 cm	0.1	Success
12	6.1 cm	0.1	Success
13	6.2 cm	0.1	Success
14	6.3 cm	0.1	Success
15	6.4 cm	0.1	Success
16	6.5 cm	0.1	Success

NO	Distance	Detection Time (seconds)	Detection Status
17	6.6 cm	0.1	Success
18	6.7 cm	-	Not Successful
19	6.8 cm	-	Not Successful
20	6.9 cm	-	Not Successful
21	7 cm	-	Not Successful
22	7.1 cm	-	Not Successful
23	7.2 cm	-	Not Successful
24	7.3 cm	-	Not Successful
25	7.4 cm	-	Not Successful

3.3.2. RFID Testing

RFID Card Sensor is a sensor used to detect whether the ID card used by parking users is registered in the system or not.

Table 3 . RFID Testing Detecting Cards

NO	Tap Distance	Response (seconds)	Detection Status
1	1 cm	1.02	Success
2	1 cm	1.01	Success
3	1 cm	0.90	Success
4	1 cm	0.90	Success
5	1 cm	0.90	Success
6	1.5 cm	0.92	Success
7	1.5 cm	0.91	Success
8	1.5 cm	0.89	Success
9	1.5 cm	0.70	Success
10	1.5 cm	0.89	Success
11	2 cm	0.91	Success
12	2.1 cm	0.95	Success
13	2.2 cm	93	Success
14	2.3 cm	1	Success
15	2.4 cm	1	Success
16	2.5 cm	1.01	Success
17	2.6 cm	1.01	Success
18	2.7 cm	1.04	Success
19	2.8 cm	1.03	Success
20	3 cm	1.01	Success
21	3.1 cm	1.04	Success
22	3.2 cm	1.05	Success
23	3.3 cm	1.00	Success
24	3.4 cm	1.02	Success
25	3.5 cm	1.05	Success

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3.3.3. Prototype Testing

Testing prototype is testing conducted For ensure all installed components walk in accordance with what is desired . Testing prototype done as many as 3 times on December 2 until by December 5, 2023.

Table 4. Testing 1 Prototype Parking Entry

NO	O'clock	Tap Distance RIFD (cm)	Servo IR Enter Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
1	9.00	1.1	0.5	2.01	3.01	Success
2	9.01	1.1	0.6	1.10	3.01	Success
3	9.04	1.4	0.1	2.03	3.02	Success
4	9.05	1.5	0.1	2.01	3.03	Success
5	9.07	1.1	1	1.12	2.90	Success
6	9.07	1.3	1	1.31	2.95	Success
7	9.08	1.4	1.1	1.01	2.90	Success
8	9.08	0.5	1.1	0.89	3.10	Success
9	9.09	0.5	1.4	1.03	3.10	Success
10	12.03	0.5	1.4	1.20	3.09	Success
11	12.05	2	2	1.21	3.04	Success
12	12.05	2.2	2	1.30	3.02	Success
13	12.06	2.2	3	2.50	3.01	Success
14	12.06	2.2	3	2.30	3.01	Success
15	12.07	2.4	4	1.20	3.03	Success
16	12.07	2.4	4	1.10	3.04	Success
17	12.08	2.5	5	1.04	3.04	Success
18	12.08	2.5	5	-	-	Not Successful
19	12.09	2.5	6	1.01	3.01	Success
20	15.05	2.6	6	1.04	3.05	Success
Average Success Rate						95%

Table 5. Testing of 2 Parking Entry Prototypes

NO	O'clock	Tap Distance RIFD (cm)	Servo IR Enter Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
1	10.29	1.1	0.8	1.10	3.03	Success
2	10.30	1.1	0.8	1.30	3.03	Success
3	10.31	1.1	0.9	1.20	3.01	Success
4	10.31	1.4	0.9	1.10	3.02	Success
5	10.32	1.4	1	1.13	3.00	Success
6	10.33	1.6	1	1.09	3.04	Success
7	10.34	1.6	1.3	1.15	2.94	Success
8	10.35	0.8	1.3	1.21	3.10	Success
9	10.36	0.8	1.5	1.23	3.13	Success
10	10.36	0.8	1.5	1.16	3.05	Success
11	12.20	2.2	1.9	1.14	3.02	Success
12	12.20	2.2	1.9	1.12	3.05	Success

NO	O'clock	Tap Distance RIFD (cm)	Servo IR Enter Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
13	12.21	2.3	1.9	1.19	3.06	Success
14	12.21	2.3	2.5	2.03	3.07	Success
15	12.21	2.5	2.5	1.39	3.07	Success
16	12.23	2.6	4.2	2.21	3.02	Success
17	12.23	2.3	4.2	2.13	3.05	Success
18	12.23	2.8	4.5	0.91	3.02	Success
19	12.25	2.9	4.5	1.01	3.06	Success
20	15.25	3	4.8	2.31	3.08	Success
Average Success Rate						100%

Table 6. Testing of 3 Parking Entry Prototypes

NO	O'clock	Tap Distance RIFD (cm)	Servo IR Enter Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
1	8.21	0.1	0.4	1.40	3.01	Success
2	8.24	0.1	0.4	1.21	3.01	Success
3	8.24	0.3	0.5	1.25	3.05	Success
4	8.25	0.3	0.6	1.31	3.07	Success
5	8.25	0.5	1.1	1.52	3.06	Success
6	8.25	0.5	1.3	1.12	3.02	Success
7	8.40	0.1	1.3	1.55	2.97	Success
8	8.40	0.10	1.4	1.10	2.90	Success
9	8.41	1.7	1.5	1.14	2.91	Success
10	8.43	1.5	1.2	1.13	3.01	Success
11	8.44	2.1	1.1	1.16	3.03	Success
12	8.46	2.2	1.6	1.13	3.02	Success
13	8.50	2.1	1.2	1.15	3.04	Success
14	8.50	2.5	2.8	1.90	3.05	Success
15	9.10	2.7	3.4	1.40	3.02	Success
16	9.10	2.2	3.3	1.12	3.01	Success
17	9.11	2.1	4.4	1.08	3.05	Success
18	9.11	2.6	4.1	1.20	3.07	Success
19	9.13	3	4.9	1.03	3.03	Success
20	9.13	3	5	1.04	3.01	Success
Average Success Rate						100%

Table 7. Testing 1 Prototype Go out Parking

NO	O'clock	Servo IR Out Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
1	10.02	0.5	0.70	3.03	Success

NO	O'clock	Servo IR Out Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
2	10.03	0.6	0.40	3.05	Success
3	10.03	0.5	1.02	3.02	Success
4	10.04	0.6	1.30	3.08	Success
5	10.04	1.1	1.21	3.04	Success
6	10.04	1.1	1.03	3.02	Success
7	10.05	1.2	1.12	2.93	Success
8	10.06	1.3	1.59	3.01	Success
9	10.06	1.4	1.20	3.03	Success
10	13.10	1.3	-	-	Not Successful
11	13.11	1.2	1.06	3.03	Success
12	13.12	1.7	1.11	3.06	Success
13	13.12	1.2	1.32	3.09	Success
14	13.12	2.2	1.30	3.4	Success
15	13.12	2.1	1.28	3.10	Success
16	13.13	2.4	0.93	3.53	Success
17	13.13	2.3	1.02	3.31	Success
18	13.13	2.5	1.20	3.49	Success
19	13.14	2.4	1.11	3.40	Success
20	13.14	3	1.02	3.09	Success
Success Rate					95%

Table 8. Testing of 2 Prototypes Go out Parking

NO	O'clock	Servo IR Out Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
1	11.11	0.3	1.02	3.05	Success
2	11.12	0.5	0.90	3.03	Success
3	11.12	0.5	1.02	3.02	Success
4	11.12	0.5	1.11	3.05	Success
5	11.13	0.8	1.43	3.07	Success
6	11.13	0.8	1.10	3.03	Success
7	11.13	1.2	1.06	3.01	Success
8	11.14	1.2	1.05	3.01	Success
9	11.15	2.1	1.03	3.05	Success
10	11.15	2.1	1.03	3.04	Success
11	11.16	2.4	1.04	3.06	Success
12	11.16	2.4	1.08	3.06	Success
13	11.16	3.3	1.11	3.04	Success
14	11.18	3.3	1.03	2.93	Success
15	11.18	3.6	1.03	3.20	Success
16	13.18	3.6	1.20	3.14	Success
17	13.21	4.2	1.31	3.10	Success
18	13.21	4.2	1.20	3.10	Success
19	13.23	4.6	1.19	3.07	Success

20	13.23	4.6	1.16	3.04	Success
Success Rate					100%

Table 9. Testing of 3 Prototypes Go out Parking

NO	O'clock	Servo IR Out Parking (cm)	Servo Open Response (sec)	Servo Close Response (sec)	Status
1	9.39	0.5	1.20	3.10	Success
2	9.39	0.4	1.13	3.07	Success
3	9.40	0.7	1.21	3.03	Success
4	9.44	0.5	1.02	3.04	Success
5	9.44	0.6	1.03	3.05	Success
6	9.45	0.4	1.05	3.11	Success
7	9.45	1.2	1.10	3.02	Success
8	9.46	1.5	1.23	3.06	Success
9	9.46	1.8	1.21	3.02	Success
10	9.50	2.3	1.43	3.04	Success
11	9.50	2.6	1.21	3.05	Success
12	9.51	2.7	1.02	3.07	Success
13	9.52	3.9	1.04	3.08	Success
14	9.55	3.5	0.90	3.16	Success
15	9.55	3.2	1.05	3.15	Success
16	9.56	4.2	1.09	3.03	Success
17	9.56	4.4	1.13	3.08	Success
18	9.56	4.3	1.12	3.14	Success
19	9.57	4.8	1.18	3.24	Success
20	9.58	4.9	1.12	3.06	Success
Success Rate					100%

4. Conclusion

Based on the results of the research above, it can be concluded that the research produces a parking management system, where vehicles can park independently in the parking area using a card whose ID has been registered in the system. The system will automatically open the parking gate if the parking quota in the area has not been met and the card used by the user has been registered in the system. The system will automatically add parking quota if it detects a vehicle leaving the parking area. Based on the results of the test carried out to enter the parking lot automatically where the parking quota has not been met and the card ID that has been registered can run well with a percentage of 98%. While the automatic parking exit system also runs well with a presentation of 98%. This presentation is influenced by the speed of the sensor in reading the presence of the vehicle.

References

[1] I. Hadijah and L. Sriharyani , " The Effect of On-Street Parking on Road Section Performance (Case Study of Jalan Imam Bonjol, Metro City)," *TAPAK (Technology Application Construction): Journal of Civil Engineering Study Program* , vol. 5, no. 2, 2016.

[2] S. Wulandari, " Management of Roadside Parking by the Parking Management UPTD at the Transportation Service in Samarinda City ," *Journal Public Administration* , vol. 3, no. 1, pp. 35–46, 2015.

[3] RB Pratama , " Implementation of eigenface method on system parking based on image processing," *Journal Disprotection* , vol. 9, no. 2, pp. 86–96, 2018.

[4] A. Wihandanto , AJ Taufiq, and W. Dwiono , " Design Get up Prototype Smart Parking System Based IoT Using Node Mcu Esp8266," *Jurnal Teknik Elektro dan Komputer TRIAC* , vol. 8, no. 1, pp. 18–22, 2021.

[5] AS Widodo and PT Prasetyaningrum, " Design Autonomous Internet of Thing (IoT) Application in Cars Designing Car Autonomous Internet of Thing (IoT) Application".

[6] B. Trengginas , H. Handayani , and A. Juwita, " Design Get up "Automatic Parking System on UBP Campus Based on IoT," *Scientific Student Journal for Information, Technology and Science* , vol. 3, no. 2, pp. 268–283, 2022.

[7] ME Mulyadi, LD Samsumar , Z. Zaenudin , and MM Efendi, "DESIGN OF PARKING LOT MONITORING SYSTEM IN BASEMENT AREA OF HOTEL ASTON INN MATARAM BASED ON INTERNET OF THINGS (IOT)," *Journal of Computer Science and Information Technology* , vol. 1, no. 4, pp. 316–326, 2024.

[8] P. Taqwa, DJC Sihombing , and J. Bata, "Social CRM Model as a Business Strategy Tourist North Sumatra Province ," in *National Informatics Seminar (SEMNASIF)* , 2015.

[9] PT Ningrum, O. Suria, and A. Witanti , " Designing library e-resources using mobile- based customer relationship management ," *Jurnal Explore Informatics* , vol. 8, no. 1, pp. 59–68, 2018.

[10] M. Irmansyah , E. Madona, and N. Anggara , "Design and Development of Water Distribution Monitoring System in Regional Drinking Water Companies (PDAM) Based on Internet of Things," in *Journal of Physics: Conference Series* , IOP Publishing, 2021, p. 012024.

[11] H. Purwanto, M. Hermawan, C. Nainggolan, and B. Wibowo, "Design of An Automatic Temperature Recorder for Fishery Vessels Using Internet of Things Technology," *Journal of Applied Engineering and Technological Science* , vol. 5, no. 2, pp. 1020–1050, 2024.

[12] H. Purwanto, "Microcontroller based parking lot monitoring system prototype," 2022.