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Smart Parking System Model Analysis with NodeMCU and IoT-Based RFID

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Abstract - There is much conventional management parking nowadays. One of them is on campus 1 of Muhammadiyah University of Bengkulu. Many vehicles that do not belong to students or staff from the Muhammadiyah University of Bengkulu are parked in the inner area of campus. In addition, it causes vulnerable to direct physical contact with other people, while the government recommends not to have direct physical contact with other people in the era of the Covid-19 virus pandemic. So this study designs a smart parking system with Node MCU and IoT-based RFID. Parking systems that use RFID are able to filter incoming vehicles, increase security and efficiency in parking areas, and able to reduce the impact of the spread of the Covid-19 virus. The technology used is RFID as a user Id reader Sensor, Node MCU as a microcontroller, E-KTP as access to the parking area, servo as a parking portal driver, LCD as a sign whether access is accepted or not, and infrared as a distance sensor that will signal to a servo to close the portal. This system can be hoped to overcome the current problems.

Keywords: Smart Parking System; Internet of Things; NodeMCU; RFID

I. INTRODUCTION

The main text format consists of the development of information systems today has been so rapid in all aspects of life, be it education, business, and others [1]. There are many parking areas/parking lots ranging from shopping places, schools, campuses/universities, hotels, places to eat, and much more. The average parking management that we find is still using conventional or traditional methods.

The same is the case with the parking system at the University of Muhammadiyah Bengkulu, especially on campus 1, which still uses a conventional parking system. Often students get a reprimand from parking attendants for parking their vehicles in an undue place as a result of full parking. After the location analysis, it turned out that many vehicles parked in the inner area of the campus did not belong to students or staff from the University of Muhammadiyah Bengkulu. That's a result of the absence of student or staff vehicle filters and the general public in campus parking lots.

Then the conventional parking system still has another drawback, namely the frequent occurrence of criminal acts of theft due to weak security systems and inefficient implementation. In addition, conventional parking is still prone to direct physical contact with other people, even though we know that in the era of the Covid-19 virus pandemic, the government recommends that there be no direct physical contact with other people, in accordance with the Decree of the Minister of Health of the Republic of Indonesia No. HK.01.07/MENKES/382/2020.

The smart parking system is considered beneficial for car parking operators, as well as in the preservation of the world's industrialization environment, the increase in the population, the city that is running slowly in its development, and the mismanagement of parking spaces in metropolitan urban areas [2, 3]. The new IoT-based parking platform makes it possible to connect, analyze, and automate the data collected from the device and enable smart parking [4]. There is research entitled radio frequency identification for motorcycle security at SMK X in which, to improve the security of parking lots, RFID technology can be applied. The system makes it easy for parking managers to monitor and manage parking data [5]. Then Raynal Fernanda, in his research which was based on the design of a smart parking system based on the RFID RC522 card, which in the research carried out raised the issue of how to design an RC522 RFID-based smart parking system to overcome the full parking area at Hassanudin University and get m Students can open and use the parking lot according to the lecture schedule at that time. If the system reads that the student has no class at the time, or is not registered, then the bar will not open. In addition to automatic parking barriers, information about the number of available parking spaces will be provided [6].

Internet of Things (IoT) technology has opened the door of opportunity for the development of smart application systems that make it possible to design smart systems that are the future of all technological advances in the evolution of industry 4.0 [7]. The term Internet of Things (IoT) is a way to describe the way the real world enters the virtual world, whether using wireless or automatic control that does not know the distance. The Internet of things (IoT) technology is included in the World Economic Forum's estimates of 14 technologies used globally in 2020 [8].

RFID is a method when it can be used to store or receive data over long distances and use a device called an RFID tag or transponder. At present, RFID is a technology made to facilitate human work when it comes to knowing objects one by one manually to be automatic and detailed. It can also reduce human error due to manually logging the identity of objects [9, 10]. The system on RFID consists of many interrogators. However, all these interrogators can be connected in one network only using a single controller [11, 12]. Similarly, on a single interrogator that can be used, more than one tag at the same time. Radio Frequency Identification (RFID) uses radio frequency waves to know objects wirelessly [13, 14].

NodeMCU is an open-source IoT platform. It consists of hardware such as the Esp 8266 On-Chip made from the Espressif System. NodeMCU is defined by default by referring to the firmware used from the NodeMCU development kit hardware, which can be categorized because of the Arduino board ESP8266 [15, 16]. In general, NodeMCU is an electronic board based on the ESP8266 chip that is able to use the function of a microcontroller that can be connected to the internet (WIFI) [17, 18]. NodeMCU operates ESP8266-based firmware that uses WIFI and ESP-12 modules. The device uses the LUA script and the Arduino language. It is built on an SDK based on non-OS for ESP8266 and is supported by the eLUA project. The firmware is represented by the nodemcu name of the development kit. NodeMCU has been used in many projects, such as SPIFFS and LUA-CISON[20]. E-KTP is a population document that has a security and control system both in terms of administration and information technology based on a single population database. A Servo motor is a motor in the form of a closed feedback system. The position of the motor will flow back to the control frame that is already in the servo motor [19, 20]. An infrared sensor (Infrared diode) is a component that delivers light to the infrared wavelength region and is usually used as an infrared wave transmitter (TX). LCD (Liquid Crystal Display) 16 x 2 is a display of liquid crystalline material whose application uses a dot matrix system. Arduino IDE is a single-board micro-controlling software that is open-source, derived from the wiring platform, and made to facilitate the use of electronics in various types of fields, the hardware uses an Atmel AVR processor, and the software has a simple C++ programming language and complete functions, so Arduino is easy to learn by beginners [21].

II. METHOD

This research is a qualitative type of research using the Research and Development (R&D) method. Before the author makes a tool that is useful as a tool in the parking system, there are several initial stages that must be done. The initial stage is the method of collecting data for research.

The following flowchart in figure 1 shows the flow of the investigation process in harmony, where everything starts from the data search process to the testing stage. Here are pictures and explanations. The first is data collection that can be used as a reference in this study from observations, interviews with related parties, and literature studies. Data from literature studies were obtained from published books, journals, articles, and internet browsing. Then analyze the system by analyzing the running system, the problems encountered and proposing solutions to solve the issues. Overview of system design, at this stage, explains what hardware and software requirements are needed. Provide an overview of tool design through block diagrams, explain the overall research process through flowcharts, explain the comprehensive work system of the tool through flowcharts, and explain the appearance of the website supporting the device through prototype images. Then design the hardware and software, starting with explaining the process of assembling each system component, explaining the design results, and creating the software in web form (localhost). After the hardware and software are designed, hardware and software testing is done by testing the entire system to run well and analyzing the test results.

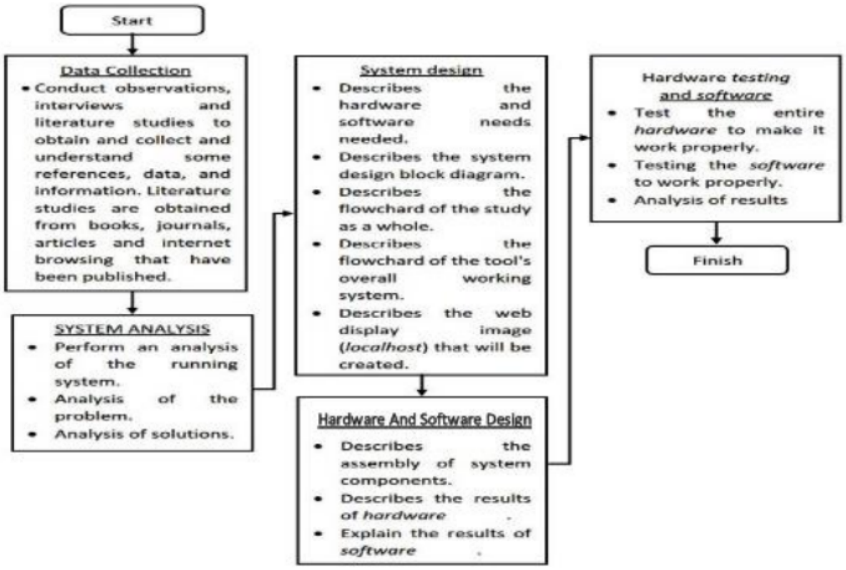


Fig. 1 Flowchard Research

The following flowchart in figure 1 is the flow of the working system of the tool in harmony from start to finish, and this flowchart explains how the tool is designed to work. The first is to provide an electrical current or voltage to the system. Then, the user attaches the E-KTP to the RFID RC522, and later the RFID will read the data on the E-KTP. The data read on the RFID will be sent to the microcontroller to be checked on the database. If the data sent by RFID is not contained in the database, the microcontroller will send a signal to the LCD to display the words "FAILED." Furthermore, users are expected to register with the admin to get access to the parking area. If the data sent by RFID is contained in the database, the microcontroller will send a signal to the LCD to display the words "WELLCOME TO UM BENGKULU," and then the microcontroller will also send a signal to the servo motor to open the portal. Ultrasonic sensors will ensure the user's vehicle has passed through the portal and will close the portal again.

III. RESULT AND DISCUSSION

A. Development Result

The working principle of this system can be seen in Figure 2. The adapter will share the electric current with the microcontroller (NodeMCU ESP8266), which is connected to wifi as access to reading data stored in the database. Suppose the ID on the E-KTP has been stored in the database. In that case, NodeMCU will signal to the LCD that the identification process is booming, and NodeMCU will also send a password to the servo motor to open the portal. Then the ultrasonic sensor detects whether the vehicle has passed through the doorway and it has not. Suppose the car has passed through the portal and is no longer detected by the ultrasonic sensor. In that case, the ultrasonic sensor will send a signal to nodeMCU, which will then send this information to the servo motor to close the portal again.

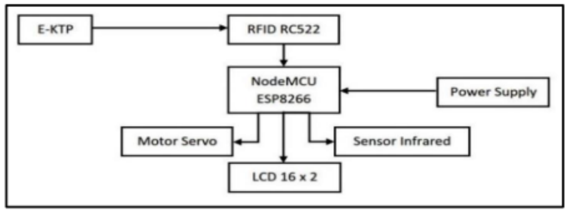


Fig. 2 System Design Diagram

This research was aimed at the vehicles of students, lecturers, and staff from the University of Muhammadiyah Bengkulu who used E-KTP as an entrance from the inner parking area of campus 1. The advantages of this smart parking system are that it can improve the security and efficiency system in the parking area, filter vehicles that will enter the parking area, and reduce the impact of the spread of the Covid-19 virus. In this study, there are several descriptions of discussions.

1. The ESP8266 MCU node as a microcontroller is programmed using the Arduino IDE.
2. E-KTP is an RFID Card claimant that functions as an entrance from the parking area.
3. RFID RC522 as an ID reader sensor on the E-KTP.
4. Servo Motor as a portal drive tool.
5. LCD is a provider of data information that has been processed.
6. The infrared sensor as a vehicle detection tool.
7. Localhost website as a storage medium for user activities.

TABLE I
RFID RC522 to NodeMCU ESP8266

RFID RC522	**Node MCU**
SDA	D2
SCK	D5
MOSI	D7
MISO	D6
GND	GND
RST	D1
3.3V	3.3V

Table 1 is a table that describes the pins that connect the RC522 RFID Sensor to NodeMCU, where the relationship between the connected lines will determine the design results of devices that are related, including SDA-D2, SCK-D5, MOSI-D7, MISO -D6, GND-GND, RST-D1, and 3.3V-3.3V.

TABLE III
Motor Servo to NodeMCU ESP8266

Motor Servo	**Node MCU**
Yellow	D0
Red	3.3V
Brown	GND

Table 2 explains the pins that connect the Servo Motor to NodeMCU to determine which cable is connected to the device that has been defined in color so that when a problem occurs, it will be easy to maintain. Among them are the yellow cable (D0), the red cable (3.3V), and the brown cable (GND).

TABLE IIIII
LCD 16x2 to NodeMCU ESP8266

LCD 16x2	Node MCU
SDA	D4
SCL	D3
VCC	VIN
GND	GND

Table 3 is a table that describes the pins that connect the 16x2 LCD to NodeMCU, with the connection of these pins displaying information related to the parking system design. Among them are SDA-D4, SCl-D3, VCC-VIN, and GND-GND.

TABLE IVV
Sensor Infrared to NodeMCU ESP8266

Sensor Infrared	Node MCU
OUT	D8
VCC	3.3V
GND	GND

Table 4 is a table that explains the pins that connect the Infrared Sensor to NodeMCU, including OUT-D8, VCC-3.3V, and GND-GND.

The IoT-based smart parking system has been designed in such a way. After going through several designs, which include tool design, program design, system design, and data upload process, it has been produced "Design and Build a Smart Parking System with MCU Nodes and IoT-based RFID."

1. Tool Design Result

   In the tool design process can be seen in figure 3, there are several stages that must be passed. First, prepare the tools and materials to be used, such as preparing a miniature parking system, NodeMCU ESP8266 microcontroller, Mifare RC522 RFID sensor, servo motor, LCD, jumper cables, and others.

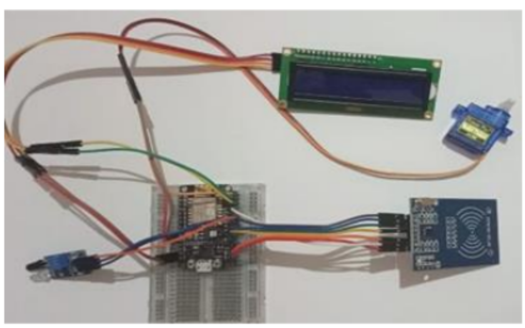


Fig. 3 Tool Design Result

2. Program Design Result

The design of the program results is shown in figure 4, where commands are made using the Arduino IDE application then the program is uploaded to the microcontroller (NodeMCU) using a USB cable.

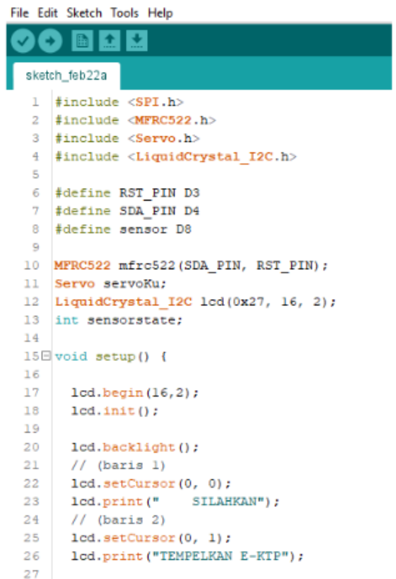


Fig. 4 Program Design Result

B. Web Application Development

In Figure 5, it is explained that this page contains the first page or the opening display of this application. On this page, the admin will find the words " *Selamat Datang Di Smart Parking System Universitas Muhammadiyah Bengkulu*. "

Fig. 5 Home Page Result

The dashboard page in figure 6 contains the second page of this application. On the dashboard page, there is a table of activities that enter from the parking area, including the name, date, entry time, and description of visitors from each activity that accesses the parking area.

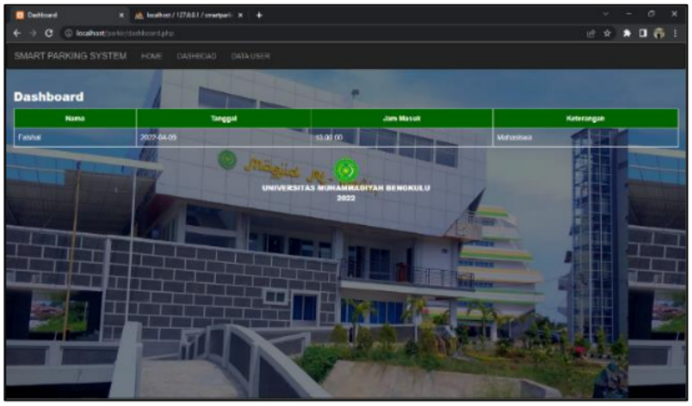


Fig. 6 Dashboard Page Result

C. Testing

At this stage, testing will be carried out on the design that has been made and implemented.

1. RFID Reading Distance Testing Against E-KTP

   The study tested the reading distance of the RFID sensor from a distance of 1 cm to a distance of 10 cm. The RFID sensor can only read E-KTP from a distance of 1 cm to a distance of 2 cm, while from a distance of 3 cm to a distance of 10 cm, it turns out that the RFID sensor cannot read E-KTP because RFID has a range limit in reading E-KTP or other cards.

TABLE V
Testing the Read Distance of the RFID Sensor

Data	Read Distance	Results	Percentage
1	1 Cm	v	100%
2	2 Cm	v	100%
3	3 Cm	x	0%
4	4 Cm	x	0%
5	5 Cm	x	0%
6	6 Cm	x	0%
7	7 Cm	x	0%
8	8 Cm	x	0%
9	9 Cm	x	0%
10	10 Cm	x	0%

Table 5 the authors have tested the reading distance of the RFID sensor from a distance of 1 cm to a distance of 10 cm. The RFID sensor can only read the E-KTP from a distance of 1 cm to a distance of 2 cm, while from a distance of 3 cm to a distance of 10 cm it turns out that the RFID sensor cannot read the E-KTP because RFID has a limited range in reading E-KTP or other cards.

2. E-KTP Position Testing on RFID
   Testing the position of the E-KTP on the RFID sensor to find out the position of the E-KTP that can be read by the RFID sensor against the E-KTP to be used. The position of the E-KTP that can be read by the RFID sensor is the front and back of the E-KTP.

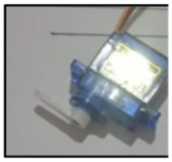
TABLE VI
Testing the Position of the E-KTP on the RFID Sensor

Data	ID card position	Explanation	Results	Percentage
1		Front left	V	100%
2		Front Right	V	100%
3		Up	V	100%
4		Bottom	V	100%

Table 6 shows that the position of the E-KTP can be read by the RFID sensor.

3. Servo Motor Testing
   Servo Motor testing is carried out with the aim of determining whether the servo motor can work properly. The servo motor can open the portal (90^o) and above after the E-KTP is read by the RFID sensor and close the portal (90^o) and below after 5 seconds.

TABLE VII
Servo Motor Testing

Data	ID card position	Results	Explanation
1		V	Initially the servo is at 0 degrees.
2		V	When connected the servo moves to 90 degrees and after a few seconds it returns to its original state which is 0 degrees.

4. 16x2 LCD Testing
   Testing on this 16x2 LCD is carried out to find out whether the LCD is working as it should be displaying numbers or letters according to the command program we are using.

TABLE VIII
LCD testing

Data	ID card position	Results	Explanation
1		V	After current flows, the LCD will display the words "Please Paste E-KTP"
2		V	After the client attaches the E-KTP to the RFID, the LCD will change to "Welcome to UM Bengkulu"

5. Infrared Testing
   Testing on infrared sensors is carried out to find out whether infrared sensors are functioning as they should by measuring distances according to the command program we use.

TABLE IX
Infrared Sensor Reading Range Test

Data	Read Distance	Results	Percentage
1	1 Cm	v	100%
2	2 Cm	v	100%
3	3 Cm	v	100%
4	4 Cm	x	0%
5	5 Cm	x	0%
6	6 Cm	x	0%
7	7 Cm	x	0%
8	8 Cm	x	0%
9	9 Cm	x	0%
10	10 Cm	x	0%

Table 9 shows that the reading distance from the infrared sensor is 3 cm.

6. The following is a test application page
   Tables 10 to 12 below are the results of page testing in the designed application.

TABLE X
Testing Dashboard Pages on The App

Input	Expect	Observation	Conclusion
Input visitor activity data	Input visitor activity data automatically	Can input visitor activity data automatically	[√] Accepted [ ] rejected

Table 10 is a test table for the dashboard page on the application, and it can be concluded that the dashboard page can input visitor activity data automatically as expected.

TABLE XI
Testing User Data Pages on The App

Input	Expect	Observation	Conclusion
Click Edit	Enter the edit menu, can edit the data, and save the data again.	Can edit data and save the data back	[√] Accepted [ ] Rejected
Click Delete	Deleting user data	Display notifications of delete and delete user data	[√] Accepted [ ] Rejected

Table 11 is a test table for the user data page in the application, and it can be concluded that the user data page can edit user data and save it back to the user data page, then can display a delete notification and delete the user data you want to delete as expected.

TABLE XII
Testing Add User Data on the Application

Input	Expect	Observation	Conclusion
Add new user data	E-KTP automatically and can save new user data	Can input the E-KTP Id automatically and can save new user data	[√] Accepted [ ] Rejected

Table 12 is a test table for the added user data page in the application, and it can be concluded that the added user data page can input the E-KTP ID automatically and store new user data as expected.

When students, lecturers, or staff from the University of Muhammadiyah Bengkulu scan the E-KTP on the RFID RC522, and the ID on the E-KTP has been registered, then access to open the parking portal will be given, and the activity data of the user will be recorded and stored in the database.

IV. CONCLUSION

After designing and testing the tool and application as a whole, the following conclusions can be drawn. The device created by the author has been successfully designed and can work properly as expected. Devices that can improve security and efficiency in the parking area because they can filter vehicles entering the parking area. The device can reduce the impact of the spread of the Covid-19 virus because users do not need to come into direct contact with other people. The RFID sensor can detect the E-KTP that has been inputted data, and the ideal reading distance on the RFID sensor against the E-KTP is 1 cm to 4 cm.

While the position of the E-KTP that can be read by the RFID sensor is the front right and back left, or there is a photo of the owner of the E-KTP. The application created by the author has been successfully designed and can work well as expected. For further development, it is expected to be able to develop and create a better system. In the next development, the author gives some suggestions as follows: To be able to use a UPS or use solar panels to overcome the problem of electricity sources when the power goes out. To be able to add other features to the tool or application.

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REFERENCES

[1] S. Fernandez, M. Imanullah, M. Y. Fathoni, and P. Pahrizal, "Utilization of the COBIT 2019 framework to identify the level of governance in internet services," *JURNAL INFOTEL*, vol. 14, no. 3, pp. 188–195, Aug. 2022, doi: 10.20895/infotel.v14i3.791.

[2] S. Fernandez and Y. W. Mandala, "Implementasi Teknologi RFID Pada Aplikasi Buku Tamu Undangan," *Jurnal Komputer Terapan*, vol. 8, no. 1, 2022, [Online]. Available: https://jurnal.pcr.ac.id/index.php/jkt/

[3] B. Kizilkaya, M. Caglar, F. Al-Turjman, and E. Ever, "Binary search tree based hierarchical placement algorithm for IoT based smart parking applications," *Internet of Things (Netherlands)*, vol. 5, pp. 71–83, Mar. 2019, doi: 10.1016/j.iot.2018.12.001.

[4] 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*, vol. 22, no. 2, pp. 1217–1224, Feb. 2021, doi: 10.1109/TITS.2020.2964604.

[5] J. Lin, S. Y. Chen, C. Y. Chang, and G. Chen, "SPA: Smart Parking Algorithm Based on Driver Behavior and Parking Traffic Predictions," *IEEE Access*, vol. 7, pp. 34275–34288, 2019, doi: 10.1109/ACCESS.2019.2904972.

[6] J. J. Barriga *et al*., "Smart parking: A literature review from the technological perspective," *Applied Sciences (Switzerland)*, vol. 9, no. 21. MDPI AG, Nov. 01, 2019. doi: 10.3390/app9214569.

[7] A. N. M. Nasution, R. Munadi, and S. Sussi, "Design and Implementation of Smart Parking System Using Location-Based Service and Gamification Based on Internet of Things," *JURNAL INFOTEL*, vol. 13, no. 2, pp. 63–75, May 2021, doi: 10.20895/infotel.v13i2.654.

[8] A. Gupta, S. Kulkarni, V. Jathar, V. Sharma, and N. Jain, "Smart Car Parking Management System Using IoT," *American Journal of Science, Engineering and Technology*, vol. 2, no. 4, pp. 112–119, 2017, doi: 10.11648/j.ajset.20170204.13.

[9] T. Perković, P. Šolić, H. Zargariasl, D. Čoko, and J. J. P. C. Rodrigues, "Smart Parking Sensors: State of the Art and Performance Evaluation," *J Clean Prod*, vol. 262, Jul. 2020, doi: 10.1016/j.jclepro.2020.121181.

[10] K. Azzahra Palar, R. Munadi, N. Bogi, and A. Karna, "Implementasi Smart Parking dengan Maps Pada End User di Pusat Perbelanjaan Menggunakan Metode QR Code," *American Journal of Science, Engineering and Technology*, vol. 2, no. 4, pp. 1449–1441, 2021.

[11] A. Fahim, M. Hasan, and M. A. Chowdhury, "Smart parking systems: comprehensive review based on various aspects," *Heliyon*, vol. 7, no. 5. Elsevier Ltd, May 01, 2021. doi: 10.1016/j.heliyon.2021.e07050.

[12] F. Costa, S. Genovesi, M. Borgese, A. Michel, F. A. Dicandia, and G. Manara, "A review of rfid sensors, the new frontier of internet of things," *Sensors*, vol. 21, no. 9. MDPI AG, May 01, 2021. doi: 10.3390/s21093138.

[13] A. Motroni, A. Buffi, and P. Nepa, "A Survey on Indoor Vehicle Localization through RFID Technology," *IEEE Access*, vol. 9, pp. 17921–17942, 2021, doi: 10.1109/ACCESS.2021.3052316.

[14] A. Ali and M. Haseeb, "Radio frequency identification (RFID) technology as a strategic tool towards higher performance of supply chain operations in textile and apparel industry of Malaysia," *Uncertain Supply Chain Management*, vol. 7, no. 2, pp. 215–226, 2019, doi: 10.5267/j.uscm.2018.10.004.

[15] IEEE Staff, *2019 IEEE 3rd Information Technology, Networking, Electronic and Automation Control Conference (ITNEC)*. IEEE, 2019.

[16] A. et al., "IoT based smart garden monitoring system using NodeMCU microcontroller," *International Journal of ADVANCED AND APPLIED SCIENCES*, vol. 7, no. 8, pp. 117–124, Aug. 2020, doi: 10.21833/ijaas.2020.08.012.

[17] R. Jayaysingh, J. David, M. Joel Morris Raaj, D. Daniel, and D. Blessytelagathoti, "IoT Based Patient Monitoring System Using NodeMCU," in *ICDCS 2020 - 2020 5th International Conference on Devices, Circuits and Systems*, Mar. 2020, pp. 240–243. doi: 10.1109/ICDCS48716.2020.243588.

[18] P. Mezzanotte, V. Palazzi, F. Alimenti, and L. Roselli, "Innovative RFID Sensors for Internet of Things Applications," *IEEE Journal of Microwaves*, vol. 1, no. 1, pp. 55–65, Jan. 2021, doi: 10.1109/jmw.2020.3035020.

[19] K. Anon, V. Ranjith, and K. Varalakshmi, "IOT INTEGRATED FOREST FIRE DETECTION AND PREDICTION USING NODE MCU," *International Journal of Electronics Engineering and Applications*, vol. IX, no. I, p. 28, Apr. 2021, doi: 10.30696/ijeea.ix.i.2021.28-35.

[20] Y. Astutik, Murad, G. M. D. Putra, and D. A. Setiawati, "Remote monitoring systems in greenhouse based on NodeMCU ESP8266 microcontroller and Android," in *AIP Conference Proceedings*, Dec. 2019, vol. 2199. doi: 10.1063/1.5141286.

[21] Ramesh Saha, S. Biswas, S. Sarmah, S. Karmakar, and P. Das, "A Working Prototype Using DS18B20 Temperature Sensor and Arduino for Health Monitoring," *SN Comput Sci*, vol. 2, no. 1, Feb. 2021, doi: 10.1007/s42979-020-00434-2.

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