Smart Box Receiver of IoT-Based Expedition Package Using a QR Code Scan

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Abstract— The increase in internet users makes the purchase of goods online also increase. Someone needs a fast and safe delivery of goods to ensure the goods they buy, but the problem is that couriers often deliver packages when the recipient is not at home, even some couriers are found throwing packages into the fence of the house which can trigger package damage. can accommodate packets to be received. The solution is to make a smart box that is connected to the internet or wifi. how it works is by registering the receipt number that has been obtained from shopping online into the web server. The receipt number will be inputted by the courier to the website via a scan of the QR code, if the receipt is registered, the courier can open the box. Testing the receipt number input by the courier, the results are 100% successful because all receipt numbers have been registered on the web server so that it produces output in the form of an automatic solenoid doorlock opening, and a servo motor rotating 90 degrees pushing the box door open. The results of the response time testing starting from the courier scanning the QR Code and inputting the receipt number into the website until the smart box door opens and locks again after the courier puts the package into the box, the average time is 59.47 seconds.

Keywords—IoT, Package, QR Code, Receipt Number, Smart Box.

I. INTRODUCTION

Currently the development of the shipping service industry has increased quite rapidly. The era of globalization requires humans to have high mobility. The existence of freight forwarding services not only facilitates the general public but also business people. Business people, especially online or e-commerce businesses, use delivery services to deliver goods to their customers throughout Indonesia and abroad [1]. The increase in Internet users makes the purchase of goods online also increase. Every individual needs fast and safe delivery of goods to ensure the goods they buy are delivered to the right time and place [2]. However, the problem is often that the ordered goods are delivered when the owner of the goods is not at home, so that some couriers take alternative actions such as entrusting the package to the nearest neighbor, or sending it back the next day, even some couriers were found throwing the package inside from outside the fence. So we need a solution to overcome this problem. Based on these problems, a system is needed that can monitor, and send notifications to the homeowner if a courier comes to the house to deliver the package, and can accommodate the package safely when the homeowner is not at home or no one is home to receive the package. Therefore, a research was conducted with the title "Smart Box Receiver Of IoT-Based Expedition Package Using A Qr Code Scan". The way this system works is by registering the package receipt number obtained after online shopping into an application that is connected to the smart box. When arriving at the recipient's address, the courier is recommended to scan the QR Code [3][4] on the surface of the box, then it will be directed to input the package receipt number[5]. If the

entered receipt number matches, the servo motor [6][7] driving the smart box door opens successfully.

II. METHOD

This section describes in detail the research carried out conducted.

A. System Block Diagram

The design that will be made to facilitate system design requires a system block diagram, in this study it is shown in Figure 1 which shows the overall system of the IoT-Based Expeditionary Package Receiver Smart Box Using QR Code Scan. The system design to be carried out in this study is shown in Figure 1.
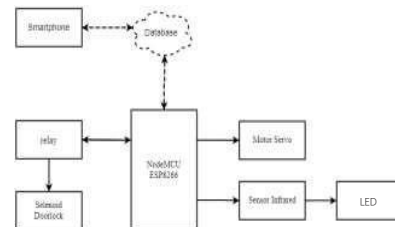

Figure 1. System Block Diagram

In the block diagram, the input data system design is on the upper left side, namely from the admin. The admin must first enter the package receipt number and the name of the owner in the database server, so that if there is a courier who delivers the package, the courier can open the smart box by scanning the QR Code and then filling in the receipt number of the package that was delivered to the website. If the package receipt number

is in the database, the courier has successfully opened the smart box

The NodeMCU [8][9] will give the Selenoid Doorlock [11][12] command to open the lock. automatically, after which the servo motor will move 180° to open the smart box door. If the package has been put in the box, the infrared sensor [13] will detect the object. then the IP camera [14][15] will capture the image and send it to the Telegram application as a notification for the package owner, on the other hand the IP camera also streams realtime video as a security system that can monitor the smart box and the situation around it which can be accessed on the website by the admin.

B. Hardware Planning

The design of making hardware includes an illustration of the design of the 3D smart box design for the recipient of the expedition package, which is shown in Figure 3.
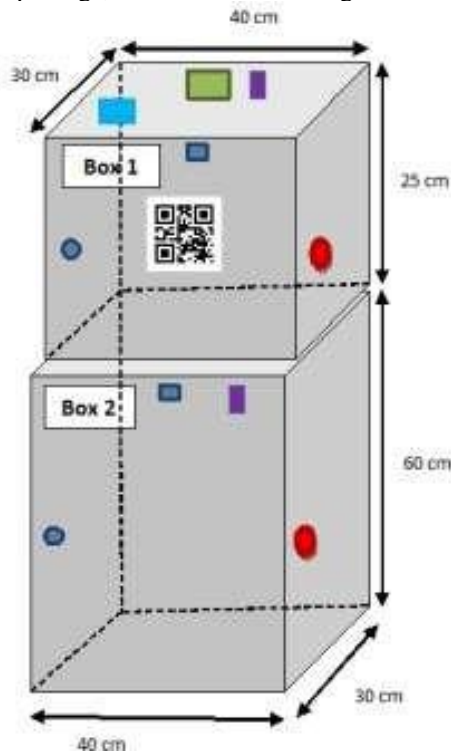

Figure 3. Hardware Planning

In Figure 3.8 is a schematic of the hardware design consisting of the ESP8266 NodeMCU, relay module, and MG996R servo motor. Explaining the circuit using the ESP8266 MCU node as a microcontroller and a WiFi module which has an input voltage of 5V, then a 5V relay module as a component that controls and flows electric current, and an MG996R servo motor as the box door driver which is connected to a 5V voltage source.
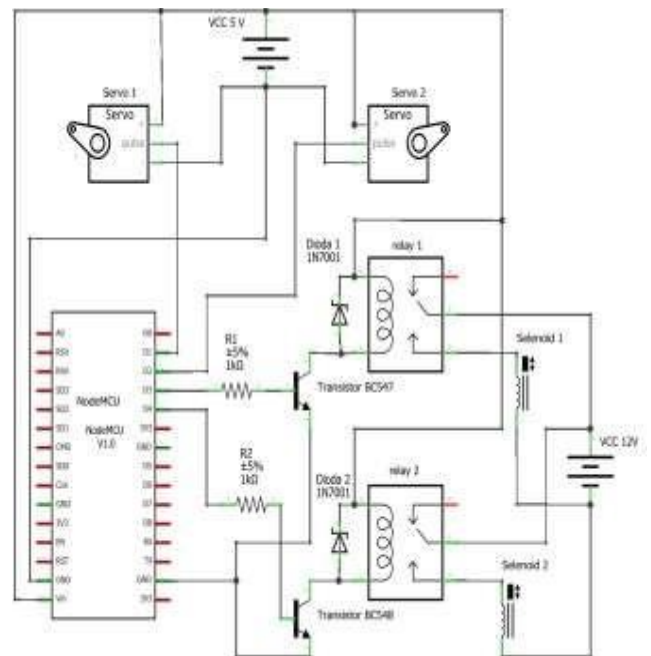

Figure 4. Hardware Design Schematic

C. Software Planning

In the following picture is a website design for courier and admin.
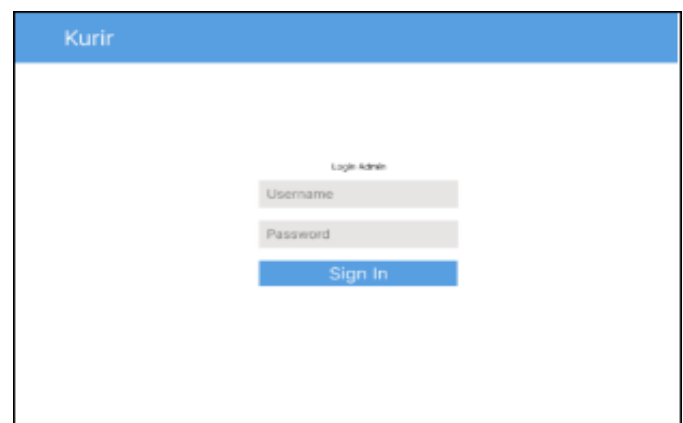

Figure 5. Courier Website
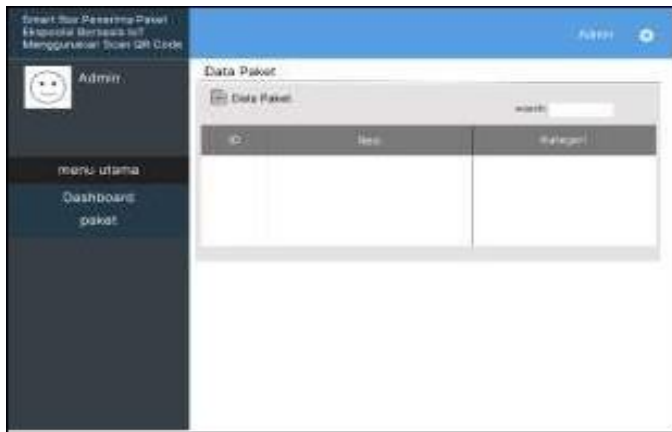

Figure 6. Admin Login Page

Figure 7. Admin Website

III. RESULTS AND DISCUSSION

A. Hardware Circuit Results

The result of the hardware is the result of a 3D design which has made a box with two different sizes along with the components that are in it.
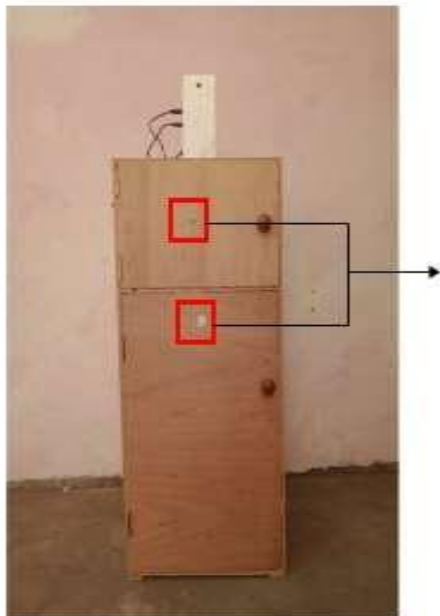

Figure 8. Front View Of The Box

The picture shows the physical appearance of the box as seen from the front view. There are two led lights in each box that are attached to the door of the box. This led light is the output of the infrared sensor which is located in the box, so that if the infrared sensor is approached by the package, the led light will turn on.
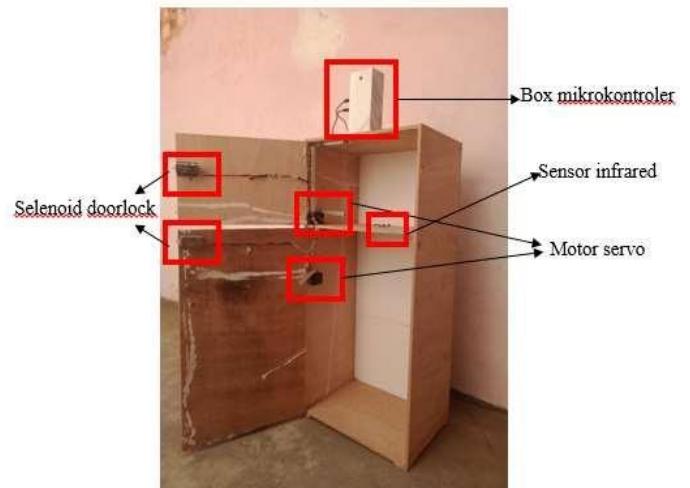

Figure 9. Components In The Box

On each part of the box there is an infrared sensor placed in the middle under the surface of the box, besides that there is an MG996R servo motor as a driving component that is placed near the box door hinge, the position of the servo motor is placed so that it can function properly to open and close the box door automatically. automatically according to the button command on the website. On the inner box door, there is a solenoid door lock as an automatic door lock for the box. At the top position there is a microcontroller box which contains the esp8266 nodeMCU or wifi module, as well as 2 relays, and 2 adapter connections.

B. Software Result

This sub-chapter describes the parts in the website display as a support system to run the package box. website created using the PHP programming language.

Figure 10. Admin Dashboard Page

Figure 10 is a display of the package data set on the admin page. On the left side of the page there is a system panel which includes the add package page, the live cam page, and the courier page. The package data Table on the main page or dashboard contains information in the form of a package receipt number and the identity of the package owner's name.

Figure 11. Courier Data Page

Figure 11 is the display result of the courier data. This courier data is obtained when the courier who delivers the package has filled in his identity through the website for the courier, so that the data is automatically stored on the admin web server. The courier data Table contains the identity of the courier's name, package receipt number, and the courier's telephone number according to the courier's input on the courier's website.

Figure 12. Courier Receipt Input Page

Figure 12 is the result of the receipt input page which is intended for couriers who deliver packages and will put the package into the box. There is a column to enter the package receipt number on the page, this is for the security system of the package, so that if it is not a courier or a foreigner who does not have a suiTable package receipt, he cannot open the box, because to be able to open the box one must have a package receipt number . There is a receipt check button under the receipt number input column, this button functions to check whether the receipt number that has been inputted is correct or not.

C. QR Code Result

The QR Code box is created using the QR Code generator available on the website https://id.qr-code-generator.com/. QR Code generator is a tool to help create custom QR Codes quickly and easily online. The way to create a QR Code box is to enter the desired link or website address.

Figure 13. QR Code Result

Figure 13 is the result of the QR Code that has been created. The QR Code is created by entering the website address for the courier, namely https://kurir.dataskripsi.site/index.php, this is intended so that when the courier delivers the package and scans the QR Code, it can be directly connected to the courier's website address so that the courier can carry out the procedure The next step is to input the package receipt number.

D. Testing Data Input by Admin Recipient

The first test is a test to enter the receipt number through the web server. There are several package receipt numbers from different shipping services with a combination of numbers and letters, according to the receipt number in general. These receipt numbers are entered into the "tb_paket" Table in the database server. All these receipt numbers have been successfully registered in the database through input from the web server. The receipt numbers tested are listed in Table 1.

TABLE I
BUS LOAD FLOW SIMULATION TEST

No.	Receipt Number	Recipient's Name
1.	JP5567910796	Alda Ardelia
2.	JP8197716084	Shafa Tasya
3.	10004893715814	Nicky
4.	1000495472038	Devy
5.	JP4652191004	Galuh
6.	004046456869	Dhelia
7.	002817744061	Alda Ardelia
8.	NJVTT00075090671	Waridatul
9.	10004927830513	Safa
10.	10002588934694	Alda
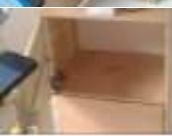
The receipt numbers in Table 1 are used for subsequent tests to test from the courier side who will open the smart box and put the package into the smart box.

E. Testing the Input Receipt by Courier

This test is carried out from the courier side when it will deliver or put the package into the box. Before the courier can put the package into the box, the selenoid doorlock box is locked. The courier scans the QR Code on the front of the box

in order to open the box door, from the QR Code the courier can connect to the website https://id.qr-code-generator.com/. On the website, the courier inputs the receipt number of the package being delivered, as well as the name and phone number. The data contained in Table 2 is the receipt number data that has been registered on the web server. This data is used as a test of receipt input from the courier side.

TABLE II
DATA INPUT TEST TABLE BY COURIER

NO	Receipt Number	Results	Description
1	JP5567910796		Succeed
2	JP8197716084		Succeed
3	10004893715814		Succeed
4	1000495472038		Succeed
5	JP4652191004		Succeed
6	004046456869		Not Successful
7	002817744061		Succeed
8	NJVTT00075090671		Succeed
9	10004927830513		Succeed
10	10002588934694		Not Successful

Testing of Table 2 based on the experiment of inputting receipt numbers from the courier was carried out 10 times with different receipt number data that have been registered in the database server. Based on the results of testing the receipt number input by the courier, the percentage of test success is obtained as follows:

Calculation of the percentage of successful testing of receipt number input by the courier.

Result = Jumlah Pengujian Berhasil / Jumlah Total Pengujian x 100% = 8 / 10 x 100% = 80%

Based on the results of calculating the percentage of success, it is known that 80% of the tests were successful and 20% of the tests were unsuccessful due to an error in inputting the receipt number from the courier, and there was an error in the box door servo motor, so the door could not be opened.

Figure 14. Selenoid Door Lock Open

If the condition of solenoid doorlock being open, so that the courier can put the package into the box, after which the recipient will get a notification on the telegram application containing information on the receipt number, courier name and telephone number of the courier who sent the package. This notification aims to let the recipient know that the package has arrived and is in the box.

Figure 15. Recipient Telegram Notification Results

IV. CONCLUSION

Based on the results of the system creation and testing that has been carried out in the previous chapter, it can be concluded for this research that; based on the results of testing receipt input by couriers, it can be concluded that of the 10 samples of receipt numbers used for testing, there was a percentage of 80%

of receipts successfully detected and 20% of the receipt numbers were not successfully detected due to an error in writing the receipt input from the courier, and there was an error in the box door servo motor. Based on 10 integrated system test results, the average time required to open the smart box door is around 59.47 seconds, starting from the courier scanning the QR Code, then inputting the receipt number on the website until the box door opens and locks again after the courier put the package into the box. In the next research, it is hoped that the microcontroller that previously used the NodeMCU ESP8266 will be developed into a Raspberry Pi so that it has more advantages in terms of features and specifications. Also create more aesthetic design innovations and mechanical forms.

REFERENCES

[1] Nurul Hidayah, "ANALISIS KEPUASAN KONSUMEN JASA PENGIRIMAN BARANG," Simki economic, 2018.

[2] Nia Oktaviani, Nita Merlina, and Nurmalasari , "Pemilihan Jasa Pengiriman Terbaik Menggunakan Metode Simple Additive Weighting (SAW)," Jurnal Sistem dan Teknologi Informasi, 2018.

[3] Muhammad Yusuf, Tata Supriyadi, and Hilman Maulana Muhammad, "Prototype Smart Mailbox untuk Penerimaan Paket Barang Berbasis IoT ," Industrial Research Workshop and National Seminar, 2021.

[4] Jonathan Ross Tew and Dr. Lydia Ray , "ADDSMART : Address digitization and smart mailbox with RFID Technology," in in 7th Annual Ubiquitous Computing, Electronic & Mobile Communication Conference (UEMCON), New York, 2016.

[5] Nandang Hermanto, Nurfaizah , and Nur Rahmat Dwi Riyanto , "APLIKASI SISTEM PRESENSI MAHASISWA BERBASIS ANDROID," Jurnal SIMETRIS, vol. vol. 10, 2019.

[6] William Winarto, Alexander Setiawan, and Resmana Lim, "Sistem Peminjaman Loker Otomatis Menggunakan QR Code dan Arduino," Jurnal Infra, vol. vol. 8, 2020.

[7] Sri Mulyati and Sumardi Sadi, "Gerbang Tertutup dan Terbuka pada Handphone Android Menggunakan Bluetooth," Jurnal Pengkajian dan Penerapan Teknik Informatika, vol. vol. 12, 2019.

[8] kelvin , "Kelvin. (2019). Sistem Pemungutan Suara Elektronik (E-Voting) Menggunakan Google Cloud Speech Api Berbasis Raspberry Pi," 2019.

[9] David Setiadi and Muhamad Nurdin Abdul Muhaemin, "Penerapan Internet Of Things (Iot) Pada Sistem Monitoring Irigasi (Smart Irigasi)," Jurnal Infotronik, vol. vol 3, 2018.

[10] M. Filipović Tretinjak, "The Implementation of QR Codes in the Educational Process ," MIPRO 2015, 2015.

[11] Desi Nur Indahsari, "Rancang Bangun Sistem Keamanan Rumah Indekos Berbasis Face Detection dan Broadcast Telegram Messenger," 2021.

[12] Koesmarijanto, N. Hidayati, Dista Dwi Cahyani, and Niko Budi Anto, "Smart Locker Menggunakan Fingerprint dan Face Recognition sebagai Sistem Keamanan Loker Penyimpanan", JASENS, vol. 4, no. 2, pp. 68 - 76, Dec. 2023.

[13] D. Dhelia Balqis Zharifa Az-Zahra, M. A. Anshori, and P. E. Mas'udia, "A Geolocation Visitors to the Polinema Library using QR Code and OTP Code on Internet of Things based Smart Locker", Jartel, vol. 13, no. 2, pp. 162-168, Jun. 2023.

[14] H. Kalkha, A. Khiat and M. Belafhaili, "Smart Cash-On-Delivery: Enhancing e-commerce transparency with smart contracts and parcel lockers," 2025 5th International Conference on Innovative Research in Applied Science, Engineering and Technology (IRASET), Fez, Morocco, 2025, pp. 1-6, doi: 10.1109/IRASET64571.2025.11008008.

[15] B. Khokher, M. B. Savadatti, A. Kumar, T. V. M. Nikhil, P. Raj and A. V. Thakre, "Advance Computing in IoT based High-Security Smart Bank Locker," 2023 7th International Conference on Computing Methodologies and Communication (ICCMC), Erode, India, 2023, pp. 1331-1335, doi: 10.1109/ICCMC56507.2023.10084110.