Implementation of LoRa on entrance and exit communication as determination of access to AI building, State Polytechnic of Malang

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***Abstract*— The COVID-19 pandemic has changed many areas of life. One of the consequences is that the learning zone causes reduced mobility and limited face-to-face meetings. State Polytechnic of Malang in overcoming face-to-face learning, especially practical learning in the AI Building, of course, many students, not only have the need for practical lectures. The research that the author is doing here is a field research using a quantitative approach. This research was conducted at the AI Building of the State Polytechnic of Malang. In collecting the data needed the author uses observation techniques. Discussion used data analysis methods. The results of the research for the RSSI pattern with the transmit power set at 18dBm lora and the antenna frequency used at 433MHz obtained the RSSI value. At a distance of 2m to 8m there is a decrease in RSSI starting from -57dBm to -80dBm, continuing from a distance of 8m to 42m there is an ups and downs in RSSI. The throughput result is strongly influenced by the value of bytes and the time the throughput value when done twice scanning is smaller than four times scanning because the scanning processes have different times, this is in accordance with the calculation formula.**

Keywords*— *RSSI, AI Building State Polytechnic of Malang, Throughput

I. INTRODUCTION

The COVID-19 pandemic has changed many areas of life. One of the consequences is that the learning zone causes reduced mobility and limited face-to-face meetings. With a Joint Decree (SKB) 4 Ministers override the implementation of education during the COVID-19 pandemic issued on December 21, 2021, the government seeks to restore education by reopening schools face-to-face in the even semester of the 2022 school year on a limited basis, and not all learning units can hold PTM in full (100 percent).

In the Ministerial Decree 4, it is stated that learning units in PPKM (Enforcement of Citizen Activity Restrictions) levels 1 and 2 can conduct PTM with 100 percent of students if the achievement of vaccination for dose 2 educators and educational staff is very little at 80 percent. That way, schools can also organize PTM every day with a maximum study period of 6 hours of lessons per day, so there needs to be an application system such as "Peduli Lindungi" in order to support the government's program to run well [1].

Peduli Lindungi is an application developed to help government agencies carry out digital tracking to stop the spread of the Corona virus. The benefits of the application can be as a warning to users, supervision, downloading vaccine certificates, information on COVID-, and as evidence for accessing public services. This application is very useful for officers at airports, shopping centers or other places to find out whether someone has undergone a vaccination program or not. Only by showing or through the QR Code scan feature will your vaccination data be displayed [2].

Universities, especially at the State Polytechnic of Malang, which are educational service providers, must be able to organize face-to-face activities in accordance with the Joint Decree (SKB) of the Four Ministers regarding the implementation of learning during the COVID which was issued on December 21 while still prioritizing the health and safety of students. lecturers and staff of the State Polytechnic of Malang.

In this case it will cause the AI Building to exceed the capacity that should be for people in the room, only 50% of the total capacity of the AI Building. This problem will be a non-compliance with the rules set by the government and the State Polytechnic of Malang itself where indoor learning is only 50% of the total room capacity.

Based on the description that has been described above, the author feels it is necessary to create a system to limit the number of people in the AI Building. The application itself can be used for access to enter and exit the AI Building using the QR code system. In this study, the author raised the title "Implementation of Lora Reach Distance in Entrance and Exit Communications as a Determination of Access to AI Building, State Polytechnic of Malang".

Several authors evaluate on the similar system. Authors in [3] used a presence method developed using a QR code application, at the beginning of the lecture session students scan the QR code displayed on the projector screen using an

Android application then the attendance data is sent to the web server. The student attendance website uses a login system. Each type of user account has different access rights. Student attendance can be done via the website and Android application. The attendance website and lecture schedule can be integrated. The absence file to be uploaded must be in PDF format and a maximum size of 2 MB. Students can only attend using an Android device that has been registered based on IMEI. The attendance recap file for each semester can be downloaded in excel format. The system algorithm cannot handle lecture times that start within the lecture schedule. Android applications cannot run on android version 10.

Application proposed in [4] is used to make it easier for students and lecturers to access this application via smartphone. In developing this application, Eclipse will be used, which is commonly used for software development. Authors in [5] proposed a tool made using an Arduino pro mini, RFID, SIM808 microcontroller which is designed to be as portable as possible so it is easy to carry anywhere. RFID functions as the identity of registered employees. When the RFID tag is read by the RFID reader, the GPS and SIM808 will be active, controlled by Arduino, then the recorded maps data will be sent to the server which can be seen in the Blynk IoT application. In this way, monitoring the employee's whereabouts is enough with a smartphone so that he is always under supervision without the employee reporting his whereabouts.

Computing technology is used in [6] with a Firebase-based 'realtime database' on Android. Use of firebase aims to transfer 'real time' data because that way the ordering process using the application will be faster. The results of this research are to show that the system that has been created to assist users in ordering food is more effective and efficient.

Waterfall method is used to create an information system to make it easier for Correctional Institution officers to record and recapitulate data on prisoners and visitors. [7]

In [8], the authors used an Android-based QR Code application to make activities easier, for example QR Codes for event tickets to make the verification process easier tickets and data collection so that events can run better, without wasting time and energy. With this research, it is hoped that the Android-based QR Code application can produce a system that is useful for simplifying the ticket verification process starting from authentication, generating QR codes, scanning QR codes, and storing all data in the Google Firebase database. Several other authors in [10-13] also proposed an information system using various technologies such as web-based, microcontroller, and QR code to assist users in daily life.

II. METHOD

A. System Design

The following is a description of each function of the input and output system designed based on the block diagram:

1. User / human is the one who operates the ID card scanning tool
2. GM 66 will capture and read the results of scanning id card
3. Receiver will receive data from scanning result
4. Captured GM 66 and forwarded to the Microcontroller
5. Then the microcontroller serves to display the results of RSSI

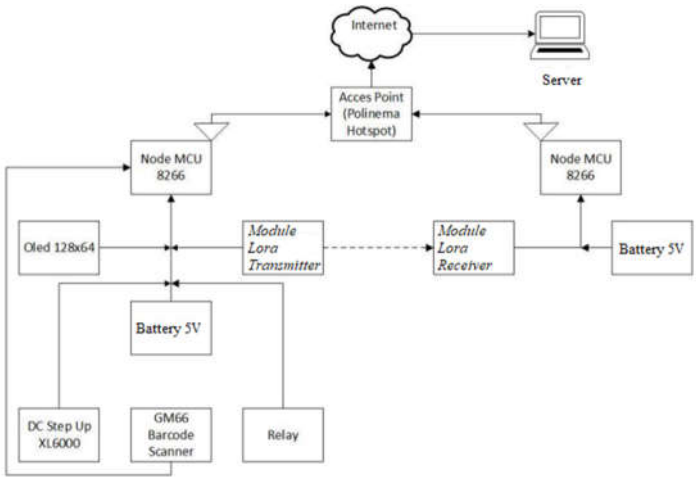

Figure 1. System Design

B. Hardware Design

Fig. 2 is a schematic design of a lora [14] transceiver that sends data in the form of FSK signals that are received by the receiver.

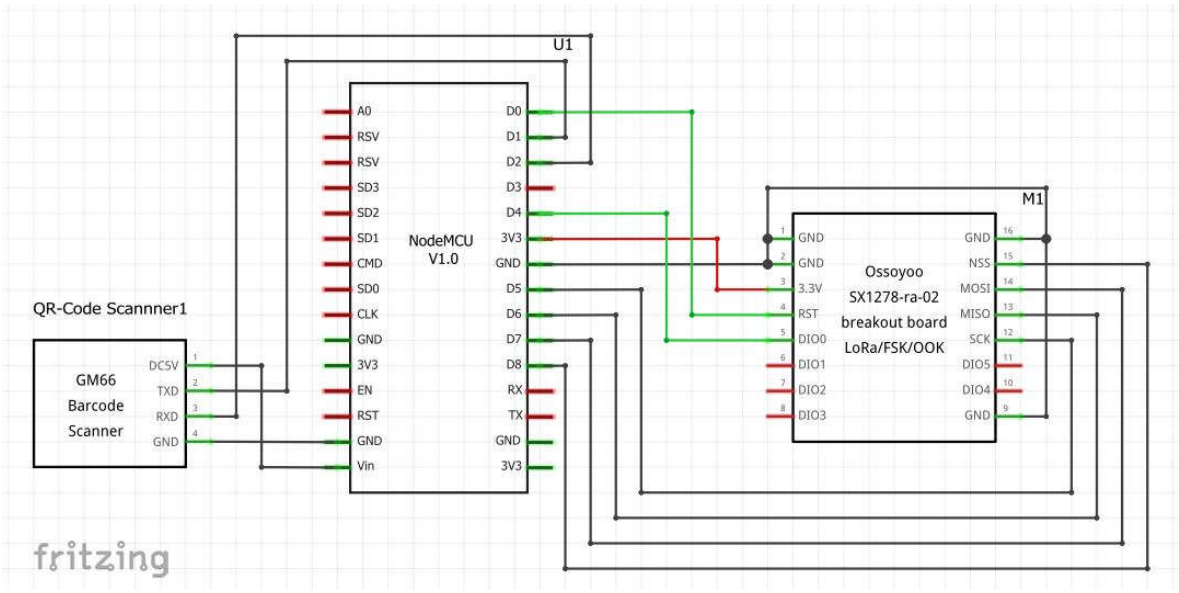

Figure 2. Lora Schematic Circuit on Transmitter

Lora consists of 16 pins each connected to NodeMCU 8266, the maximum transmit power of lora used by the author on the transmitter and receiver is 18 each, how it works:

- Ground pin pin on MCU 8266 Ground pin
- 3.3V pin suffering for NodeMcu 8266 pin 3V3
- 3.3V pin suffering for NodeMcu 8266 pin 3V3
- pin pin RST for pin D0 Mcu 8266
- pin pin D1O0 to pin D4 NodeMcu 8266
- NSS pain on pin D8 Node Mcu 8266
- MOSI pin difficulty for NodeMcu 8266 D7 pin
- MISO pin suffering for NodeMcu 8266 D6 pin
- SCK pin difficulty for NodeMcu 826 D5 pin

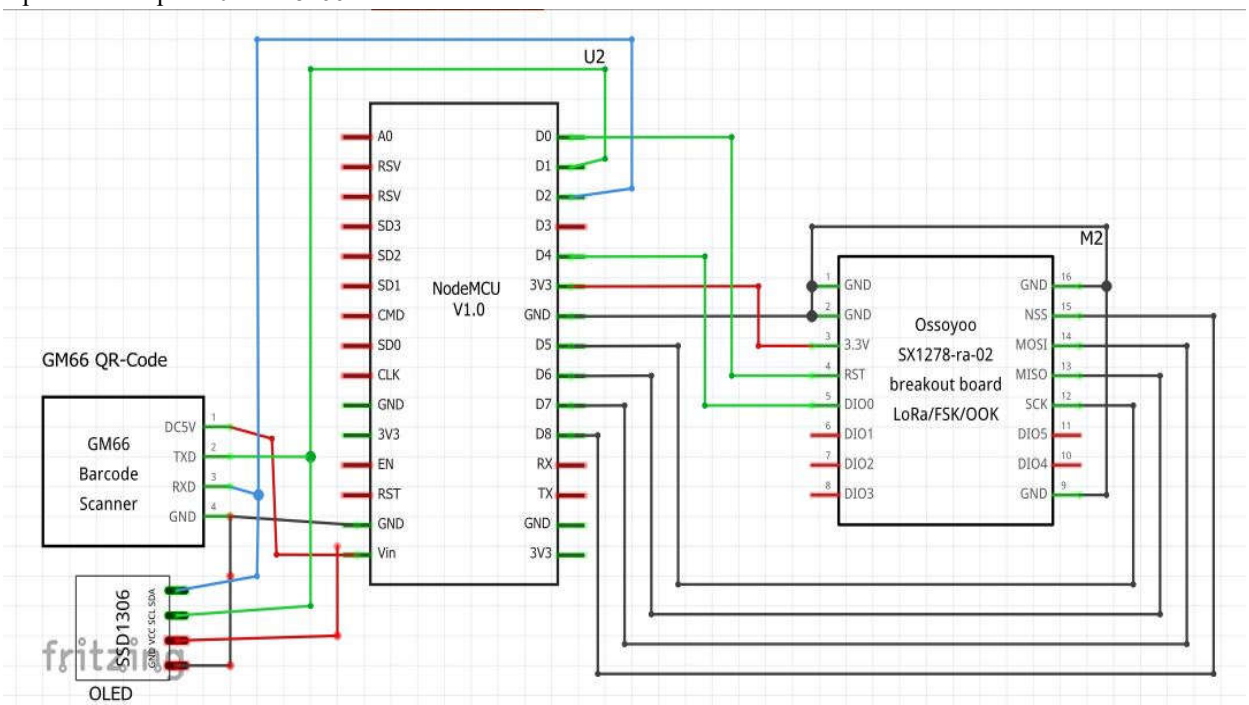

Figure 3. Lora Schematic Circuit on Receiver

Figure 3 is a schematic design of a lora receiver that receives discrete signals then processed and displayed on the lcd.

C. Software Design

The software design on the lora transceiver and receiver system has 3 parts, namely:

1. Website
2. Databases
3. Barcode Scan

Figure 4. Login Page

The website on this system serves as a media to display user login access, where on the website there are 4 user accesses, namely:

1. Admin
2. Student
3. Lecturer
4. Staff

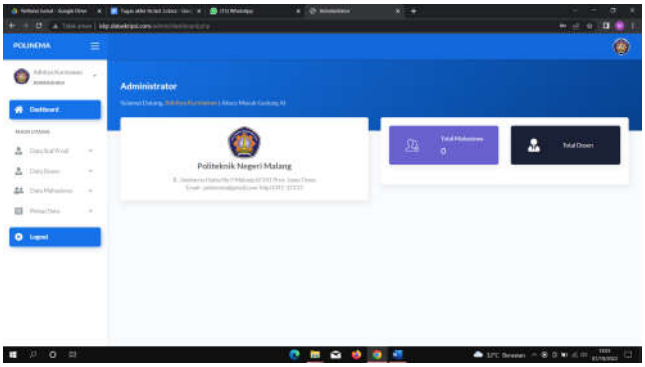

Figure 5 Menu Admin

Admin can add, delete and edit student, lecturer and staff data, besides that admin can see a recap of users who access the AI building of the State Polytechnic of Malang.

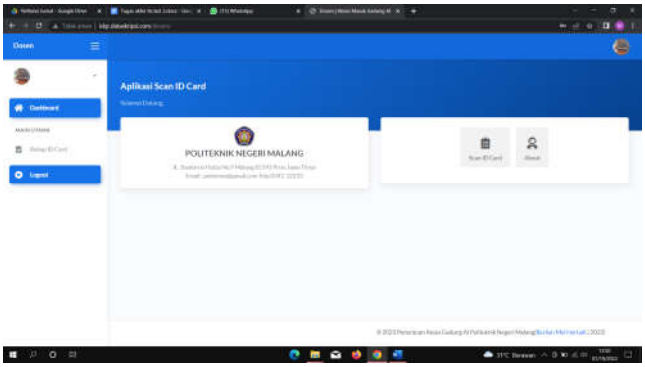

Figure 6. Lecturer Menu

Lecturers cannot add, delete and edit student data, lecturers and staff, but can see a recap of users who access the AI building of the State Polytechnic of Malang.

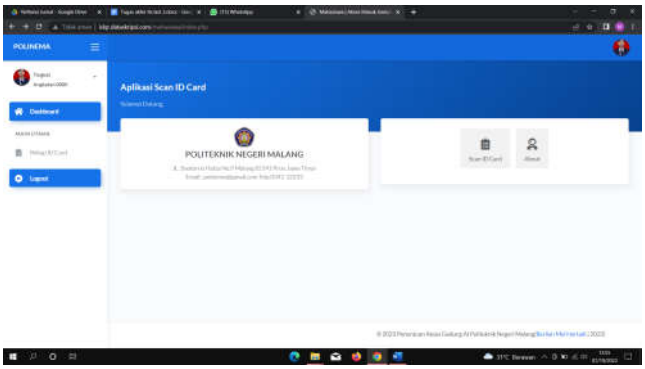

Figure 7. Student Menu

Student cannot add, delete and edit student data, lecturers and staff, and cannot see a recap of users who access the AI building of the State Polytechnic of Malang but student can change password student account.

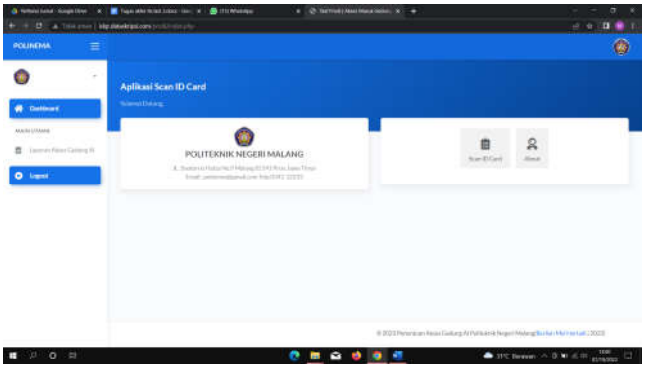

Figure 8. Staff Menu

Staff cannot add, delete and edit student data, lecturers and staff, but can see a recap of users who access the AI building of the State Polytechnic of Malang.

III. RESULTS AND DISCUSSION

A. RSSI Test Result

This test was carried out to determine the RSSI [15] value obtained from the distance in the State Polytechnic of Malang AI building.

TABLE I.
OBSERVATION OF LORA'S REACH DISTANCE TO RSSI

Range(m)	RSSI(dBm)
2	-57
4	-70
6	-70
8	-80
10	-72
12	-76
14	-83
16	-78
18	-87
20	-82
22	-85

Range(m)	RSSI(dBm)
24	-91
26	-75
28	-79
30	-84
32	-84
34	-80
36	-82
38	-80
40	-78
42	-79

In table 1, the results for the RSSI pattern with the transmit power set at 18dBm lora and the antenna frequency used at 433MHz obtained the RSSI value in table 4.3. At a distance of 2m to 8m there is a decrease in RSSI starting from -57dBm to -80dBm, continuing from a distance of 8m to 42m there is an ups and downs in RSSI. The highest decrease in the results of the study from table 4.3 is known at a distance of 2m to 4m RSSI of 13dBm, the decrease is from -57dBm to -70dBm. While the highest increase in the results of the study from table 4.3 is known at a distance of 24m to 26m RSSI of 16dBm, the increase is from -91dBm to -75dBm.

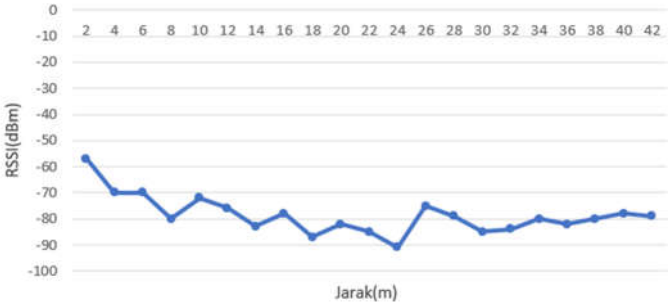

Figure 9. Graph of Testing Range Against RSSI

The test results in Fig. 9 there is a constant decrease from a distance of 2m to a distance of 24m. Between these distances, at a distance of 2m to 4m, there is a decrease in RSSI at most 13dBm. Meanwhile, from a distance of 24m to 42m the RSSI is more constant and between these distances there is an increase at a distance of 24m to 26m by 16dBm. The increase in RSSI at a distance of 24m to 26m is the largest increase over the overall distance. While the decrease in RSSI at a distance of 2m to 4m is the highest decrease from the overall distance.

B. Throughput test result

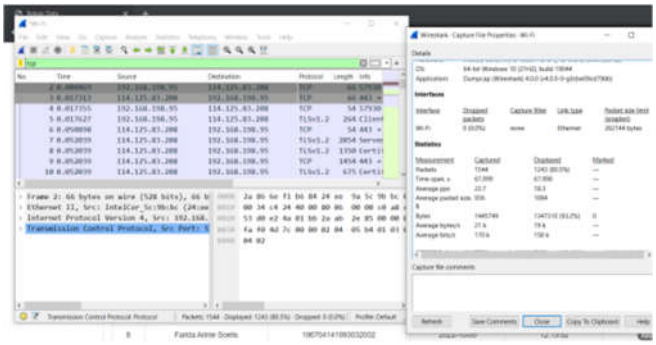

Figure 10. Throughput test using wireshark

Throughput was tested using wireshark and calculate the total data sent in the system.

$$Throughput = \frac{Bytes}{Time\ Span(s)}$$

$$Throughput = \frac{1445749}{67{,}999}$$

$$Throughput\ (bit) = 21261{,}327\ x\ 8$$

$$Throughput = 170090{,}616\ bps$$

TABLE II.
THROUGHPUT MEASUREMENT WHEN EACH EXPERIMENT IS PERFORMED TWICE SCANNING

Measurements	Bytes	Time Span,s	Throughput x 8 (Kbit/s)
1.	1445749	67,999	170090,616
2.	29876	20,677	11,55912
3.	4711	15,603	2,41056
4.	2980	25,575	932,16
5.	2195	16,921	1,03776
Average	297102,2	13615,555	34207,556

TABLE III.
THROUGHPUT MEASUREMENT WHEN EACH EXPERIMENT IS SCANNED FOUR TIMES

Measurements	Bytes	Time Span,s	Throughput x 8 (Kbit/s)
1.	2516578	68,776	292727,456
2.	2111569	75,889	22,592
3.	3555321	66,887	425233,12
4.	2559002	70,445	290609,92
5.	2889543	69,667	331,811
Average	11320378,6	28974,399	201784,979

From the test results, it is known that the throughput value when done twice scanning is smaller than four times scanning because the two scanning processes have different times, this is in accordance with the calculation of the throughput formula. The results of these calculations can be seen from the average trial of two scanning and four scanning times of 34207,556 Kbps and 201784,979 Kbps, respectively.

IV. CONCLUSION

Based on the manufacture and testing of the system that has been made, the following conclusions can be drawn:

The selection of lora with 433MHz power and antenna with the same frequency as lora power, namely 433MHz, which is used by the user plays an important role in displaying information related to RSSI reception. The measured distance affects the RSSI value, between these distances at a distance of 2m to 4m there is a decrease in RSSI at most 13dBm. Meanwhile, from a distance of 24m to 42m the RSSI is more constant and between these distances there is an increase at a distance of 24m to 26m by 16dBm. The increase in RSSI at a distance of 24m to 26m is the largest increase over the overall distance. While the decrease in RSSI at a distance of 2m to 4m is the highest decrease from the overall distance.

The throughput result is strongly influenced by the value of bytes and the time the throughput value when done twice scanning is smaller than four times scanning because the two scanning processes have different times, this is in accordance with the calculation of the throughput formula. The results of these calculations can be seen from the average trial of two

scanning and four scanning times of 34207,556 Kbps and 201784,979 Kbps, respectively. More than 2 lora can be added to collect data, data displayed on the website can be added and deleted periodically, features can be added on the website.

REFERENCES

[1] "Ini Manfaat Aplikasi PeduliLindungi yang Belum Banyak Diketahui," KOMINFO, 08 September 2021. [Online]. Available: https://covid19.go.id/id/p/berita/ini-manfaat-aplikasi-pedulilindungi-yang-belum-banyak-diketahui#:~:text=PeduliLindungi%20merupakan%20aplikasi%20yang%20dikembangkan,Memberikan%20peringatan%20pada%20pengguna. [Accessed 06 Februari 2022].

[2] P. W. Kemendikbud, "Syarat PTM 100 Persen : PPKM Level 1-2 dan Capaian Vaksinasi Guru," Kemendikbud, 05 Januari 2022. [Online]. Available: https://www.kemdikbud.go.id/main/blog/2022/01/syarat-ptm-100-persen-ppkm-level-12-dan-capaian-vaksinasi-guru. [Accessed 06 Februari 2022].

[3] A. R. &. V. V. Fauzi, "Perangkat Lunak Presensi Prodi Telekomunikasi Menggunakan Aplikasi QR Code di Smartphone Android," In Prosiding Industrial Research Workshop and National Seminar, vol. 11, pp. 676-681, 2020.

[4] N. K. C. A. I. B. G. A. K. J. &. A. P. W. Dewi, "Rancang Bangun Aplikasi Mobile Siska Berbasis Android," SINTECH (Science and Information Technology) Journal, pp. 100-107, 2018.

[5] H. I. W. &. M. Z. A. Isyanto, "Desain Monitoring Human Tracking dengan RFID dan GPS," RESISTOR (Elektronika Kendali Telekomunikasi Tenaga Listrik Komputer), pp. 9-16, 2020.

[6] G. R. &. T. R. Payara, "Penerapan Firebase Realtime Database Pada Prototype Aplikasi Pemesanan Makanan Berbasis Android," Jurnal Teknik Informatika dan Sistem Informasi, pp. 397-406, 2018.

[7] Y. R. U. &. A. U. Irawan, "Sistem Database Pemasyarakatan Studi Kasus Lapas Kelas II A Pekanbaru," Journal of Technopreneurship and Information System, pp. 59-67, 2019.

[8] D. T. I. I. &. I. N. Ramadana, "Perancangan Aplikasi Android Untuk Ticket Acara Berbasis QR Code.," eProceedings of Engineering, 2019.

[9] N. S. M. G. &. W. B. Sibarani, "Analisis Performa Aplikasi Android Pada Bahasa Pemrograman Java dan Kotlin," In Prosiding Industrial Research Workshop and National Seminar, vol. 9, pp. 319-324, 2018.

[10] A. Mubarak, "Rancang Bangun Aplikasi Web Sekolah Menggunakan Uml (Unified Modeling Language) Dan Bahasa Pemrograman Php (Php Hypertext Preprocessor) Berorientasi Objek," JIKO (Jurnal Informatika dan Komputer), pp. 19-25, 2019.

[11] D. W. L. R. &. T. T. Pratomo, "Sistem Akses Parkir dengan QR Code," Jurnal Teknik Elektro, pp. 8-13, 2020.

[12] R. B. S. A. R. P. &. I. D. Bayu, "Rancang Bangun Smarthome Berbasis QR Code Dengan Mikrokontroller Module ESP32," JASEE Journal of Application and Science on Electrical Engineering, pp. 47-60, 2021.

[13] M. &. L. L. Muhajirin, "Sistem keamanan pintu berbasis arduino mega.," Jurnal Informatika Upgris, 2017.

[14] K. Qrimly, "Apa Itu Lora," Logic Gates, 24 Juli 2017. [Online]. Available: https://www.logicgates.id/blogs/news/apa-itu-lora. [Accessed 06 Februari 2022].

[15] S. S. S. Garnis Aishah, "Pengkajian Kualitas Sinyal Dan Posisi Wifi Access Point Dengan Metode Rssi Di Gedung Kpa Politeknik Negeri Sriwijaya," Prosiding SNATIF, pp. 47-60, 2017.