QR-Barcode Application for Barrier Gate Opener based on Android

I Gede Susrama Mas Diyasa
Department of Data Science
University of Pembangunan Nasional "Veteran" Jawa Timur, Indonesia, 60294
Igsusrama.if@upnjatim.ac.id

I Nyoman Dita Pahang Putra
Department of Civil Engineering
University of Pembangunan Nasional "Veteran" Jawa Timur, Indonesia, 60294
putra_indp.ts@upnajtim.ac.id

I Gede Okta Budi Merdana
Department of Information System
University of Pembangunan Nasional "Veteran" Jawa Timur, Indonesia, 60294
igoktamerdana@gmail.com

Ni Made Ika Marini Mandeni
Department of Information Technology
University of Udayana, Denpasar
Bali, Indonesia, 60294
Made_ikamarini@unud.ac.id

***Abstract*—The use of Android-based smartphones is a personal assistant who is often a primary need in helping human activities. Based on this, this study uses Android to create a control device for access rights using QR-Code to open the barrier gate where the data will be added to the database server, and the system is called Q-BaGOS (QR-Code Based Barrier Gate Opening System). The design of this access system utilizes a QR-code scanner application that is made in-house and modified with coding to instruct Android as a medium to open a barrier gate containing a QR-code. In the application, there are menus such as login username and password, status and barcode data. If you already have user data, it can be used as an access right to unlock the barrier gate. In this case, to manage it all, a web server is built that will communicate with Arduino Uno to control the entire security system, by storing user access rights data, recording user data that performs scanners and entering the port. Barcode or barcode is a set of data that is described by lines and spacing (space). The working principle of this tool when opening a scanner application on Android, users are required to log in the username and password data first. After logging in, it automatically opens the QR-code scanner camera. After the scan process automatically enters the data on the web database server, then the servo door automatically opens. After the user enters, the ultrasonic sensor works, and the barrier gate is automatically closed again.**

Keywords—Barrier gate; Android; QR-Code

I. INTRODUCTION

Along with the increasing development and economic growth in Indonesia today, especially in big cities, it has become an attraction for people to use air transportation to fulfill their needs. However, to meet all of this, a land transportation mode is needed to reach the port location. The methods of land transportation that can be used vary widely, from public transport (buses, travel, and taxis) to private vehicles. With this attraction factor, the level of need for parking [1]areas will also increase.

Ketapang Gilimanuk Port is one of the busiest ports in Indonesia which is managed by PT. ASDP Indonesia Ferry (Persero) [2]. As one of the marine transportation infrastructures in Indonesia, Ketapang Gilimanuk Port is very significant in supporting the demand for maritime transportation as a means of mobility for the population in Indonesia [3]. Therefore, it is essential to know how the current condition of Ketapang Gilimanuk Port is related to its parking characteristics, the need for the terminal area and the management process at the port [4].

To enter the port of Ketapang (Banyuwangi) Gilimanuk [5], you must pass through the port gate, which has several counters, including passenger counters, 2-wheeled vehicle counters, four PNP wheeled vehicle counters, bus counters, and goods vehicle counters. All of these counters are equipped with automatic doors (bars) or what is called a barrier gate. At Ketapang Port (Banyuwangi) Gilimanuk to open the barrier gate is currently using an electronic money card, which can be said to have a high level of effectiveness. However, if the electronic money card user does not know the remaining funds stored on the card, so in this study, a substitute for an electronic card based on an android application was made using QR-Code to open the barrier gate at the payment counter at the port entrance.

From several studies that have been conducted by previous researchers related to the use of QR-Code to open the barrier gate, among others led by Erman Hamid et al. where the research made a barrier gate opening system for access in and out of staff or employees in a company, this system was designed using PIR motion sensor, servo motor, Arduino microcontroller, Piezo buzzer, and camera. The software is implemented using VB.NET, and the QR recognition rate is about 99% accurate [6].

In another study, Kalinkar et al., where the study designed an automatic toll road payment system using QR-Code, with other supporting components. This system is also equipped with a vehicle registration application and payment deductions. It is also equipped with information systems stations, hospitals, schools, all tolls and restaurants in the nearest area [7]. Meanwhile, Mulik and Lalit Kumar, in their research were almost the same as the research conducted by Kalinkar, but here using RF-ID [8].

From some of the previous studies above, in this study, what was carried out was the use of methods in reading QR-codes and matching them with existing data in the Android application. The smartphone can control the opening and closing of the barrier gate. The process to open the barrier gate is carried out after the user registers or provides personal data input and makes payment so that a QR-Code will appear, and this is done for the security side of the system.

II. METHODOLOGY

A. System Diagram

The Q-BaGOS application can be installed first on a smartphone (Android and IOS) [9] so that later it can open the barrier gate. The system will match via WAP (Wireless Access Point) to the data on the server, as in the Block diagram Fig. 1."

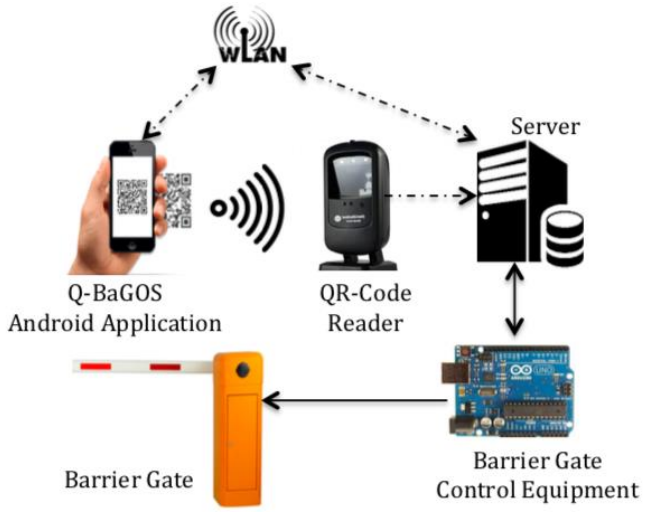

Fig. 1. Block diagram of the system.

Information:

1. Smartphone android [10] serves as input to open the door.
2. Wireless access point functions to connect an Android smartphone to a WLAN network.
3. Server to store all transactions, including the database system
4. Microcontroller and other controlling equipment for the primary control of opening and closing devices

How the system works:

This system only discusses making android applications to open barrier gate latches, and this system is intended for parking at Ketapang Gilimanuk Port with *single Gate System.* Where users (users, customers) have access to control the entrance and exit of the Gate with the open and close method on the android application, how this system works, namely:

1. Q-BaGOS users register on the AAP (Personal Android Application) provided in the Android application to gain access to open the parking latch.
2. After verification by the system, the data is stored in the system database, which will be used automatically by the network, to match the data of users or vehicles that enter and leave the port.
3. When you want to enter the designated parking area, this android system application will automatically detect the wifi signal on the cellphone used when registering, while the hardware (proximity sensor) has monitored that a vehicle is going to pass, the system will automatically looking for the data, if the data exists then the system will provide data on the hardware that "the data is correct".
4. The latch will automatically open when the vehicle enters; the latch will automatically close again and give the user a QR-Code-Barcode.
5. Likewise, when users want to leave, they need to show the QR-Barcode on the AAP application, and the portal will open and close automatically when the vehicle has passed the latch.

B. System Flow

At the beginning of using this system, it was preceded by a registration process [11], whose function was to gain access rights to open and close latches [12].

The registered vehicle enters the port area, a few meters from the BIC (Barrier In Control) unit the cellphone signal will emit a call, which will be captured by the CMC (Central Management Control) Unit and will be forwarded to the BIC Unit, the BIC Unit will order the Sensor Distance is to detect the distance between oncoming vehicles if space is following the device settings, the proximity sensor provides input to the CTU (Central Terminal Unit) to open the entrance latch. The car passes; the passing sensor will work and give a signal to CTU to record the vehicle and the passenger (Q-BaGOS Database System).

Prototype opening and closing the Gate will apply one type of computer network, namely WLAN [13]. The prototype acts as a server and the android smartphone as a client, which will be connected using a wireless access point with the Internet protocol address (IP address) 192.168.1.1. The prototype (server) will use the IP Address 192.168.1.3. At the same time, the android smartphone will get a Dynamic IP Address when connected to the wireless access point by entering the password "abababab" first.

C. QR-Code Design

QR Code is a matrix code or two-dimensional barcode that comes from the word "Quick Response", where the contents of the code can be deciphered quickly and precisely. QR Code was developed by Denso Wave, a Japanese company published in 1994. Compared to an ordinary barcode, QR Code is easier to read by the scanner and able to store data both horizontally and vertically.

QR Code has two types, namely Static QR Code and Dynamic QR Code. The difference is Static QR Code, namely QR Code which contains a link to a fixed web page. The use of Static QR Code causes the QR Code content to be irreversible. Meanwhile, Dynamic QR Code is a QR Code containing a short URL which is then redirected to another web page. The use of Dynamic QR Code allows the QR Code to be changed and reused continuously.

QR Code works by reading some components in the code box. The three large squares in each corner represent the code delimiter. Meanwhile, a smaller container is useful for measuring the size of the box. Some of the components in the middle of the code are the time pattern, information data, and version number. These areas are read by a scanner and the data processed so that the QR Code functions. Keep in mind, QR Code is not only limited to payment functions but can also be used for other instruments. In this case, the QR Code functions as a platform interface. The amount of data that can be stored varies depending on the QR Code version, the QR Code size and the Error Correction Capability level. Table 1 shows the variations in the amount of data that the QR Code can load. In this study, a QR Code with a Special Mobile Application was used, as in Fig. 2.

Table 1. Variations in the Amount of Data that can be Loaded by the QR Code

QR-Code version	Module	Level of Error Correction Capability	Amount of Data (bits)
1	21x21	L	152
		M	128
		Q	104
		H	72
2	25x25	L	272
		M	224
		Q	176
		H	128
3	29x29	L	440
		M	352
		Q	272
		H	208

QR codes can contain standard content, such as a URL to a web page or file download, business cards, and so on. QR codes of this kind can be scanned with any QR-scanner. However, there is a QR code that is specifically for scanning using specific applications. If this type of QR code is checked using any QR-scanner, it will produce a message that is not understood. The following is an example of a QR-code for https://web.whatsapp.com when scanned using a typical QR scanner.

1@DprPFQguSO4B/KxdgPldXz+rxHxzRJGayoB1DJie2mpNu3ayLWC0CuWU,98skm6
yAHgUhL9ZuIdvuil+fq9WV/4OJtmlx9lWZwlc=,fC/Idlx2fv9Ar3JYSZd3GQ==

The message cannot be understood because it is an encrypted message from the Whatsapp application. I scanned using the Whatsapp application, and navigation will occur to the Whatsapp web for an account. Therefore, this kind of QR code can only be used by checking with specific applications.

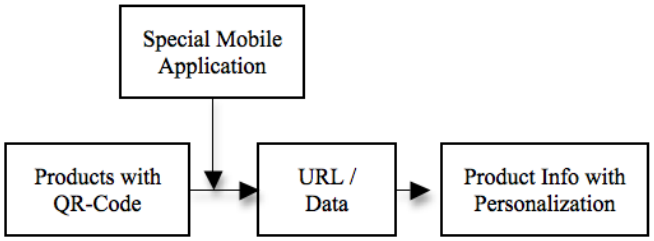

Fig. 2. a QR Code with a Special Mobile Application was used

D. WLAN design

There are many choices of routing systems that can be used to build a network. Some are free, and some are paid. Some are easy to configure; some need to squeeze your energy and mind into the installation. In this research, the routing system used to build the network is PCMikrotik Router OS. PC Mikrotik Router OS is a reliable network router, equipped with various features and tools, both for wired and wireless networks.

In the network development process, in this case, it is necessary to have a working method design scheme that is used to describe network development. The sketch is in the form of a flowchart to explain the functions used. The configuration process has several stages, namely the interface configuration process, IP address configuration, IP Route and Gateway configuration, firewall configuration, DNS server configuration, IP Pool configuration, bandwidth limitation configuration and the router-server integration process. In the network development process, a sketch is also needed in the Access Point configuration process. The design includes quint, dynamic IP, user/password creation, LAN and WAN IP and DHCP settings.

E. Microcontroller Design-Arduino Uno

Arduino Uno acts as a microcontroller which plays a vital role as the primary control tool. The ports used on the Arduino Uno microcontroller [14] can be seen in Table 2.

The Arduino board communicates with the W5100 and SD card using the SPI bus. The SPI.h and Ethernet manage this communication. h libraries. The SPI bus uses digital ports 11,12,13 on the Arduino. Digital port ten is used to select W5100, and digital port four is used to fix the SD card. The

ports previously mentioned cannot be used as public input or output when we use an ethernet shield. The Ethernet shield is connected to the Arduino by attaching the ethernet shield directly to the Arduino board [15].

Table 2. The port of the Arduino Uno microcontroller used

Part	***Port***	**Information**
Driver DC motor	8, 9	Pins 8, 9 functions as data input to the driver DC motor.
Ethernet *shield*	10, 11, 12, 13	*Port* used to select W5100 and port 11, 12, 13 are used for SPI Bus.
Solenoid door driver	A3	The driver circuit is connected to port A3—the driver circuit functions as a switch on the solenoid door.

F. System for Registration at Q-BaGOS

In the early days of using this system, a registration process, whose function was to gain access rights to open the latch, preceded it. The registration process is as follows:

a. Download the Q-BaGOS Application
b. Enter personal data, name, cellphone number, email, address, including the type of vehicle used and immediately register and activate so that the vehicle data will be sent to the server.
c. After activation, users can use this application.
d. To open the latch, the user has set the place through the application "Q-BaGOS."
e. When the vehicle has arrived at the destination, the system will automatically detect the car through the cellphone number, so that the controller will open the latch, or press the open gate button that has been provided. The system will record the vehicle on the CMC Unit.
f. After the vehicle passes the BIC, the AAP will automatically display a QR Code / Barcode that is the same as the receipt printed from the printer at the BIC.

G. Transaction Process Entering Q-BaGOS

The registered vehicle enters the port area, a few meters from the BIC (Barrier In Control) unit the cellphone signal will emit a call, which will be captured by the CMC (Central Management Control) Unit and will be forwarded to the BIC Unit, the BIC Unit will order the Sensor Distance is to detect the distance between oncoming vehicles if space is by the device settings, the proximity sensor provides input to the CTU (Central Terminal Unit) to open the entrance latch. The car passes; the passing sensor will work and give a signal to the CTU to record the vehicle (Q-BaGOS Database).

III. IMPLEMENTATION

The last stage of this research is the implementation of Q-BaGOS based on QR Code, which is implemented in the Barrier Gate opening to help make it easier to manage passenger manifest data and make it easy to get information on the passenger side.

A. QR-code test

QR-Code testing aims to test whether a scanner can read the QR-Code or not; the scope of the test includes the scanning distance, lighting, shape, fade, and QR-Code folds.

1) QR-Code Test Based on Distance

Scanning tests the minimum and maximum range of QR-Code scanning that can be read by the smartphone scanner application. The test distance starts from 10 cm to 50 cm. The results of the scanning distance test can be seen in Table 3.

Table 3. Testing the distance of QR-Code Scanning

Distance (cm)	Result
10	Detected
15	Detected
20	Detected
25	Detected
30	Detected
35	Detected
40	Not detected
45	Not detected
50	Not detected

2) Exposure QR-Code Test

Lighting in testing the QR-Code with various lighting conditions ranging from very dark to very bright conditions. The results of lighting testing can be seen in Table 4

Table 4. QR-Code lighting testing

Lighting	Result
Very bright	Detected
Light	Detected
Dim	Detected
It's a little dark	Not detected
Dark	Not detected
Very dark	Not detected

3) QR-Code Test Based on Form

The form in testing the QR-Code form that can still be read by the smartphone scanner application. The purpose of trying the QR-Code form here is the integrity of the QR-Code, starting from perfect to less than ideal. The results of testing the QR-Code form can be seen in Table 5.

Table 5. Testing the QR-Code Form

QR-Code form	Result
Perfect form (100%)	Detected
Imperfect form (90%)	Not detected
Imperfect form (70%)	Not detected
Imperfect form (50%)	Not detected
Imperfect form (40%)	Not detected
Imperfect form (10%)	Not detected

4) QR-Code Test Based on Fade

It fades in testing the QR-Code which can still be read by the smartphone scanner application when the QR-Code that is outside fading due to exposure to rainwater. The results of the fading test can be seen in Table 6.

Table 6. QR-Code Failure Testing

Fade ability Rate	Result
Yards (90%)	Detected
Yards (60%)	Detected
Durability (40%)	Detected
Yards (30%)	Detected
Durability (20%)	Detected
Yield (10%)	Detected

5) QR-Code Test Based on Folds

Folds in testing QR-Code boundaries with conditions when the QR-Code is folded due to colliding or nudging with visitors or visitors' luggage. The results of the fold test can be seen in Table 7.

Table 7. Testing QR-Code Fold Level

Fold Level	Result
One fold	Detected
Two Folds	Detected
Three Folds	Detected
Four Folds	Detected
Six Folds	Detected
Ten Folds	Not detected

B. Q-BaGOS Test

In the Q-BaGOS test that was made, using the black box testing method. The black box testing method serves to test system functionality to see whether the system is running well or not. The results of the black-box test can be seen in Table 8.

Table 8. Results from the Q-BaGOS black-box test

No.	Testing Scenarios	Status	Fact
1.	Users can register	OK	Corresponding
2.	Users can log into the system.	OK	Corresponding
3.	Users can view ship schedule information.	OK	Corresponding
4.	User orders tickets	OK	Corresponding
5.	Users view order details.	OK	Corresponding
6.	Users can save tickets.	OK	Corresponding
7.	User can view order history.	OK	Corresponding
8.	Users can view private accounts.	OK	Corresponding
9.	Users can log out of the system.	OK	Corresponding

IV. CONCLUSION

The conclusion obtained from this research is that the use of the latest technology can make innovations that can facilitate people's daily lives and simultaneously save the environment. By implementing an integrated system Q-BaGOS (QR-Code Based Barrier Gate Opening System**)** between hardware equipped with QR-Code and a mobile application for automatic barrier gate opening (Barrier Gate) will make it easier for users because transaction data is stored in the android application. Using QR-Code at the Barrier gate will speed up the payment process, which is done through an integrated Android application. The Q-BaGOS application, from the results of the QR-Code trial, turns out that the lighting level and distance are of great concern.

ACKNOWLEDGMENT

Thank you to LPPM UPN Veteran East Java, for the research that has been given, so that we can publish papers in several journals.

REFERENCES

[1] Mas Diyasa, I G, *et al.* (2020) 'Progressive Parking Smart System in Surabaya's Open Area Based on IoT', *Journal of Physics: Conference Series*, 1569(2). doi: 10.1088/1742-6596/1569/2/022043.

[2] PT. ASDP Indonesia Ferry, 'A Wave of Transformation', 2018

[3] Budiartha, N., Mandi, R. and Port, S. (2017) 'Development of Ferry Port as a Complement of " Tol Laut ": Case Study on Ferry Port of Ketapang Tol Laut', 6(3), pp. 31–37.

[4] Mantong, A. W. et al. (2020) Maritime Safety in Indonesia: Mapping the Challenges and Opportunities. Fist. Edited by M. Shafiah F. Jakarta - Indonesia: Centre for Strategic and International Studies (CSIS) Jakarta. Available at: ISBN 978-979-1295-33-8.

[5] Sulistiono, S., Setiarina, D. E. M. and Prabowo, R. E. (2017) 'Intertidal Barnacle Community of Ketapang and Gilimanuk Ports That Separated By the Indonesian Throughflow of Bali Strait', Scripta Biologica, 4(4), p. 207. doi: 10.20884/1.sb.2017.4.4.615.

[6] Hamid, E. et al. (2018) 'Implementation of Intelligent Automated Gate System with QR Code-An IOT System to help gate management', International Journal of Advanced Computer Science and Applications, 9(10), pp. 359–363. doi: 10.14569/IJACSA.2018.091043.

[7] Kalinkar, K. V et al. (2018) 'International Journal of Advance Engineering and Research Automatic Toll Payment System Using QR Code Scanning', pp. 1–5.

[8] Mulik, C. A. and Kumar, P. L. (2020) 'RFID / Barcode Scanner Half Height Tripod Turnstile', (May), pp. 4616–4620.

[9] Gede Susrama Mas Diyasa, I. et al. (2019) 'Smart Passenger Information System Based on IoT', Proceedings - 2019 TRON Symposium, TRONSHOW 2019, 6(C). doi: 10.23919/TRONSHOW48796.2019.9166143.

[10] Susrama, I Gede, et al (2019) 'Rancang Bangun Aplikasi "W-Mass (Weight Monitor Assistant)" Berbasis Android Studio Dengan Bahasa Native Java; Application Design "W-Mass (Weight Monitor Assistant)" Based on Android Studio with Native Java Language', Penelitian Journal, Poltekbang Surabaya, 4(2), pp. 1–19.

[11] Ariyono, S., *et al*. (2020) 'Design and Development of Chatbot Using Dialog Flowin Surya Sembada PDAM Surabaya City', 196(Ijcse), pp. 114–118.

[12] Rommi, Ilham, (2018), 'Parking Management Information System Based On Android (Study Case : Higher Education In Indonesia)', International Journal Of Research Science & Management, 5(9), pp. 1–9. doi: 10.5281/zenodo.1405454.

[13] Rahim, R, *et al.* (2018) 'Prototype file transfer protocol application for LAN and Wi-Fi communication', *International Journal of Engineering and Technology(UAE)*, 7(2.13 Special Issue 13), pp. 345–347. doi: 10.14419/ijet.v7i2.13.16917.

[14] Nandyal, S, *et al.* (2018) 'Smart Car Parking System using Arduino UNO' *International Journal of Computer Applications*, 169(1), pp. 13–18. doi: 10.5120/ijca2017914425.

[15] Priyanka, Sharmila R, et al. (2016),' Smart Parking System Using Internet of Things (IoT)', International Conference on Innovations in Engineering and Technology, pp. 389-392 .